EXHIBIT 1

November 2022

THE BEST PRACTICES ANALYSIS

EXEMPLARY ENERGY EFFICIENCY, LOAD MANAGEMENT, AND DISTRIBUTED ENERGY PROGRAMS

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Executive Summary

EcoMotion was retained by Glendale Water and Power (GWP) to research best practices with customer energy efficiency, load management, and distributed energy resources. What kinds of programs and services are being implemented by leading utilities? What kinds of programs are worthy for examination by GWP? What approaches might be customized and replicated in Glendale? How much capacity might these resources provide to the GWP power system by 2025?

Californian, national, and international examples of leading programs are presented across all customer classes from residential to commercial, industrial, and institutional accounts. Investor-owned utilities, municipal utilities, cooperatives, and community choice aggregator programs are considered. So are city and regional programs. Cross-cutting initiatives are explored, such as education programs, peak day campaigns, and financing.

Given its potential for meeting peak demand, the report presents a special section on Vehicle Grid Integration (VGI), the new term for Vehicle to Grid. That section begins with a review of best practices managing the growing electric vehicle load, and providing for critical infrastructure for charging. VGI links those vehicles back to the grid, with electric vehicles and their battery packs serving as operating reserves for utilities that can be discharged during peak periods.

Implementing ever-more robust efficiency, load management, and distributed energy resources programs is challenging, and made more so by a number of strategic considerations. Utilities are having to decarbonize their power supplies while electrification of mobility and buildings are very significant new loads. Pricing options are discussed, from Time of Use, to Real Time and Dynamic Pricing, and Rate to Drive (RTD) for EV charging. The report frames the organizational need to prepare to contract for smaller “chunks” of capacity as GWP moves towards and partners with customer-sited distributed energy resources.

The Best Practices Analysis concludes with seven recommendations.

1. Catalyze a Fresh Movement: Implementing an aggressive customer program will require full management support, a fresh approach, significant outreach costs, and robust staffing resources.

2. Adjust Pricing: EcoMotion recommends that GWP carefully roll-out mandating time of use pricing, exploring real time pricing, and envisioning new business directions with end use pricing.
3. Double Energy Efficiency: The report focuses on boosting services for low income customers and small businesses. It highlights the use of rich incentives and marketing approaches to reach targeted customer sub-segments.
4. Ramp-Up Distributed Energy Storage: EcoMotion recommends adding storage to existing solar systems, as well as supporting stand-alone storage installations.
5. Encourage Distributed Energy Resources: While a distant second priority, allow interested customers to interconnect and in case provide dispatchable capacity including generators, microturbines, and fuel cells.
6. Meet the Solar Mandate with Storage: The report presents a Five-Point Solar Plan that meets the City Council solar mandate, and does so with 63 MW of storage, nearly equivalent to the storage planned at the Grayson Power Plant.
7. Create a Banner Vehicle Grid Integration Program: Pilot, Phase 1, and Phase 2 programs are presented which respectively deliver 1 MW, 8.5 MW, and 22.5 MW of peak capacity to GWP.

The Best Practices Report: Exemplary Energy Efficiency, Load Management, and Distributed Energy Programs, ends with a rough order estimate of the gross potential and the gross costs of implementing the recommendations in full. Based on assumed participation levels, and made possible by utility and city commitment, EcoMotion finds that the seven recommendations can provide 104 - 126 MW of peak capacity over the next 3 - 5 years. This is done at an estimated cost to GWP of ~$280 - 321 million, matched by a consumer investment of $158 million.

Introduction

On March 1, 2022, the Glendale City Council adopted Resolution No. 22-34, which modified the implementation of repowering the Grayson Power Plant and directed staff to work on identifying cleaner alternatives. As one of the methods to contribute to the accomplishment of this goal, the City contracted with EcoMotion Incorporated to examine best practices with Energy Efficiency, Load Management, and Distributed Energy Resources throughout California, the nation, and overseas. EcoMotion's job has been to harvest effective and innovative program designs that can boost GWP's capacity savings. EcoMotion was to make recommendations and to analyze the potential for these resources to augment the Glendale Water and Power power system.

Glendale Water and Power (GWP) is in a precarious position given limited generation resources and the required closure of all but Unit 9 at the Grayson Power Plant. The challenge to deliver reliable power is ever more so given the 2022 City Council commitment for 100% clean energy by 2035.[1] The mandate for 100% clean and green is merely 13 years away. Considerable progress has been made. GWP reports that the portfolio is currently 69% renewable.[2]

Quite fundamental to the power equation is that transmission constraints severely limit the amount of power that can be imported to the City, especially during peak periods. GWP system planners expect GWP to be short in the Summer of 2025. It may be too late for any repowering of the Grayson Power Plant in time for that date. Without additional capacity at Grayson, and without the ability to import more power using transmission, the need to expeditiously develop efficiency, load management, and distributed energy resources is paramount.

There are solar goals as well: Resolution No 22-125, adopted by consensus by the Glendale City Council on August 16, 2022, states that, "The City intends to adopt policies and practices designed to reach a goal of having at least 10% of GWP customers adopt solar and energy storage systems by 2027, and develop additional demand management measures, with a minimum total peak dispatchable and peak-load-reducing capacity of 100 MW."[3] Today less than 3% of Glendale customers are solar.

Scholl Canyon's fate has not been determined. It may never be a site for power generation. If a subset of vocal community members succeed, that will be the case. A legal challenge is seeking to overturn Council's decision to advance the Scholl Canyon generation project. If the lawsuit is successful and the project is blocked, GWP loses 12 MW of baseload "renewable" capacity. When 93 MW was proposed for Grayson, GWP was planning on the 12 MW from the Scholl Canyon Biogas project. Now the hole – the capacity divide – gets deeper.

These are major drivers in the Council's decision on the Grayson Power Plant and how many Wartsila engines to purchase and site there. Out of necessity, GWP is a utility on the go shifting toward a clean energy future at a pace that is faster than comfort allows. Without sufficient resources, the City may experience a serious capacity crunch in a matter of years. Well designed and implemented Energy Efficiency programs, Load Management programs, and policies and incentives that support customer-owned Distributed Energy Resources can help.

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[1] "100% Clean Energy by 2035," August 23, 2022, Clean energy resolution passes, council vote 4-1, Glendale Environmental Coalition archives
[2] Personal communications with GWP General Manager Mark Young, October 2022.
[3] City of Glendale Resolution No. 22-125, "A Resolution to the City Council of the City of Glendale Establishing Goals for Solar and Energy Storage Installations by Glendale Water and Power Customers and Clean Energy Targets, and Directing Staff to Take Actions in Furtherance of Thereof," Approved unanimously by Council, August 16, 2022.

Glendale's challenge is compounded by the fact that significant electrification will add to the GWP system load and add to the capacity challenges at hand. Electrification of cars and buildings is being driven by new technologies and by the imperative to go green to decarbonize our grid and society. This report focuses on electrification of single passenger vehicles, light and heavy-duty trucks, buses, scooters, etc. All these forms of e-mobility will of course add to the system load and further stress limited resources. An entire section of the report is devoted to EVs, both infrastructure programs and Vehicle Grid Integration (VGI, formerly known as V2G – Vehicle to Grid).

Concurrently, building electrification is also a huge trend and factor. Homes and businesses in Glendale, throughout California, across the country, and indeed around the world, will switch from fossil-based resources to clean power resources, such as heat pumps that use electricity to heat and cool. While electrification is wonderful, its ramifications to GWP's integrated resource planning are significant. GWP's historic peak of 346 MW occurring in 2017 could well rise to 450 MW or above. This year's peak event occurred on September 6 at 4:17 pm and was 331 MW.[4]

Best Practices Analysis for Glendale

It is in this context that this consulting report has been requested and authorized. Members of the Glendale City Council are looking for capacity solutions. What more can be done with Energy Efficiency, Load Management, and Distributed Energy Resources? What amount of capacity can be realized from these demand-side resources and installed and assured in short order?

The focus of this analysis is on customer-owned resources, in and on customers' premises. They are largely behind-the-meter on the customer's side of the meter. The primary target is cutting peak demand, reducing megawatts, or inversely generating "negawatts." The objective is to realize savings achieved through "demand-side management," which includes efficiency and load management, plus distributed resources like solar, batteries, and connected EVs. In Glendale's case, the challenge is heightened by promoting energy efficiency, load management, and distributed energy resources to residents from foreign countries and different cultures.

The Best Practices Analysis

- Energy Efficiency
- Load Management
- Distributed Energy Resources

[4] Data provided by Hovsep Barkhordarian, Glendale Water and Power, November 2022.

This Best Practices Analysis presents a broad set of innovations and solutions for consideration. Good ideas in the form of effective program design can augment current works, adding to the current portfolio, can be stitched together in a custom way for Glendale. Are there examples of successful programs from other California utilities – municipal utilities, investor-owned utilities, and now community choice aggregators – that are instructive and might potentially be emulated? We think so.

Defining Best Practices

Digging into the definition of "successful" and "exemplary" programs is important. Fundamentally, is an initiative or program worthy of consideration for replicating in Glendale?

There are many ways to define success. All are valid. A consistent message from industry practitioners – energy efficiency program designers - is that no one shoe fits all. You've got to provide a rich tapestry of programs. They have to be well designed and well messaged, with sufficient time spent before program launch to explain and alert customers that it's coming and why participation is so cool! This is something that utilities have never had to do.[5] Defining success is also qualitative, suggesting the important behavioral dimension of energy efficiency programs.

Definitions of Program Success

1. Level of Savings
    a. kWh (energy)
    b. kW (capacity)

2. Participation Rates
    a. Percent of universe and/or target segment that participate
    b. Depth of savings, penetration, per customer

3. Behavioral Change
    a. Motivates customer segments to take action
    b. Stimulates long-term thinking and action

[5] Adam Maxwell, former official at Esource, personal communications, October 2022.

The Results Center

EcoMotion has a history documenting best practices in the energy efficiency program design space. After working at Rocky Mountain Institute and developing materials on best technologies – lighting, HVAC, drivepower, refrigeration, etc. – EcoMotion's founder and leader, Ted Flanigan, was funded by the John D. and Catherine T. MacArthur Foundation to focus on how to motivate power users to use less. With foundation support and an early membership, The Results Center was born in 1990 and tracked the most successful programs in North America, then Europe and Asia. Each case study was presented in sufficient detail as to hold up in regulatory scrutiny.

The Results Center[6] case studies were written from 1990 - 1996 and were detailed. Each case study was presented in a standard format for ease in comparison. Each case study had an executive summary in written and tabular form. The case studies then covered marketing approaches, implementation strategies, participation rates, costs, annual and cumulative savings, and lessons learned. Fully 128 case studies were written. Unfortunately, there does not seem to be a select repository of successful programs today. This made the search for best practices much more difficult.

To find insights on exemplary programs and initiatives that might make sense for Glendale, EcoMotion developed and carried out a number of tactics. EcoMotion tracked a number of trade associations and their energy efficiency and energy management awards. These include the American Public Power Association, (APPA), California Municipal Utilities Association (CMUA), Electric Power Research Institute (EPRI), Edison Electric Institute (EEI), National Rural Electric Cooperatives Association (NRECA), and the California Community Choice Association (CalCCA). These groups' awarded programs are baked into the research findings.

ACEEE Demand Side Management Survey

The American Council for an Energy-Efficient Economy (ACEEE) publishes an annual utility efficiency scorecard. The most recent version assessed the energy efficiency initiatives of the 52 largest utilities across the country.[7] It is a rich assortment of programs and services for GWP consideration. The report gives an overall score and also spotlights utilities with exemplary programs. Note that the definition of "efficiency programs" is inclusive and crosses over to load management initiatives and distributed energy resources.

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[6] The Results Center, https://ecomotion.us/the-results-center/

[7] ACEEE Research Report, The 2020 Utility Energy Efficiency Scorecard, February 20, 2020, https://www.aceee.org/research-report/u2004; https://www.aceee.org/sites/default/files/pdfs/u2004%20rev_0.pdf

ACEEE's 2020 Award-Winning Utilities:

1) Eversource MA
2) National Grid MA
3) San Diego Gas & Electric CA
4) Commonwealth Edison IL
5) Baltimore Gas & Electric MD
6) Pacific Gas & Electric CA
7) Los Angeles Department of Water & Power CA
8) DTE Energy MI
9) Pacific Gas & Electric CA
10) Eversource CT

Tapping the Experts

Having done considerable research scouring the industry for exemplary demand-side management programs, it was time to lean on the EcoMotion network. Some of The Results Center advisors are still in the business. We've been guided to leading program designers across the country. These experts were approached and asked about their insights into leading utilities that are cutting customer energy use and slashing peak demand.

We got lots of insights. We've taken a national perspective from Rhapponeck Electric Cooperative in Virginia, to ConEd in the Big Apple, to ComEd in Chicago, and Holy Cross in Colorado. Naturally, EcoMotion was proud that California's utilities were often heralded for delivering energy efficiency services. Chapters 2 - 5 of this report are a fertile ground for GWP program design and includes dozens of programs selected for consideration.

The Experts:

1. Ralph Cavanagh, Natural Resources Defense Council
2. Ahmed Faruqui, former Brattle Group
3. Adam Maxwell, former Esource
4. Bryan Hannagen, Holy Cross Energy
5. Randy Reuscher, Fort Collins Utilities
6. Rich Philip, Peak Load Management Association
7. Rachel Gold, Rocky Mountain Institute
8. Paul Spencer, former Clean Energy Collective

9. George Baker, Gridworks Energy
10. Dylan Voohies, Vermont Energy Investment Corporation

In each case, the experts provided insights on their leading utilities and program designs. Adam Maxwell, for example, provided this list based on his recent experiences: Consolidated Edison for targeted DSM and in particular, targeted Demand Response. He mentioned a mobile energy storage unit concept. Commonwealth Edison in Chicago is to be noted for its program innovation, specifically for its programs' behavioral bent and how they engage customers.

Maxwell's list of progressive energy services providers includes Austin Energy, the Salt River Project, Avista, Excel, and the California utilities. Rachel Gold, now with Rocky Mountain Institute, and formerly with ACEEE, provided Sacramento Municipal Utility District, Duke, Arizona Public Service, Hawaiian Electric Company, and Green Mountain Power. The experts suggestions and contacts were helpful in fleshing out this best practices report.

Best Practices Far and Wide

The search for best practices results in at least one fork in the road, explains Rachel Gold with Rocky Mountain Institute.[8] In her experience, largely at ACEEE in Washington DC, she finds that some programs and utilities are exemplary for their innovative kinds of services. Others are successful at scale. She cites Duke, Arizona Public Service, and SMUD for trying to get it right and "maybe SMUD for scale." HECO's commission is trying to make HECO do it, she says. GMP is in the innovative category. But she makes clear that few utilities are achieving efficiency at scale. The top ten utilities in the nation for efficiency are saving 1.5% of sales each year.[9] Clearly efficiency is a fringe activity relegated by many utilities as a public benefit versus a resource.

GWP's planners and program designers for public benefits programs as well as utility resource programs are familiar with California programs and initiatives, especially those from municipal utilities. California Municipal Utilities Association's annual energy efficiency report presents each utility's programs, progress, and successes. This Best Practices Analysis builds on and augments that base of program knowledge with best practices from outside of California. This report presents findings nationally.

Further afield, but often intriguing, if not instructive, are programs and initiatives from other countries that might be adapted and deployed for GWP benefit. Included is a daily outreach

[8] Personal communications with Rachel Gold, Rocky Mountain Institute, October 2022.
[9] Eversource Massachusetts and National Grid Massachusetts led the pack and respectively achieved 3.1% and 3.7% energy savings as a percentage of sales in 2018. SMUD and Seattle City Light were achieving 6+% savings in the 1990s from their EE programs.

program from South Africa, and a new tariff in the United Kingdom. How can GWP engage the public to cut carbon, keep rates in check, and build GWP system reliability? Are there examples of this that can be fashioned for Glendale?

What follows are chapters that review energy efficiency, load management, and distributed resources programs far and wide for potential replication in Glendale. As a new utility resource, and given its potential, the report has a special section on EVs and Vehicle Grid Integration. The team then provides an analysis of GWP's energy efficiency programs, before concluding with a discussion of strategic considerations, and then a final chapter on recommendations and potentials for the Glendale Water and Power.

Best Practices - Energy Efficiency

Residential Programs

This section of the report focuses on energy efficiency programs. We begin with the Residential Sector and then address the Commercial, Industrial, and MUSH Sectors. MUSH refers to Municipal, University, Schools, and Hospitals. In each case, we highlight exemplary programs and approaches for consideration.

Before diving in, we salute the pioneers! Seattle City Light claims to have the longest continually running energy efficiency program in the country. Since its inception in 1977, energy efficiency measures supported by the utility have been installed in residential, commercial, and industrial facilities throughout the service territory. As a result of these legacy and current programs, City Light's annual load was reduced by over 1,380,000 megawatt-hours in 2018. That is the equivalent annual electricity use of 190,000 average Seattle homes.[10]

Featured Utility: Seattle City Light

Seattle City Light, a Department of the City of Seattle, is the 10th largest public electric utility in the United States. It has some of the lowest rates of any urban utility – providing reliable, renewable and

[10] Seattle City Light Customer Guide, https://www.seattle.gov/light/AboutUs/CustomerGuide/docs/Fingertip-Facts_2018.pdf

environmentally responsible power to nearly one million Seattle area residents.[11]

The City of Seattle took the 2rd place overall in the ACEEE 2021 City Clean Energy Scorecard.

Seattle ranked first in Community-Wide initiatives garnering praise for GHG reduction goals for the community and strategies to mitigate the heat island effect.[12] Also, the city has undertaken community engagement with historically marginalized local groups.

ACEEE cited Seattle's stringent building energy codes and noted the City has instituted multiple requirements to improve the energy performance of large existing buildings. The City follows the State of Washington building mandates as well.

Green Power Program: Seattle City Light's Green Power Program funds local renewable energy demonstration projects. A portion of funds support education and training programs for teachers, students, and the general public. Since 2002, the program has completed 24 solar projects at schools, parks, libraries, and other public places.[13]

Education Programs

Education programs are perhaps at the root of utility's energy efficiency program portfolios. Programs tailored to our youth will have lasting impacts. GWP has done well in this department, partnering with both LivingWise and the Solar Schoolhouse.

PEAK Student Energy Actions

Peak Student Energy Actions is another student education program, with hands-on and classroom lessons. It was developed by The Energy Coalition to teach "smart energy management," being efficient, shifting loads off peak, and fulfilling base power requirements with renewables. PEAK's programs run in schools in Northern and Southern California, Illinois, and in Sweden. PEAK is sponsored by utilities and implemented by teachers in schools.[14]

[11] Seattle City Lights, https://terragotech.com/resources/customer-success-stories/seattle-city-lights/
[12] ACEEE 2021 Clean Energy Scorecard, https://www.aceee.org/research-report/u2107
[13] Seattle City Light Green Power Program, https://cebrightfutures.org/partners/seattle-city-light
[14] PEAK Program Video, https://crscience.org/educators/pdpeak/ https://vimeo.com/user7299372

Sonoma Clean Power (SCP) Advanced Energy Center

SCP has introduced a whole-service center which includes online resources and a Brick and Mortar Hub.[15] The center supports mostly building electrification, but energy efficiency too. It includes rebate information, an "Educational Hub" with many videos on everything from options for electric and energy efficient heating, cooling and cooking options, yard equipment to education on solar and storage, and education on finance. The Hub offers training for contractors and a prescreened contractors list also. Customers can visit the Advanced Energy Center building by booking a 30 minute tour to see the latest energy saving equipment and try the state-of-the-art appliances.

Sonoma Clean Power (SCP) New Headquarters is a Grid Optimized Building

SCP's new headquarters is the first pilot project for the GridOptimal ® Buildings Initiative, a joint program of the New Buildings Institute and the U.S. Green Building Council.[16] The program aims to redefine how building design and operations can cost-effectively support decarbonization of the power grid and a fully renewable electricity supply.

"After eight years of growing our team and expanding our mission, we're able to show what an advanced energy building looks like in practice with the most efficient and climate-friendly facility we know how to build," said Geof Syphers, CEO of Sonoma Clean Power. "Our new headquarters is a 'test case' that's working well, and we want people to know that this can be replicated — that clean electricity and decarbonization are attainable today. We also want people to understand that a 24/7 zero-emissions future for buildings is achievable and practical."

2022 Chartwell Silver Program Award
National Grid – LED Marketing Campaign

NG New York received the Chartwell Silver Program Marketing Award for its "Choose the Right Light" campaign, developed with Mower Energy and Sustainability. The campaign used customer-centric storytelling to amplify awareness and educational content to prompt the sale of more than 3.5 million LEDs in a single year and enable the utility's Residential Energy Efficiency Lighting program to exceed its annual

[15] Sonoma Clean Power Advanced Energy Center: https://scpadvancedenergycenter.org/
[16] World's First "GridOptimal" Building, September 21, 2022, https://cal-cca.org/21131-2/

energy-savings goal by more than 150%. Mower Energy and Sustainability writes about the combined effort:[17]

"Making the switch to LED light bulbs may be the right thing to do, but it does come with some challenges. In order to choose the right light for the right environment, we need to educate ourselves on the language of LED technology. Our multichannel "Choose the Right Light" campaign for energy company National Grid did precisely that. Two parts education and two-part customer engagement, it helped educate millions of customers and sold more than 3.5 million LEDs in a single year, which was +157% above their goal. You can learn more about the winning work here".[18]

East Bay Community Energy Residential Energy Efficiency Program

The program[19] has something to offer for all residents in partnership with Bayren and others and includes the following: Induction cooktop loan program; Induction range rebate of $750; Heat pump rebates of up to $2,000; Home appliance assessments and resources; Income-qualifying programs; and smart charging programs for electric vehicles.

Sonoma Clean Power DIY Toolkits for Library Loan

Sonoma Clean Power offers an energy efficiency/water savings DIY tool kit available for loan at Sonoma and Mendocino County Library locations.[20]

Each toolkit comes with a copy of a Home Energy and Water Savings Guidebook that provides tips and guidance on simple home upgrades, as well as dimmable LED light bulbs, weather stripping, low-flow shower heads and aerators for customers to install. Also included are measuring devices like a Kill-a-Watt, infrared laser thermometer, and flow rate bag to help to save energy, water, and money. Customers can borrow the meter, thermometer, and flow rate bag for 3 weeks as a library loan.

The program is a partnership between Sonoma Clean Power, County of Sonoma Energy and Sustainability Division, Sonoma County Library, County of Mendocino, Sonoma Water, Sonoma Marin Saving Water Partnership,and the Mendocino County Library.

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[17] Chartwell 2022 Silver Best Practice Award: https://mower.com/news/mower-and-national-grid-receive-chartwells-2022-silver-best-practices-award-for-utility-marketing-campaign-the-right-light/
[18] https://fierce-friends.com/wp-content/uploads/2022/01/NG-Lighting.pdf
[19] EBCE Residential Programs: https://ebce.org/programs-residential/
[20] Sonoma Clean Power DIY Toolkits: https://sonomacleanpower.org/programs/diy-toolkit

Household Energy Assessments

Typically free. Typically backed up with some "goodies," like water-efficient showerheads and faucet aerators, some LED light bulbs, perhaps a refrigerator inspection for age and condition. These programs often check for a second refrigerator in the unconditioned garage? We hear of the importance of sensitive crews entering homes of customers who come from foreign countries, may not speak English, are fearful of authorities in their spaces, etc..

2019 APPA Award Winner
City of Palo Alto Home Efficiency Genie

The Genie House Call program[21] has generated a high level of trust in the Palo Alto community by providing energy efficiency services tailored to individual needs since each home and its occupants are unique. As a result, the program has received a high Net Promoter Score: 9 out of 10 Genie House Call customers would recommend the program, and 94% of Genie House Call customers say they are "very satisfied" with their utility, compared to 76% of CPAU customers overall. Comparatively statewide, 57% of municipal customers say they are "very satisfied" with their utility. The Genie has become a supportive and reliable resource for all of a homeowner's efficiency needs.

Avista Energy " Always On" Energy Calculator

Avista Energy Washington has a simple online tool for customers to discover average energy use of items they leave plugged in.[22] "Find out how much you could save by pulling the plug." Customers can select devices from a pull-down menu and see average yearly kWh use and approximate cost. The "Always On" list is comprised of appliances and electronic devices that are always plugged and are consuming energy even when not being used. Electronics may continue to use power even when they are in the off, standby or sleep modes.

Several examples from the list include the Mobile Charger (each device) average kWh/year = 20, Energy cost/year = $2.00; Desktop Computer (each device) average kWh/year = 342, Energy cost/year = $31.00; DVR (each device) average kWh/year = 446, Energy cost/year = $40.00

[21] Palo Alto Home Efficiency Genie: https://www.cityofpaloalto.org/Departments/Utilities/Residential/Home-Efficiency-Genie
[22] Avista Energy Always On Calculator: https://www.myavista.com/energy-savings/always-on

Customers are given suggestions on how to reduce their carbon footprint such as unplugging devices, using a digital timer, adjusting power settings, plugging devices into a smart power strip, looking for the ENERGY STAR label when purchasing new electronics, and weighing environmental Impacts.

Around 20% of a home's electricity use is due to always on consumption. For an average home using 900 kWh, that is 180 kWh per month. Pulling from resources such as the Berkeley Lab Standby Power[23] Avista educates customers. In Spokane, an average home's annual "Always on" usage is 2,160 kWh.

Types of Rebates

Perhaps the most basic energy efficiency program design is to provide incentives for energy efficient devices, be they lighting products, HVAC, refrigerators, etc. These "prescriptive rebates" provide a per-unit price. Custom rebates are generally used for larger clients that employ a number of energy management and even operational strategies to cut power use for a set number of cents/kilowatt-hour.

Classic Rebates: Let's call it the "cereal box rebate" model. There's a coupon that you get when you buy a new set of LED lamps, you fill them in, mail them to the redeemer, and wait for weeks. Often such a coupon redemption process concluded with a message that for some reason or another, your rebate application was too late, incorrectly filled, no longer valid, etc.

Classic rebates still exist. You buy or lease an EV in California, and you are eligible for a clean air rebate. Just follow the paper process and ultimately receive a check.

Instant Rebates: Within the realm of rebates are "Instant Rebates." These really make the rebate process efficient. Instant gratification for consumers. Rather than taking a coupon and mailing it in, and hoping for the best, you get the rebate value as you check out. The store takes care of it with the utility.

Contractor Rebates: Another form of rebates target the contractors, not the end users. This can be very efficient. Sometimes contractor competitions can be used. For instance, the contractor who sells the most heat pumps gets a free, all-expenses-paid trip to Hawaii. Studies have found that when well designed, this targeted, upstream rebates approach can be more cost effective than incentivizing every consumer.

[23] Berkeley Lab Standby Power: https://standby.lbl.gov/

Upstream Incentives: Let's push further upstream. If you can get a manufacturer to change the formula for making something, and it saves everyone money for years and years to come… that's a home run. The Golden Carrot proved to be a telling story of how to do so with 18 cubic foot refrigerators. It was a manufacturer's incentive program run by the Consortium for Energy Efficiency out of Boston. It was formally known as the Super Efficient Refrigerator Program.

Super Efficient Refrigerator Program

In the early 1990s, a group of utilities, started by Pacific Gas and Electric and Southern California Edison, along with the U.S EPA and the Natural Resources Defense Council, recognized that there was a gap between the high energy use needed to power typical refrigerators and the level of performance that was potentially available with more efficient technology. They wanted to know what would motivate manufacturers to supply the market with super efficient refrigerators.[24]

Others signed on including the Bonneville Power Administration, Los Angeles Department of Water and Power, Long Island Lighting Company, Sacramento Municipal Utility District, and the Washington State Energy Office. Together, they engaged in brainstorming before deciding on a winner-take-all manufacturer competition to design a market-ready refrigerator that would be 25 - 50 % more efficient. The winning plan also had to show that the company was able to manufacture the product, distribute it, and track its sales.

In turn, the winning refrigerator would be promoted by efficiency programs. By the time the program was underway, a total of 24 utilities had joined in, making the prize worth $30 million, plus a broad swath of the market available in which to promote the winning product.

In 1994, over 7,000 MWh were saved through the purchase of new refrigerators. While Whirlpool won that first contest, other manufacturers recognized the predictable and coordinated support from program administrators and quickly featured efficiency in order to compete in the market. SERP also showed that utilities, working together, could advance efficiency. The Consortium for Energy Efficiency was born.

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Next best is to influence those that distribute wares. The greener the line of things they rep, the better. Then it's the retailer. He or she can really make the efficiency deal. The consumer is at the end of this supply chain of green products. Can Glendale do anything about that? Perhaps. This is all part of the market transformation.

[24] CEE Golden Carrots (SERP), https://cee1.org/content/golden-carrots-beginning

Prescriptive Rebates: This tends to confuse people. Let's just call them rebates! We are all familiar with them: You get a $10 rebate for each efficiency lamp you buy. Everyone gets the same deal… whether it's solar, batteries, or energy efficiency measures. These measures and their rebate prices are "prescribed."

Also known as "deemed rebates," the rebates are money-back for purchasing and installing qualified energy-saving products. These include lighting, refrigeration, HVAC, boilers and water heaters, food service equipment, and variable frequency drives. Some refer to these as "targeted rebates" when focused on a technology or geographic area, for instance heat pump water heater incentives for contractors… $1,000 a shot.

Custom Rebates: In contrast to prescriptive rebates are custom rebates. If an industry, for example, can change its process to use less energy, and can prove it, can be rewarded with a custom rebate. Its prices are based on the kWh and kW saving values that the measures create.

Multifamily / Apartment Programs

Sacramento Municipal Utility District - Go Electric Programs

Multifamily property program for EV charging, heat pump HVAC, dryers, cooktops for 5 units or more (Incentives are also available to install upgrades that improve energy efficiency and to install electric vehicle charging stations).[25] Examples of efficient electrification incentives include:

- Heat Pump water heaters: $1,800 - $2,000
- Heat Pump HVAC heating/cooling systems: $1,400 - $2,500 or $2.50/ft2 served
- Residential heat pump dryer: $400
- Induction Cooktops $750 gas to electric, $100 electric to induction electric
- Energy efficiency incentives to replace older, less efficient heaters, appliances

Puget Sound Energy - Energy Efficiency For Renters

PSE offers special incentives on energy-efficient in-unit and common area equipment for multifamily properties with five or more attached units. Landlord participation is

[25] SMUD Multi-Family Electrification and Efficiency Incentives, https://www.smud.org/en/Business-Solutions-and-Rebates/Business-Rebates/Multi-Family-go-electric-incentives

required. Renters are asked to share the multifamily retrofit page with their property manager or download the multifamily retrofit brochure.[26]

There are free direct-install replacement measures, electric incentives, and natural gas incentives. Higher incentives are available for "Mod" income or income-qualified tenants.

The offers are extensive and include appliances, thermostats, air sealing, window replacement and insulation, and incentives to reduce electric induction appliances

Free Direct Installation:

- LED Replacement
- Advanced Power Strip
- Shower valve
- Bathtub spout (thermostatically controlled model prevents loss of hot water)

Electric Incentives:

- Air sealing
    - Attic sealing—$1.00 per sq. ft.
    - Crawlspace/underfloor sealing—$1.00 per sq. ft.
    - Dense pack wall insulation—$3.00 per sq. ft.
    - Door kit—$100 each

Windows and Sliding Glass Doors:

- $3 per sq. ft. (upgrade from U-factor of .30 to .22 or lower)
- $5 per sq. ft. (upgrade from U-factor of .60 to .30 or lower)
- Now $7 per sq. ft. (upgrade from U-factor of .60 to .22 or lower)
- In-unit LED retrofit, $30 per lamp
- In-unit kitchen LED replacement, $70 per fixture
- In-unit ENERGY STAR® certified front loading clothes washer, $50 per unit

Extra Incentives for Income-Qualified

- Windows and sliding glass door, $6 - $18 per sq. ft.
- In-unit LEDs, (free)
- Common area LEDs, $.05 per kWh
- Smart line voltage thermostats, (free)

[26] PSE Brochure for multi-family retrofit, https://www.pse.com/-/media/PDFs/REBATES/4111_wb_MF_Retrofit.pdf?sc_lang=en&modified=20221011210734&hash=FDC3521504A186E40CE36A2B3C1B8DB1

For PSE Landlords: Incentives apply to all existing multifamily properties with five or more attached units located in PSE's service area. Landlords are encouraged to schedule a free eligibility assessment to determine the range of eligible energy efficiency upgrades, and to prioritize low-cost and no-cost energy and water saving upgrades. Program managers work with landlords then to request bids for capital improvements from PSE's Contractor Alliance Network members.

Low Income Programs

Low income programs are important for social equity and to address the regressive nature of inefficiency. These programs are generally subsidized, often 100% of the cost of measures is covered at no charge to the customers. This "direct install" approach gets the job done; it gets measures installed.

Stewards of Affordable Housing Bringing Sustainability Home

Bringing Sustainability Home provides practical resources, tools, and step-by-step guides that make it easier for affordable housing practitioners to adopt environmentally sustainable practices.[27] In this space, affordable housing practitioners share learnings and best practices from their on-the-ground experience with green building programs and healthy building strategies. This includes resilient building strategies in response to climate change that directly impact the operations of these communities and the lives of its residents. SAHF partners with key organizations—including Energy Efficiency for All and the Healthy Building Network—to create opportunities for the energy, affordable housing, and health industries to collaborate to ensure sustainable, equitable outcomes for residents.

The SAHF website contains multiple resources for download: fact sheets, white papers and resource papers in environmental and health areas. Topics include: Buildings Upgrade Fact Sheets For Residents, Driving Toward The Greater Good White Paper, Centering Residents In Building Decisions, Leveraging Utility Programs Case Study.

[27] SAHF Bringing Sustainability Home, https://www.sahfnet.org/bringing-sustainability-home

ACEEE 2020 Energy Efficient Scorecard Spotlight
American Electric Power – Ohio Low Income

Low Income Community Assistance Program (CAP) and exemplary performance in weatherization services. AEP OH's Community Assistance Program (CAP) offers an array of energy efficiency programs and healthy home enhancements to residential customers with annual incomes at or below 200% of the federal poverty line.[28]

Multifamily units are also eligible to participate if at least half of the units in an apartment building with less than 50 units are rented by eligible customers and are individually metered. Along with air sealing and insulation, this program offers measures such as appliance recycling, home audits, HVAC replacement, health and safety repairs, and more at no cost to the customer. To implement this program, AEP OH distributes funding to community-based agencies.

SCE Low Income Programs

SCE offers discounts to income qualifying customers through several CPUC originated programs such as Family Electric Rate Assistance (FERA) and California Alternate Rates for Energy (CARE).[29] FERA qualifying families receive 18% off their electric bills. CARE income qualifying families of two or more receive up to 30% off their monthly electric bills.

SCE Medical Baseline Allowance

An additional 16.5 kilowatt-hours per day of low-priced "baseline" energy is provided year round for persons with certain medical conditions to help offset the price of running the medical device.

SCE Energy Assistance Fund

SCE allows customers to donate money to help other customers[30]. The program theme is, "Your Pennies Can Help Power a Home." SCE works in partnership with

[28] ACEEE 2020 Utility Energy Efficiency Scorecard, February 2020, report U2004, https://www.aceee.org/sites/default/files/pdfs/u2004%20rev_0.pdf
[29] FERA/CARE, https://www.cpuc.ca.gov/consumer-support/financial-assistance-savings-and-discounts
[30] SCE Energy Assistance Fund, https://www.sce.com/residential/assistance/energy-assistance-fund

the United Way of Greater Los Angeles. The program has provided one-time bill payments of up to $100 for nearly 250,000 qualified Southern California households since the Energy Assistance Fund started in 1982. In 2021, 15,000 SCE customers received help.

Peninsula Clean Energy Home Upgrade Program

The Peninsula Clean Energy Home Upgrade program provides home repairs, insulation, windows, appliances for income qualified homeowners in San Mateo County. There is no cost for the assessments or installations. The work covers windows, plumbing, water heating, and stairway railings.[31]

East Bay Community Energy "Health-e-Homes"

Health-e-Homes is for low and moderate-income residents.[32] Participants receive energy efficiency and home electrification services. The program is not free, but offers low to 0 interest loans to cover costs over a period of 15 years. Program partners are BlocPower and ReValue.io for home energy assessments and support.

Featured Provider: BlocPower

BlocPower – a World Economic Forum Global Innovator that was recently ranked fourth on Fast Company's 2022 worldwide list of most innovative companies – has proven that off-the-shelf electric heat-pump technology, coupled with a holistic financing and installation model, can quickly decarbonize buildings in low-to-moderate income communities with no upfront cost to the property owner.[33]

BlocPower has installed electric heat pumps in more than 1,200 buildings in New York City, where the company is based, and now has projects in more than 25 cities across the US.

[31] Peninsula Clean Energy Home Upgrade Program, https://www.peninsulacleanenergy.com/home-upgrade-program/
[32] Residential Programs Health-e-Homes Program: https://ebce.org/health-e-home/
[33] 3 urban energy innovations with global implications, May 12, 2022, https://www.weforum.org/agenda/2022/05/3-urban-energy-innovations-with-global-implications/

Meanwhile, the International Energy Agency (IEA) has endorsed phasing in electrification by calling for 1.8 billion heat pumps in buildings by 2050. Currently, only 180 million heat pumps have been installed, or about 7% of systems worldwide, but adoption rates are growing, especially in China, Europe and North America. To reach underserved communities, however, locally tailored models for financing and installation are critical.

LADWP Free Refrigerator Exchange Program

Low income residents can exchange older models for new Energy Star models.[34] Multifamily affordable housing units and non-profits also qualify. The LADWP's Refrigerator Exchange Program provides new energy-saving, ENERGY STAR® rated refrigerators in exchange for qualified older model refrigerators, free of charge. The Refrigerator Exchange Program offers participants either a 15 or an 18 cubic foot model.

To qualify, the refrigerator must be located in the LADWP service territory and owned by the tenant, property owner, or organization. It must be at least 10 years old and a minimum of 14 cubic feet (ft2). In working condition and used as the primary unit – not in storage (must be located in the kitchen for residential customers). It must be plugged into a properly grounded outlet. All refrigerator outlets must be properly grounded with a 3-prong plug in accordance with Article 250.114 (3)(a) of the National Electrical Code.

The program estimates savings of $60 annually on refrigerator operating costs as New Energy Star qualified refrigerators use half the electricity of non-Energy Star models.

Los Angeles Department of Water and Power
ACEEE 2020 Energy Efficient Scorecard Spotlight - Most Improved Emerging EE Programs

LADWP was the most-improved utility in the ACEEE 2020 Scorecard.[35] Much of this is due to improvements in portfolio comprehensiveness; it is the second-most improved utility in the emerging program offerings metric. LAWDP had only three “emerging” program offerings in 2017 but now has 13, demonstrating its commitment to energy efficiency and to offering program solutions for a more diverse range of customers and end uses.

[34] LADWP Refrigerator Exchange Program, https://tinyurl.com/LADWP-Refrigerator
[35] ACEEE 2020 Utility Energy Efficiency Scorecard, February 2020, report U200, https://www.aceee.org/sites/default/files/pdfs/u2004%20rev_0.pdf

LADWP has responded to California's increased goals for energy efficiency savings from utility programs, codes and standards, financing, behavioral programs, market transformation, and improvements in the agriculture and industry sectors. To meet these goals, LADWP has undertaken programs such as free home upgrades and a residential energy efficiency loan (REEL) program to assist customers with financing energy efficiency improvements.

Alameda Municipal Power Residential Incentives and Rebates

- Electric Bikes
  - Up to $600
- Smart Thermostat
  - $50
- Electric Panel Upgrade
  - Up to $2,500
- EV Charger
  - Up to $800
- Heat Pump Space Heating
  - Up to $1,500
- Heat Pump Water Heater
  - Save $1,500
- Used Electric Vehicle
  - Up to $1,500
- Electric Clothes Dryer
  - Up to $100
- LED Lighting

Commercial, Industrial, and MUSH Sector Programs

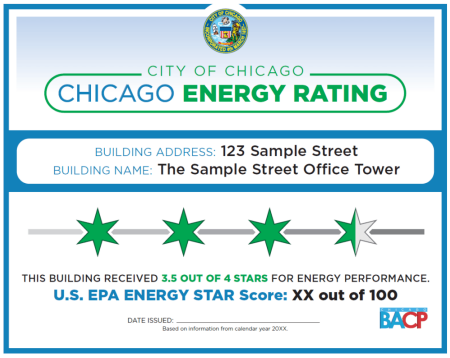
Energy efficiency takes a step up when we move to the commercial sector, to the commercial sector, and to the MUSH sector – Municipal, Universities, Schools, and Hospitals. These are larger properties, more lightbulbs, etc. In these sectors, there are great opportunities for efficiency at scale.

Assessments / Coaching

MCE Commercial Strategic Energy Management

MCE's Strategic Energy Management program provides an "Energy Coach" who flags operations and maintenance changes for greater efficiency. The program highlights stakeholder engagement and an onsite walk through. The program is available for commercial , municipal, agricultural, industrial, multifamily properties, (5 or more units). The program is administered by Clear Result. The coaching is complemented with incentives: Marin Clean Energy pays 3 cents per kWh and 25 cents per therm saved. Promo materials suggest that participation, "Helps you reduce your energy use by 3 - 15% with little to no capital."

Chicago Building Energy Rating/Benchmarking System



The initial Chicago Energy Benchmarking ordinance, adopted in 2013, raises awareness of energy performance through information and transparency, with the goal of unlocking energy and cost savings opportunities for businesses and residents.[36] Building owners or managers of properties 50,000 square feet or greater are required to measure and report whole-building energy use once a year, and have the data verified once every three years. All work can be done in-house and there is not a requirement to hire a third party.

Zero to Four Star Rating: In 2017 The City created the Chicago Energy Rating System. The new rating system is based on existing and publicly available energy data, alongside recent energy improvements to buildings. Each building over 50,000 square feet is required to post their rating in a prominent location on the property, and share this information at the time of sale or lease listing. The Chicago Energy Rating System officially launched in August 2019. The delay between the ordinance passage and the launch of the program was intended to give building owners and the City ample time to prepare for the new Rating System. The program is managed by Elevate, a non-profit Chicago-based Energy Organization.[37]

[36] Chicago Building Benchmarking Ordinance, https://www.chicago.gov/city/en/progs/env/building-energy-benchmarking---transparency.html
[37] Elevate Benchmarking Program, https://www.elevatenp.org/municipal-energy-benchmarking/

PG&E Business Energy Checkup Program

Small and medium businesses can sign up free for the Business Checkup. It's an online program[38]. There are 3 steps to the program: 1. Register to have energy use tracked over a year, month or week. 2. Answer some questions and receive great ideas to help create savings. 3. Create an energy savings plan. The program is available 24/7. Details are in easy-to-read pages, or available on video. Business owners register using their account information and get detailed energy savings information and resources. PG&E offers extensive catalogs of rebates under different categories for commercial customers.

Renew Boston Community Initiative - Embedded Energy Manager

The Renew Boston Initiative has placed the City among the energy elite worldwide.[39] Boston leaders have instilled community-wide programs and partnered with local utility partnerships to reduce energy consumption in a wide range of areas including wind turbines, solar panels, and recycling. Boston has replaced standard street lights with LEDs. Its underlying objective is to entirely rely on renewable energy systems that are both human-produced and completely organic. Work with NSTAR and National Grid on the initiative, designed to strategically leverage utility programs to meet the City's aggressive energy efficiency and renewable goals. Through the program, the electric utility loans the customer one of the utilities' full time utility program managers. The program manager helps to identify and coordinate large energy efficiency projects.

New Construction Design Services

Given the scale, it behooves utilities to work carefully with new construction projects in the service territory. Getting efficiency embedded early, from the initial design onward to commissioning, will result in the greatest efficiency gains, and gains that last.

[38] PG&E Business Energy Check-Up: https://www.pge.com/en_US/small-medium-business/save-energy-and-money/energy-savings-tools-and-tips/business-energy-savings-tool.page?

[39] Eight Innovative Cities, https://biofriendlyplanet.com/eco-awareness/energy/8-innovative-cities-using-technology-to-reduce-energy-use/

California Energy Design Assistance

CEDA is an assistance program provided in SCE, SDG&E, PGE, and SoCalGas territories for new construction or major retrofit projects.[40] The program is managed in partnership with Wildan and is available for commercial, public, industrial, agriculture, and high-rise multifamily designs. The program offers energy design assistance, lifelong energy savings and financial incentives. The program is offered on a first-come, first-serve basis and is funded by the utilities and funding through the public purpose surcharge.

Building Initiative for Low-Emissions Development (BUILD)

Sponsored by the California Energy Commission, BUILD provides eligible applicants constructing their first all-electric, low-income multifamily building (10+ units) with up to $100,000 design award to defray direct design costs, and 300 hours of no-cost technical assistance. Builders or owners of low-income housing can receive up to $2,000,000 incentive program cap per applicant.[41]

Puget Sound Energy New Construction Incentive Options

PSE's new construction programs will help you lower the cost of incorporating energy-efficient systems and equipment into your design. When planning a new project be sure to integrate measures that will help you build more efficiently and earn incentives through PSE's new construction programs.

Current PSE new construction programs include:

- High Performance Homes: Customers earn incentives for building new single-family homes that are beyond the current energy code with three or fewer attached units

- New Multifamily: Customers earn for building beyond the current energy code or commissioning a new business site

[40] California Energy Design Assistance Program: https://ceda.willdan.com/
[41] CEC - Building Initiative for Low-Emissions Development Program (BUILD), https://www.energy.ca.gov/programs-and-topics/programs/building-initiative-low-emissions-development-program

- Energy Star Manufactured Homes: Customers earn incentives for buying Energy Star certified manufactured homes

- Commercial New Construction: Earn incentives for incorporating energy efficient equipment and efficient design strategies into your new construction building.

LADWP Zero By Design New Construction Incentive Program

LADWP's Zero By Design encourages developers to build more sustainably by providing financial incentives for commercial and high-rise multifamily new construction projects which exceed Title 24 or industry standards.[42] LADWP Zero By Design's Whole Building Performance path rewards developments which exceed Title 24 requirements by more than 10%.

Owners receive incentives to help offset the added costs of building more efficiently. In addition, applicants receive complimentary design assistance and review to aid them in realizing their projects' maximum efficiency potential.

Design Teams may also be eligible for incentives by attaining aggressive energy savings goals. In order to qualify, Design Teams must submit an approved energy model to participate. Note that Design Team incentives are capped at $50,000 per project.

LADWP Zero By Design Express provides incentives for the purchase and installation of high efficiency new equipment. For the purposes of calculating incentives, LADWP uses deemed savings calculations.

Mexico City: Sustainable Buildings Certification Program

The Mexico City's Ministry of the Environment manages the voluntary Sustainable Buildings Certification Program.[43] The Program aims to foster sustainable construction and usage of commercial, industrial and residential buildings by awarding certification that reflect various levels of sustainability performance in the areas of energy efficiency, water, mobility, solid waste, social and environmental responsibility, and green roofs.

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[42] LADWP Zero By Design New Construction Incentive Program, https://tinyurl.com/LADWP-ZeroByDesign
[43] Urban Efficiency II, C40 Cities, https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000Mo5i/z8xF0YmnG3TNkgWkgrvbtLXL1NeW1YWT_1Q6DVdaHI8

Voluntary participation from building owners and tenants is incentivized through tax reductions, reduced energy and water bills, access to project financing, expedited permitting procedures, and finally, prospects of increased rental yields from green premiums.

- Green roofs, green gardens, tax incentives for owners who help renters w/energy efficiency

Direct Install Programs

It's been many years since utilities realized that to knock out efficiency gains in the small business sector, you had to give away the measures and install them to boot.

This is Direct Install: A business owner or manager authorizes a complete lighting retrofit. The equipment is on the truck, ready to serve the entire strip mall that day. That's direct install…. And while costly it upgrades properties and saves energy.

Pacific Gas and Electric Direct Install

PG&E helps businesses save money on their energy projects through the Direct Install Program.[44] The program is administered with support by contracted energy efficiency experts including Staples and Associates and Ecology Action. These experts take businesses from start to finish.

Program benefits include:

- Energy audits by industry experts with access to engineers and technical designers.
- Focus on cost savings including finding the right equipment, rebates and financing, so equipment is installed at low or no cost.
- A streamlined process: Energy efficiency experts will help with initial planning, installation and project completion, including rebate and incentive applications.
- Post installation support: Receive services for routine equipment maintenance and employee training.

[44] PG&E Direct Install Program Page, https://www.pge.com/en_US/small-medium-business/building-and-property-management/find-contractors-and-trade-professionals/find-partner-programs.page

PG&E offers a direct install program through multiple third party providers. Providers can apply to the on the contractor's list of "implementation specialists" through a website that serves all three California investor-owned electric utilities and SoCalGas. The program is called Proposal Evaluation and Proposal Management Application (PEPMA).[45] Contractors can register and bid on projects. The program is funded in part by the utility user's tax.

Other Commercial Rebate and Incentive Programs

Wisconsin Electric Power (We) - ACEEE 2020 Energy Efficient Scorecard Spotlight - Portfolio

We Energies earned the top spot in the ACEEE "portfolio comprehensiveness" metric, with 24 programs.[46] We Energies[47] partners with Focus on Energy to provide incentives and rebates on appliance recycling, smart thermostats, and energy-efficient equipment such as heat pump water heaters and lighting, among other residential products. Through the Large Energy Users Program, large commercial customers have access to their energy usage data along with technical training and financial incentives for energy management. For midsize and small commercial customers, the utility offers custom services like hourly energy usage data and bill savings estimates for modified consumption behavior. The Focus on Energy's Agriculture, Schools, and Government (AgSG) program offers tailored energy efficiency solutions to a variety of customers such as schools and universities, farms, wastewater treatment plants, and government facilities.

ACEEE 2020 Energy Efficient Scorecard Spotlight

Portland General Electric - AMI

PGE OR has 100% penetration of advanced metering infrastructure (AMI, or smart meters) and is making use of the technology to further its energy efficiency efforts. Its smart grid strategy is focused on minimizing power outages, maintaining electricity affordability, and increasing clean energy in the system). While AMI does not in itself produce energy or demand savings, there are many ways that utilities can use the technology to do so.

[45] PEPMA, https://www.pepma-ca.com/Public/Default.aspx
[46] ACEEE 2020 Utility Energy Efficiency Scorecard, February 2020, report U2004, https://www.aceee.org/sites/default/files/pdfs/u2004%20rev_0.pdf
[47] Wisconsin Electric Power, https://www.we-energies.com/

PGE is undertaking all five of the approaches identified in the Scorecard: rate design, data disaggregation, direct feedback to customers, behavior-based feedback, and grid-interactive efficient buildings (GEBs). To take one example, PGE provides customers with insights about their energy use so they can optimize consumption.

PGE offers two energy monitoring systems for businesses in conjunction with their smart meters: Energy Tracker for small businesses and Energy Expert for larger operations and businesses with multiple sites. These systems provide automatic detailed reports on meter level energy consumption as frequently as the user desires. The systems are compatible with mobile phones and produce visual aids. They also provide customized recommendations on how to save energy with savings estimates.

Orange & Rockland Business Direct Install Pathway

Orange & Rockland provides businesses multiple "pathways" for energy efficiency.[48]
The Business Direct Install Pathway offers whole-building energy solutions to help businesses and facilities use energy more efficiently and save money.[49] Businesses apply for an assessment and after choosing a contractor get assistance on implementation of the program. The program goal is to make it easy (3 steps) with 12 – 24 months, 0% financing for qualifying projects $2,000 to $25,000. This program helps businesses lower their energy usage and monthly costs.

The 3 steps for customers: Proposal - Get a proposal from a participating contractor or their own pre-approved contractor. Application - Customers notify the contractor to apply. They receive notification of approval typically within 2 - 3 business days of application. Installation - Customers sign closing documents and begin the installation. The first repayment is typically one month following project completion and verification.

Chicago Based Commonwealth Edison

ComEd has multiple incentives for energy efficiency and makes it easy through a user-friendly website. The website provides a combination of education, easy online applications, assessment, and incentives for businesses and municipalities.[50] The website lists businesses by categories. They offer

[48] Orange & Rockland EE Rebates and Incentives Pathways, https://www.oru.com/en/save-money/rebates-incentives-credits/new-york-customers/incentives-for-business-customers-ny/energy-efficiency-upgrades-installations/
[49] Orange & Rockland Business Direct Install Pathway, https://www.neifund.org/orange-and-rockland/
[50] ComEd Business Energy Efficiency, https://www.comed.com/WaysToSave/ForYourBusiness/Pages/BusinessTypes.aspx

multiple options depending on the business category. Click on any category and find rebate offers.

Marin Clean Energy Energy Efficiency Comprehensive Program

Marin Clean Energy was the first Community Choice Aggregation (CCA) provider to launch in California in 2010. It has led the charge in CCA EE and DR programs. As this report is updated, it has become clear that the landscape for EE and DR changes rapidly, and programs/website updates can occur frequently. The below details from MCE show an updated "one-stop" website with comprehensive program information for both residential and commercial energy efficiency.[51]

MCE's programs offer solutions to save money, address climate change, and reduce greenhouse gas emissions. The energy efficiency, electric vehicle, and infrastructure programs help customers reduce their carbon footprint, while improving the comfort and health of their homes and workplaces. In addition, the workforce programs ensure energy professionals and job seekers are trained in the latest clean energy and energy efficiency technologies.

<u>Residential</u>

- Low-Income: Free home energy audits and upgrades for income qualifying residents
- Multifamily: Rebates up to $6,000 per unit for electrification measures, free comprehensive assessments, and additional upgrades for multifamily properties.
- "LIFT" Program: Low Income Families and Tenants. The program layers an extra $1,200 per unit onto the Multifamily Energy Savings Program rebate for energy and water savings measures for income-qualified properties.

<u>Commercial</u>

- Commercial Energy Efficiency: No-cost, no obligation energy assessments, dedicated project management and technical assistance, and incentives covering 10-90% of project costs for businesses of all sizes.
- Strategic Energy Management: Long-term approach to help businesses save money, earn incentives, and better manage energy usage through cohort-style trainings, onsite assessments, individual coaching, and peer-to-peer learning.

[51] MCE Customer EE/DR Programs, https://www.mcecleanenergy.org/customer-programs/

- Commercial and Residential Efficiency Markets: Pays aggregators and project developers for realizing energy reductions with an emphasis on peak period savings and load-shaped energy efficiency.
- Peak FlexMarket: First-of-its-kind marketplace platform that pays participants for load shifting and shedding during summer peak hours and demand response events.

ACEEE 2020 Energy Efficient Scorecard Spotlight
Xcel Minnesota - Integrated Resource Planning

Xcel MN earned full points in the new resource planning metric by including energy efficiency as a supply-side resource in its integrated resource plan (IRP). Xcel MN's goal is to provide 100% carbon-free energy to its customers by 2050.[52] In July 2019 the utility released a 2020– 2034 IRP that lays out the preferred resource mix for achieving this goal as well as other objectives like maintaining reliability, increasing energy affordability, and minimizing risk.

Xcel considers energy efficiency a supply-side resource, a change from its previous plan. The utility continues to present its load forecast with and without energy efficiency but does not embed efficiency in the forecast used for modeling. Instead, Xcel treats energy efficiency as a supply-side resource by creating bundles of measures that achieve a certain estimated amount of avoided load per year at a cost that blends the estimated measure costs.

These bundles are considered along with all other resources in the software Xcel uses to optimize its resources based on cost and other goals. Its preferred resource plan features ambitious demand-side management including both energy efficiency and demand response (Xcel Energy 2019). Substantial increases in efficiency investment will create more than 780 GWh of savings annually, compared with about 444 GWh in the previous plan.

Riverside Public Utilities Premium Motor Incentive Program

RPU offers incentives for new, efficient, premium motors.[53] Rebates for improvement in Consortium for Energy Efficiency (CEE) levels up to $100,000 for the largest users. Manufacturers using older motors are encouraged to purchase and install electric motors with the highest energy

[52] ACEEE 2020 Utility Energy Efficiency Scorecard, February 2020, report U2004, https://www.aceee.org/sites/default/files/pdfs/u2004%20rev_0.pdf
[53] Riverside Premium Motor Incentive, https://www.riversideca.gov/utilities/businesses/rebates/energy-rebates/premium-motor-incentives

efficiency output needed. The RPU website has a list of qualifying equipment and program guidelines.

Riverside Public Utilities Air Conditioning Incentives

RPU offers incentives for customers who install high-efficiency central air conditioning units and chiller systems. Rebates range in value from $150 - 300 per ton when linked with demand response. The incentive cap is $100,000 per customer.[54]

Program Guidelines. All Energy Star units are eligible. The minimum qualified SEER/EER ratings start at 15 SEER/11.7 EER and go up. A matching evaporator coil must be installed to qualify for the rebate. A copy of the original, dated sales receipt must be provided, and is subject to verification. The sales receipt must note the make, model number, serial number, tonnage, and SEER/EER rating of the new unit(s). Rebate amount is $150 per ton for units rated at 15 SEER/11.7 EER. Rebate amount is $250 per ton for units rated 16 SEER/12.8 EER or greater. Rebate amount is $300 per ton with units incorporating load shifting or demand response capabilities. Rebate amount for HVAC tune-ups, including refrigerant recharge, is $10 per ton.

Rebate amount cannot exceed $25,000 for Flat Rate customers, $50,000 for Demand Customers, and $100,000 for Time of Use (TOU) customers. In addition, rebates cannot exceed 50% of the project cost. Customers are limited to one capped rebate per program per fiscal year per premise.

SmartRiverside Personal Computer Power Management Rebate

In keeping with its goal of attracting and fostering business in the City of Riverside, Riverside Public Utilities has joined with SmartRiverside to develop the Personal Computer Power Management Rebate Program.[55] Under the program, businesses located in the City of Riverside can receive energy efficiency rebates for implementing PC power management software on personal computers. PC Power Management software is an energy saving solution for desktop computers. There is an

[54] Riverside Air Conditioning Incentives, https://www.riversideca.gov/utilities/businesses/rebates/energy-rebates/air-conditioning-incentives
[55] Riverside Personal Computer Incentives, https://www.riversideca.gov/utilities/businesses/rebates/energy-rebates/pc-power-management

application process for businesses with multiple computers that utilize power management systems.

For customers, the rebate helps to offset the costs of purchasing power management software for personal computers. The rebate incentive is up to $15 per PC license for the power management software. Rebate amounts cannot exceed the power management software costs. The maximum rebate per Riverside Public Utilities business electric customer is $25,000 per site.

To be eligible for the SmartRiverside Personal Computer Power Rebate Program, companies must meet the following eligibility requirements: A participant must purchase Personal Computer Power Management Software, install software program and monitor power consumption, provide data reports from software showing savings for 3 months after installation, run software program to efficiently manage PC power consumption, submit proof of purchase and energy savings report with rebate application.

Silicon Valley Power Heat Pump Pool Heaters

SVP is offering generous rebates for reducing the use of natural gas-fired equipment through the installation of energy efficient all-electric equipment. Currently, rebates are available for installing heat recovery chillers and heat pump pool heaters.[56]

Pacific Gas & Electric Industry Rebates by Category

Small and medium businesses can access a list of rebates depending on industry category.[57] There are rebates for retail, grocery, biotech, health care, office buildings, high tech, hospitality, food services, industrial businesses, agriculture and food processing, K-12 schools.

California IOU Statewide Programs

The State of California's investor-owned utilities, regulated by the California Public Utilities Commission, have been directed to implement a number of statewide programs. They are largely managed and implemented by third parties, companies such as Willdan and Staples and

[56] Silicon Valley Business Rebates, https://www.siliconvalleypower.com/businesses/rebates
[57] PG&E Industry Rebates By Category, https://www.pge.com/en_US/small-medium-business/save-energy-and-money/rebates-and-incentives/industry-rebates.page?

Associates. PG&E's website explains that, "There are a variety of Energy Programs available to all business customers. Some are statewide core programs and others are managed by an energy-efficiency partner selected by PG&E."

SCE provides a link on its website[58]. It presents a brief description of each of the third-party programs, and then links for further information and depending on zip code to sign up. Here are three program examples, followed by an annotated list of other programs:

- CEDA California Energy Design Assistance program provides complimentary comprehensive analysis of different energy efficiency options.. Its savings and incentives are tailored to each project. CEDA serves commercial, multifamily, four stories and higher, public, industrial, and agricultural customers.

- Food Service Instant Rebates for commercial foodservice equipment dealers to offer rebates at the point of sale. High efficiency gas and electric kitchen equipment

- CALNEXT is a program to support Electric Emerging Technologies program, branded as CALNEXT. Its goal is decarbonization through electrification. Its goal is to advance the State's priorities… load flex, engaging hard to reach, disadvantaged communities, select projects to be tested…

- Comfortably CA, a program targeted at commercial and residential HVAC distributors and retailers
- Illuminate CA, incentives for lighting
- Midstream water heating program
- Program for state-owned buildings

ACEEE 2020 Energy Efficient Scorecard Spotlight
DTE Energy (DTE) - 2030 Bold Goal

Based in Detroit, Michigan, DTE has a bold goal for its contribution to Michigan's clean energy future. Its goal is for 50% of energy customer demand to be met through renewable energy resources and energy waste reduction (what it calls energy efficiency) by 2030. To achieve this goal, DTE increased its energy efficiency savings targets beyond the mandated level of 1% of energy sales to 1.45% of sales. In 2018, DTE rolled out prescriptive and

[58] SCE Third Party Energy Efficiency Programs, https://www.sce.com/business/savings-incentives/third-party-energy-efficiency-programs

non-prescriptive C&I programs including retro commissioning, energy management controls, programs for small businesses, and incentives for energy-efficient equipment such as LEDs, HVAC, and food and refrigeration. For homes, DTE added appliance recycling, smart thermostats, lighting, and new construction programs..[59]

Rocky Mountain Power Energy Efficiency Project Financing

Serving parts of the states of Idaho, Wyoming, and Utah, Rocky Mountain Power provides Trusted Commercial Financing for its contractors and customers.[60] With incentives from Rocky Mountain Power and energy project financing, contractors and their customers can cover up to 100% of project costs with no money down. The program offers simple instructions: "Three Simple Steps for Customers" and "Three Simple Steps for Contractors. The projects must be $2,000 and up.

Qualified projects include Energy Efficiency & Related Equipment; Lighting & Controls; HVAC & Refrigeration; Battery Storage & Electrical Vehicle Charging; Solar & Solar Thermal; Indoor Air Quality; Plumbing Work & Water Efficiency Equipment; and Non-Efficiency Equipment (case-by-case).

Pacific Gas and Electric Resource Innovations HEFI Program

The Healthcare Energy Fitness Initiative (HEFI) is a customer-centric demand side management (DSM) program that offers tailored solutions for PG&E's healthcare customers. The program is a comprehensive energy efficiency solution designed to support PG&E healthcare customers in saving money by optimizing their energy performance.[61]

The program focuses on the highest potential end uses in the healthcare segment, including: HVAC retrofits, controls, and optimization – including central heating, cooling, and steam plants; Lighting fixtures and advanced lighting controls; process and equipment loads, refrigeration, and plug loads. Education on load management is an important part of the program. The program is available to healthcare, residential care, social assistance, and outpatient services facilities. PG&E has a partnership with National Energy Improvement Fund (NEIF) to help fund and operate the program.

[59] DTE 2021 Annual Report, https://dteempowermi.wpenginepowered.com/wp-content/uploads/DTEEEAnnualReport2021.pdf
[60] Rocky Mountain Power Energy Efficiency, https://www.neifund.org/rocky-mountain-power/
[61] Resource Innovations HEFI Program, https://www.neifund.org/hefi/

Silicon Valley Power Data Center program

The Data Center Program is targeted to data centers with IT server loads greater than 350 kW or IT cooling loads greater than 100 tons.[62] This program provides unique opportunities for energy-efficiency projects that may not otherwise fit into our standard rebate and customer assistance offerings.

Energy efficiency projects that decrease electrical usage at a data center facility in SVP service territory may qualify. Retrofits to existing data centers that reduce fan energy usage or increase the efficiency of the cooling system may be eligible for rebate. New data centers with an energy efficient design as compared to a typical data center may also be eligible for rebate.

Silicon Valley Power Emerging Technologies Grant Program

SVP wants to implement projects that demonstrate new products and product applications not yet commercially viable in today's marketplace, install energy efficient technologies not generally known or widely accepted, yet show potential for successful market growth, successfully apply energy efficiency solutions in new ways, and introduce energy efficiency into industries or businesses that are resistant to adopting new technologies or practices.

SVP provides grants to customers who implement exceptionally creative uses of energy technology. Grant award limits are paid based on energy saved, subject to a maximum of 85% of project cost up to a $250,000 limit per customer. Program funding is limited to $500,000 per year.[63]

Silicon Valley Power Grant Program for Non-Profit Organizations

Silicon Valley Power offers grants to eligible nonprofit organizations located in the City of Santa Clara to help fund energy efficiency upgrades.[64] This program is targeted at helping nonprofit organizations improve energy efficiency of their facilities and reduce their electric bills.

[62] Silicon Valley Power Data Center program, https://www.siliconvalleypower.com/businesses/rebates
[63] Silicon Valley Power Grant for Non-Profit, https://www.siliconvalleypower.com/businesses/rebates
[64] Energy Efficiency Rebates, https://www.siliconvalleypower.com/businesses/rebates

Organizations registered as a 501(c)3 nonprofit organization may apply. Organizations must own or lease property in the City of Santa Clara and receive electric service from Silicon Valley Power.

Energy efficiency projects that save electric energy may be eligible. Typical projects include but are not limited to lighting, HVAC, and weatherization upgrades.

The maximum available funds for a single project is $25,000. Matching funds of 20% are required. Grant funds will be paid per the schedule outlined in the pre-approval notice.

LADWP Commercial Lighting Incentive Program

CLIP provides incentives on the installation of newly purchased and installed energy-saving lighting and controls.[65] With CLIP's calculated savings approach, participants can tailor their lighting efficiency upgrades to better meet their lighting needs, attain greater energy saving, and receive higher incentive payments.

Incentive levels are based on the calculated energy savings of each project, with rates ranging from $0.08 to $0.24 per kilowatt-hour (kWh) of annualized savings.

The CLIP incentives are based on complexity (and thus cost) of the measures. Category A incentives are for screw in lamps, linear fluorescent tube replacements, etc and are rewarded with $0.08/kWh saved in the first year. Category B involves fixture replacement and is also 8 cents. Category C complete LED fixture replacement (24 cents/kWh), and Category D for Sensor based control at 15 cents/kWh. A fifth category involves "interactive effects" and is rewarded with 8 cents/kWh.

Energy Saving Lighting Equipment Included:

- LED Interior Ceiling Mounted, Downlight, and high bay Fixtures
- Exterior LED pole-mounted and wall-pack fixtures
- LED Screw-In Lamps
- Occupancy Sensors and Daylight Controls
- New Induction Lamps and Fixtures
- High Performance Reduced Wattage Fluorescent Lamps and Ballasts

[65] LADWP Commercial Lighting Incentive Program, https://tinyurl.com/LADWP-Commercial-Lighting

SMUD Express Energy Solutions

SMUD's Express Energy Solutions program is for lighting, refrigeration, heating and cooling, food service, electric water heating, cooking, and cooling.[66] SMUD's Go Electric programs include incentives to convert commercial natural gas-fired equipment to efficient heat pump and induction technologies. The incentives are based on simple equipment choices and are best for smaller or less complex buildings.

Incentives up to $20,000 are available for heat pump water heaters, heat pump space heaters, and induction ranges/cooktop. SMUD is partnered with local contractors to receive instant rebates from SMUD on qualifying gas-to-electric equipment installations and the rebates are passed on to customers at the time of purchase.

Equipment or measures:

- Commercial food service equipment
- Heat pump water heaters
- Refrigeration
    - Anti-sweat heater controls
    - High efficiency fan motors
    - Auto door closers
    - Strip curtains
- Lighting
    - Hi Bay
    - Exterior lighting
    - Refrigeration case lighting
- Heating and cooling equipment
    - Package unit and split system replacements
    - VFD or HVAC fan
    - Ductless mini split heat pumps
    - PTAC (packaged terminal air conditioners)

SMUD Energy Profiler and Energy Star Portfolio Manager

SMUD's Energy Profiler and Energy Star Portfolio Manager program provides customized insights for customers into

[66] SMUD Express Energy Solutions, https://www.smud.org/Business-Solutions-and-Rebates/Business-Rebates/Express-Energy-Solutions

their energy consumption so they can monitor, analyze and optimize usage over time.[67] Customers get comparisons; they can compare energy charges monthly or annually. They can view usage and view energy usage in 15 minutes and demand intervals. There are more features such as downloading usage data via Green Button, view end-use disaggregation and more.

SMUD will provide up to 24 months of a building's electrical energy usage data, in either individual meter or aggregated data form. This includes one-time uploads of 12 months of aggregated or individual meter usage data can be provided to Portfolio Manager, so an energy use intensity (EUI) or an ENERGY STAR® score may be calculated. Alternatively, for most customers, continuous data sharing of individual meter usage. This can be provided to the Portfolio Manager to track and monitor a building's usage on an ongoing basis.

Customers using Campus billing may only receive data in aggregated form. Campus accounts with access to the SMUD Energy Profile Online may email for help uploading their meter data uploaded into Portfolio Manager via custom template.

Under the California AB 802 Building Energy Use Disclosure and Public Benchmarking law, SMUD will provide aggregated data upon request for covered buildings that meet either or both of the following guidelines:

- Any building with no residential utility accounts
- Any building with five or more active utility accounts, residential or nonresidential

Trinity Public Utilities District Heat Pump Rebate Program

Trinity PUD is offering a "cleaner heating" incentive in the form of a rebate/credit of $700 to a limited number of qualified District customers who purchase an energy efficient, electric heat pump for their home.[68]

Whether it's new construction or retro-fit, Trinity PUD can help customers take advantage of low cost, renewable, 100% carbon-free hydro power. The cost of operating an electric heat pump is substantially less than a propane furnace. As an example, at an electric rate of ten cents per kilowatt hour, the cost of propane would have to be less than $1.00 per gallon in order to be competitive with an electric heat pump. Given current rates for electricity and propane in the

[67] SMUD Manage My Energy, https://www.smud.org/en/Business-Solutions-and-Rebates/Manage-My-Energy
[68] Trinity PUD Heat Pump, https://www.trinitypud.com/rebates/heat-pump

Trinity PUD service territory, propane heating costs approximately three times as much as heating with an electric heat pump.

Trinity Public Utilities District Electric Water Heater Rebate

Trinity PUD is offering an incentive in the form of a rebate/credit of $200 (for a conventional electric water heater) or $250 (for a hybrid electric water heater) to a limited number of qualified District customers who purchase an energy-efficient, electric water heater for their home.[69]

Whether it's new construction or retro-fit, Trinity PUD can help customers take advantage of low cost, renewable, 100% carbon-free hydro power. With Trinity PUD's low electric rates a family could lower its water heating costs 50% or more by switching from a propane water heater to an efficient electric water heater. The cost of operating an electric water heater is substantially less than a propane unit. As an example, at an electric rate of ten cents per kilowatt hour, the cost of propane would have to be less than $1.50 per gallon in order to be competitive.

SCE Interest-Free Financing on Energy-Efficiency Upgrades

SCE offers energy-efficient improvements to business owners who need help financing. Businesses could qualify for The On-Bill Financing Program (OBF).

SCE Offers Businesses Zero Interest Loans for Energy Upgrades: Program participants receive 0% interest loans, no fees, and loan repayment through the monthly SCE utility bill.

Customers can also receive additional benefits from the project, including long-term energy savings and financial incentives for installing qualified energy-efficient equipment (restrictions apply)[70].

Electrification and DER

Electrification projects that also combine DER programs can help increase the speed and adoption of decarbonization efforts.

[69] Trinity PUD Electric Water Heater, https://www.trinitypud.com/rebates/water-heater
[70] SCE OBF Fact Sheet, https://authoring.dms.sce.com/sites/default/files/inline-files/OBF_Fact_Sheet_032822_WCAG.pdf

"One-Stop" EE and Load Management partners

Elevate Energy Multifamily Energy Savings Program

Elevate Energy is a Chicago-based non-profit that works with partners nationally to advance the growth of high-performance buildings.[71] It offers multiple programs supporting energy efficiency, green certifications, solar and storage, water efficiency, finance support, and more.

One program is the multifamily energy savings program. The owners of affordable multifamily buildings partner with Elevate to improve the energy efficiency of their buildings in a way that benefits them, their tenants, and the environment. Owners save money and see improved tenant retention, tenants save money and enjoy better living conditions, all while helping to reduce carbon pollution.

Since the program's launch in 2007, more than 620 affordable multifamily buildings (comprising 28,600 units) have completed upgrades in Illinois and Michigan alone. These retrofits have avoided more than 49,400 metric tons of CO2, equivalent to the annual emissions from the energy use of approximately 5,200 average American homes.

Elevate partners with a variety of financial institutions to provide financing to owners to pay for the energy improvements. For example, Elevate collaborates with the Community Investment Corporation (CIC). The CIC uses projected energy savings to underwrite loans at a fixed rate of three percent with a seven-year term, with an average investment per unit of $2,500.

In an effort to reach some of the lowest-income members of the community, Elevate also partners with nonprofit affordable housing organizations. Other important partners are local certified contractors that complete the energy savings upgrades. Program locations include Chicago IL, Detroit MI, Lansing MI, Springfield IL, Kansas City MO, Oakland CA, Portland OR.

BlocPower

BlocPower is a Brooklyn-based climate technology company dedicated to greening American cities.[72] Since its founding in 2014, the company has completed energy projects in 1,200+ buildings. BlocPower utilizes its proprietary software for analysis, leasing, project management, and

[71] Elevate Energy, https://www.elevatenp.org/
[72] BlocPower Public/Private Partnerships: https://www.blocpower.io/

monitoring of urban clean energy projects that can save its customers 20-40% on their energy bills.

The company is backed by the world's top investors, including Goldman Sachs, Kapor Capital, Microsoft's Climate Innovation Fund, Andreessen Horowitz and American Family Insurance Institute for Corporate and Social Impact. In 2022, *Fast Company* named BlocPower the #4 Most Innovative Companies in the World. Bloc Power is minority owned and focused on jobs and job training, and equity.

Currently BlocPower is set to work with Menlo Park to electrify 10,000 buildings by 2030. The company is also set to work with Oakland, San Luis Obispo, Denver, Alameda County, (besides New York City and Ithaca). Block power provides a lease program for a set number of years. Afterward homeowners own their equipment.

Best Practices - Load Management

This section of the Best Practices Analysis focuses on load management, means to control loads to reduce peak period consumer demand. Controlling loads can be as simple and manual as flipping a switch, or using a SPAN smart panel, or can be done using pre-programmed energy management systems that link utility power with local solar and storage for system optimization.

Controls have indeed become sophisticated, and this is a good thing. Thanks to wireless systems, individual appliances can be controlled, even from a distance. Proverbially, using a phone or tablet, building managers can monitor and control loads in facilities while on the golf course.

Naturally, buildings that already have energy management systems – that control lighting, HVAC, security, etc. – are off to the races. They work well with load management programs. They are able to reap incentives for cutting non-essential loads when called upon to do so. But there are also solutions for facilities without sophisticated controls.

Residential Program

Information

GWP would be nicely supported with an emergency system that alerts the masses to address the peak of the peaks…. now! Like the Flex Your Power campaign, GWP might consider

developing something unique to Glendale. Then ideally, when GWP sends out a call, everyone knows that it's real… that GWP is on the brink, about to have to go into rolling black out mode. That's bad. Glendale-FLEX is good. It makes the reality clear to consumers. It sets a goal, for instance to cut 5 - 10% of the entire peak load within an hour. Doing so will avert highly disruptive and costly black-outs.

California Statewide Flex Your Power

Flex Your Power was developed in response to the California power crises of 2001 and 2002. It is now known as the largest electricity conservation campaign ever conducted in any state. It was the brainchild of Wally Maguire.[73] It helped avert power outages for many years. In 2007, it incorporated the severity of global warming in its messaging.

Here's the setting: California had not built any new power plants for years. Sound familiar? Increased air conditioning loads were putting tremendous strain on the system. Prior to the Summer of 2001, California was projected to have 34 days of blackouts and a resulting economic cost of $16 billion.

The State was searching for a magic bullet and Flex was born. Its goal was to "generate" 5,000 MW of load shedding in five months. It was to have the ability to shed 14% of the peak power system. Flex's mission was clear: Shave the peak. Prevent blackouts. Make conservation a way of life.

When Wally McGuire started the initiative, polling showed that only 10% of Californians knew what peak power is. Most thought they already conserved. Some thought that the situation was hopeless. McGuire employed the CIGAR strategy. It called for programming for every segment of the power sector: Commercial, Industrial, Governmental, Agricultural, and Residential. Flex built a theme, "Together we can do this."

Flex raised consumer awareness through Alerts, but also worked with utilities to ramp up incentives and to institute tiered pricing to price out energy hogs. There were prohibitions on outdoor lighting. There was a CEO pledge. And Flex built partnerships, for instance with Sears, to provide instant rebates (rebates at the point of sale) and efficient product placement in stores. Flex involved extensive public education. There was a school challenge... and students

[73] Flex Your Power Campaign, https://toolsofchange.com/en/case-studies/detail/192

were made aware of the link between energy use and water use. Flex dramatically boosted sales of Energy Star appliances thanks to more utility rebate dollars.

The California Energy Commission Summer Study 2001 Conservation Report found that demand response and rebate incentive programs resulted in 3,743 MW of savings plus voluntary conservation savings of 2,616 MW. Depending on how you slice the overall outcome, Flex as a leader in a joint exercise of great proportion, exceeded its 5,000 MW goal.

EcoMotion recommends developing a special Flex program for Glendale. It will no doubt have a different name, but its mission is the same.

Automated Thermostat Programs

Thermostat programs go after one of the biggest residential loads, and a load that is largely peak coincident, namely air conditioning. By controlling thermostats throughout the community, being able to cut three degrees from every participating home when needed, has a great result. GWP is doing this with its program run by Franklin Energy for homes and businesses.

SCE Residential Demand Response Programs

Smart Energy Program: Customers with a Smart Thermostat can allow it to be adjusted during a peak event.[74] They get $75 to enroll and $40 annually. Customers can override the program, but they may impact their continued participation in the program.

Summer Discount Program: Remote control of customer's air conditioning in exchange for bill credits in summer billing cycle period. Customers get up to $230 in credits on their energy bill. The program gives customers "Comfort Level Options" and allows customers to override the control up to 5 times during the summer. SCE A/C Options are below:

Voluntary Consumer Actions – Smart Panels/Smart Breakers

"Smart panels" such as those produced by SPAN (residential) and the Johnson Controls Energy Control Center (commercial) can be programmed and controlled for different scenarios. They can be remotely operated… turning off loads. "Smart Breakers" do the same thing at a more

[74] SCE Residential Demand Response Programs, https://www.sce.com/residential/demand-response

granular level. Imagine being able to control the top five or six loads in any given facility to cut power use.

SCE Smart Thermostat Rebates | Up to $75

Customers receive a $75 bill credit when they enroll an eligible smart thermostat in a qualifying demand response program through an authorized thermostat provider. Receive $30 for disposal of old thermostat.

PG&E ENERGY STAR® Smart Thermostat Program

For homes with furnace HVAC systems[75]
$50 per household

PG&E ENERGY STAR® Smart Thermostat with Time-of-Use

For homes with furnace HVAC systems
$120 per household

Holy Cross Energy Peak Power +

Holy Cross Energy in Colorado's Peak Time Payback Program[76] rewards members for reducing electricity usage during blocks of time when demand is high. The utility pays customers 50 cents to $1 per kWh saved during that time. The program includes any kind of demand response: for example, customers can choose to turn down their programmable thermostat or set their EV chargers to charge outside the peak window.

Consolidated Edison Smart Usage Rewards Program

Consolidated Edison of New York has been cited for targeting its customers through its Smart Usage Rewards program, Con Edison's Demand

[75] PG&E Smart Thermostat Program, https://www.pge.com/en_US/residential/save-energy-money/savings-solutions-and-rebates/rebates-by-product/smart-thermostats/smart-thermostats.page?WT.mc_, id=Vanity_smartthermostat
[76] Holy Cross Peak Time Payback, https://www.holycross.com/peak-time-payback/

Response Program.[77] ConEd reaches out to its customers: "When energy demand peaks during the summer, we'll pay you to reduce your electric use temporarily. You'll help reduce strain on the energy grid and ensure others have safe, reliable power when they need it most".

The utility offers customers both capacity payments and performance payments of up to $18,000 a year for every 100 kilowatts (kW) reduced. There are several programs customers can participate in currently:

<u>Commercial System Relief Program (CSRP):</u>

- Notifications: 21 hours prior to Planned events
- Reward levels:
    - Brooklyn, Bronx, Manhattan, and Queens participants earn $18/kW per month
    - Staten Island and Westchester participants earn $6/kW per month
    - Participants earn a $1/kWh performance payment rate during events

Events are generally system-wide, with each network having an assigned call window throughout the day. Conditions that trigger an event include forecasted peak demand or temperature variable.

<u>Distribution Load Relief Program (DLRP):</u>

- Notifications: 2 hours prior to Contingency events; fewer, prior to Immediate events
- Reward levels:
    - Tier 1 Network participants can earn $18/kW per month
    - Tier 2 Network participants can earn $25/KW per month
    - Earn a $1/kWh performance payment rate during events

Participants are generally called by network based on need. Conditions that trigger an event include being one contingency away from a "Condition Yellow" or an active voltage reduction by network.

Participants make a pledge to reduce their load and sign up with a local aggregator. Participants receive monthly payments based on kW pledged and/or the amount of actual kilowatt hours (kWh) reduced. A customer example is given: The customer reached their pledge and received:

[77] ConEd Demand Response Program, https://www.coned.com/en/save-money/rebates-incentives-tax-credits/rebates-incentives-tax-credits-for-commercial-industrial-buildings-customers/smart-usage-rewards

Zone 1 - $6,000, Zone 2 - $3,500, Zone 3 - $2,500. Voluntary customers can be enrolled after the enrollment deadlines and receive $3/kWh performance payment rate during events.[78]

SDG&E Power Saver Rewards Program

If customers are eligible and can reduce their energy use during a Power Saver Rewards event, when the grid is especially stressed — they receive a bill credit of $2/kWh. Participating is entirely voluntary, and the more energy saved the more they earn.[79]

A Power Saver event may occur any day of the week from 4 pm to 9 pm during the months of May through October. Customers are notified a day ahead of the event so that they can plan and prepare.

In terms of program eligibility, customers must be a residential electric customer with a smart meter within SDG&E's territory. They must not be a participant of other SDG&E energy incentive programs. Residential customers participating in Community Choice Aggregator (CCA) or Direct Access (DA) are eligible for the program. NEM customers are also eligible to participate.

"Typical Use" Requirements and Conditions: Power Saver Rewards customers are eligible to receive a bill credit if they can reduce their energy use below their Typical Use on similar days prior to the Power Saver Rewards event.

SCE Program Saver Rewards - Run by Third Party, Olivine

SCE Power Saver Rewards program occurs May 1 to Oct 31.[80] An event can be called from 4 - 9 pm, the summer peak period. Customers get paid $2 kWh for energy saved. SCE reports if over eight events occur customers on average can earn $40 in credits. The Program is managed by Olivine and participants must have an SCE interval or SmartConnect™ meter.

Demand Response Programs

Utilities are starting to pay more for a quicker response, ties nicely with interval meters and building automation systems. DR programs provide payments to large energy consumers - and

[78] ConEd Participating DR Aggregator List, https://www.coned.com/en/save-money/rebates-incentives-tax-credits/smart-usage-rewards-form
[79] SDG&E Power Saver Rewards Program, https://www.sdge.com/residential/savings-center/energy-saving-programs/reduce-your-use/power-saver-program
[80] SCE Power Save, https://powersaver.sce.com/

now even small consumers – that agree to reduce either energy or demand during times of electricity grid stress.

Some regional transmission organizations allow demand response programs to offer into the wholesale electricity markets with other generators. Instead of offering to fulfill electricity demand with generation, an aggregator of customers willing to stop using energy at a certain time for payment will offer a price into the market for not using a certain amount of energy.

For example, the Electricity Reliability Council of Texas (ERCOT), allows demand response to offer into energy and resource markets. And it deploys utility programs and other demand response scenarios under emergency conditions. In ERCOT, about 3.7% of peak demand was reduced by utility-run demand response programs in 2017.[81]

United Kingdom: Octopus Energy, Demand Response

Octopus is Britain's fourth latest electricity retailer. It has recently announced that it will compensate customers who use less during power periods of high demand, helping to blunt the impact of the looming crisis in Europe. The U.K. "staring down potential fuel shortages…" so the strategy is to shift away from peak when the nation's gas supplies will be stretched thin due to the Ukraine War. National Grid is looking for 2 GW of "flexible demand," i.e. demand response. Octopus will now, for the first time, lean on consumers to cut demand… for households to collectively supply the grid by reducing their consumption during crucial hours.[82]

This winter, there may not be enough natural gas to both heat homes and run power plants, Russia's invasion of Ukraine has gas prices spiking. The London-based company will invite its U.K. customers with digital smart meters – 1.4 million homes and 5,000 businesses – to participate, targeting 250 MW of grid capacity. National grid will identify tight periods, and Octopus will alert its customers when to cut back usage, likely in peak periods 4 - 7 pm. Participants will be paid for performance, based on their deviation from standard usage patterns. They will be paid four pounds per kilowatt-hour – equivalent to $4.59 per kWh. A participant could earn ~$10,000 this winter season.

[81] Energy Information Administration, Today in Energy, Demand-Side Management Programs Save Energy and Reduce Peak Demand, March 2019, https://www.eia.gov/todayinenergy/detail.php?id=38872
[82] "This Winter, UK Households can get paid to help prevent grid blackouts," Canary Media, November 1, 2022.

Primary hurdle is not technical, Octopus notes, it's winning the trust of customers so they bother to participate at all. A few years ago, Octopus ran a pilot, offering just 23 pence per kilowatt hour to 300,000 customers, and 100,000 signed up. Last year in the Houston heat wave, OE bought out a bar and gave customers free cold beers if they left home with the thermostat set at 80 degrees.

Arizona Public Service Residential Battery Pilot

Arizona Public Service (APS) offers $3,750 in incentives when customers purchase a home battery by enrolling in the APS Residential Battery Pilot.[83] The Pilot pays incentives for participating in either the data only or data and battery management options.

Option 1: Data Only Customers who choose the Data Only option agree to share their battery system performance data with APS and are eligible for an incentive of $500 per installed kW of battery capacity, with a maximum incentive of $2,500 per home.

Option 2: Data and Battery Management With the Data and Battery Management option, the customer agrees to give APS access to data associated with the battery system and share up to 80% of the battery system's capacity for a maximum of 100 events a year. The customer is eligible for an incentive of $500 per installed kW (up to $2,500 per home) for installed battery capacity plus an additional $1,250, with a maximum incentive of $3,750 per home. Both options are a one-time, upfront incentive paid to customers when their battery systems are approved by APS for interconnection and receive the Permission to Operate.

In terms of eligibility, pilot participants need to be customers in APS territory and must be on a time-of-use service plan or a grandfathered service plan with a solar rate rider. The battery system must be one of the participating battery partners' eligible models, and the design must allow for the battery production to be measured separately. The device must also connect to the APS grid and the Resource Operating Platform for the first time.

Featured Utility: Salt River Project, Arizona

The Salt River Project (SRP) is the first electric utility in the U.S. to earn Platinum status for its 2020 reporting year emissions inventory.

[83] APS Battery Pilot, https://www.chargingrewards.com/apsbattery/

The Climate Registry announced recently that Salt River Project (SRP) has been awarded Climate Registered Platinum Status for the 2020 reporting year.[84]

The Climate Registry, a nonprofit organization, is North America's largest voluntary registry for greenhouse gas (GHG) emissions. SRP was acknowledged for distinct goals: setting and disclosing a public GHG reduction goal as well as a public base year; and publicly reporting a third-party verified GHG emissions inventory for its operations. This data will enable SRP to track its climate initiatives and GHG reductions credibly over time.

In 2019, SRP's Board of Directors approved enhanced 2035 Sustainability Goals that include a commitment to reducing carbon intensity by more than 65% by 2035 and by 90% in 2050 from 2005 levels. "SRP is also committed to adding 2,025 MW of new utility-scale solar energy to its renewable energy portfolio by 2025 and 450 MW of battery storage by 2023, one of the largest battery storage commitments in the Western U.S", said Kelly Barr, SRP's chief sustainability executive.

Duke Energy 2022 SEPA Award for Demand Response/Renewable Energy Pilot Program

Duke Energy subscription pilot program wins prestigious SEPA utility transformation program award. Duke Energy was named SEPA's 2022 Utility Transformation Program of the Year award winner for its Energy Service Subscription pilot program, a fixed bill program with a renewable energy match.[85] SEPA's annual award, now in its fourteenth year, recognizes specific, innovative projects and contributions by utilities, organizations and individuals to advance the modern, carbon-free future of electricity.

The program allowed participants in Florida to pay the same flat-rate energy bill for 12 months with no adjustments at the conclusion of the program. Customers were guaranteed the same rate each month, even through market price fluctuations – such as fuel – or drastic weather changes that normally drive up energy costs. Monthly payments were based on customers' past energy usage, historical average weather temperatures and a small program fee.

As part of the pilot program bundle, Duke Energy matched customers' electric energy usage with an equal amount of renewable energy attributes for a year – called the Renewable Energy

[84] SRP Earned Reporting Award, The Fountain Hills Times, Aug 8, 2022,https://www.fhtimes.com/news/local_news/srp-earned-reporting-award/article_86297bd2-128d-11ed-b426-2f9492316312.html
[85] Duke Energy 2022 SEPA DR Award, https://news.duke-energy.com/releases/duke-energy-subscription-pilot-program-wins-prestigious-sepa-utility-transformation-program-award

Bonus – at no additional cost. The program also provided a financial bonus for pilot participants who chose to register their smart thermostats, allowing Duke Energy to make slight temperature adjustments during periods of peak energy demand.

Virtual Power Plants

GWP Experience: The notion of a virtual power plant is front and center these days. Instead of centralized power generation, virtual plants are aggregations of solar and storage systems at customer sites. They can be spread through our community, and they can be controlled by the utility to deliver peak capacity resources.

VPPs can benefit utilities. Instead of being threatened by customer-sited renewable energy systems, VPPs make solar and storage an agreeable resource for utilities. VPPs make these DERs a dispatchable resource. That's beneficial for utilities, and worth money. Utilities get access to thousands of mini power plants and clean energy without building their own. It's a great partnering concept.

In 2022, and after nearly two years of negotiation, Sunrun elected to back out of contract negotiations with GWP for a Virtual Power Plant. The plant was to be made up of distributed solar and storage systems to 4,000 - 5,000 households and for ~50 multifamily apartment complexes. The VPP was to provide 25 MW of capacity at peak periods. The batteries were to be loaded with 50 MWh of energy storage, able to deliver 25 MW for up to two hours.

Different VPP Models: For a variety of reasons the deal was never consummated. Contentious issues apparently included REC ownership and performance guarantees. Sadly, GWP's bold and innovative VPP program was scuttled. But why? Sunrun has successfully built VPPs for at least a half dozen utilities. While variations on the VPP model, other Sunrun VPP variations have been developed for SCE, EBCE, Peninsula Clean Energy, Silicon Valley Power, and Hawaiian Electric. Sunrun is also developing virtual power plants in New England. Sunrun is also working in Texas and with ERCOT. Most of these programs operate with NEM tariffs.

The Sunrun model proposed for Glendale was fully financed. Interested homeowners, apartment complex managers, only had to say "yes"… and solar and storage systems would be installed. In other VPP program designs, consumers own their systems and "play" into utility markets with their excess capacity. In both scenarios, in the event of a grid failure, the host site gets the battery power.

BYOD Design Option: In the BYOD model… that's Bring Your Own Device… the device is a battery! BYOD model participants are "conventional" Net Energy Metering customers… meaning that their solar and storage devices are behind-the-meter. They are owned by customers. In this VPP model, customers allow their utilities to control their batteries. Specifically, when needed, the batteries are discharged to the grid and their owners are paid for the capacity they provide.

The BYOD model can be supported by utility incentives. For instance, while a consumer may be monetizing tax credits… a local utility can sweeten the deal and offer incentives for the battery capacity. Then the customer gets payments based on the utility use of the batteries. In this program design, the upfront cost is paid down through an incentive, and the customer gets a nice payment for the use of the batteries each year.

Featured Utility: San Antonio, Texas

In 2017, the City of San Antonio launched SmartSA, a smart-cities program in partnership with local utility companies CPS Energy and San Antonio Water System, the VIA Metropolitan Transit Authority, the University of Texas at San Antonio (UTSA), and others set on improving quality of life in San Antonio through data, technology, and community. [86]

Bridging the digital divide is a central focus as is expanding broadband internet access. CivTechSA, is a partnership with local coworking space Geekdom to engage students, companies, and the tech community to grow "civically minded tech talent." Its Innovation Academy trains subject-matter experts from other City departments to do the jobs of the Office of Innovation to expand the City's capacity to take on more projects and upskill talent.

CPS Energy serves the City of San Antonio. Renewable energy use in San Antonio increased 69% from 2010 to 2018, and will continue to increase under the plan. Natural gGas usage will decrease 72%, and coal will be reduced an additional 61% after dropping 44% from 2010 to 2018. Other initiatives include expanding solar and wind resources and integrating battery storage and electric vehicles.

CPS Energy is currently developing the "FlexPOWER Bundle" to replace gas steam units that are near the end of their lifecycle. In their stead will be increased solar resources, energy storage, and "all-source firming capacity," or any technology that can be utilized when

[86] "Inside San Antonio's Office of Innovation," Business Insider, May 5, 2021, https://www.businessinsider.com/san-antonio-texas-office-innovation-smart-tech-infrastructure-divide-2021-5

renewables aren't available.

This past spring, CPS launched another phase of its Save for Tomorrow Energy Plan (STEP), focusing on conservation and energy efficiency. The FlexSTEP RFP aims to strengthen CPS Energy's reliability by blending "Tried & True" programs, like rebates for being energy efficient, with "Innovative & New" solutions to help customers save money and learn new, more efficient energy-use behaviors.

CPS Energy is one of San Antonio's partners in its smart-city initiative to launch more data- and technology-oriented projects. A Smart Streetlight Technology pilot recently debuted in partnership with the City, AT&T, and Itron. Existing CPS Energy lighting will be equipped with sensors that allow them to be controlled remotely and test air quality, temperature, ambient noise, parking, and flooding. The goal is to gather data to enable the City to save money and address community needs.[87]

SunPower's Connected Solutions in New England

In New England, SunPower is operating through the Connected Solutions program being offered in Massachusetts, Connecticut, and Rhode Island.[88] Through the program, SunPower coordinates the charge and discharge of customers' batteries. They share electricity with the utility while reserving enough backup power for home use. Customers are alerted in advance and can either choose to decline to participate or pre-set systems so back up energy levels do not fall below a certain level.

Cape Light Compact, working in Connecticut, Massachusetts and Rhode Island have combined forces under the ConnectedSolutions program to pay customers annual incentives to access behind-the-meter stored energy. The program is set up as a bring-your-own-device (BYOD) design, and payout is determined by the brand of battery and how much it is used.

[87] "How San Antonio-based CPS Energy is Helping The City Recover," Business Insider, May 14, 2021, https://www.businessinsider.com/cps-energy-san-antonio-texas-resilient-winter-storm-2021-5

[88] "SunPower rolls out new virtual power plant offering to Connecticut, Massachusetts and Rhode Island," Sean Rai-Roche, November 18, 2021, https://www.energy-storage.news/sunpower-rolls-out-virtual-power-plant-offering-to-connecticut-massachusetts-and-rhode-island/

Green Mountain Power Home Energy Storage Program

Vermont utility Green Mountain Power (GMP) put itself on the map in 2017 as the first utility in the country to partner with Tesla to use customer Powerwalls in a Virtual Power Plant. Through the early program, Green Mountain Power drew on electricity from 500 Tesla Powerwall batteries installed in about 400 homes to address peak demand.

The savings from wholesale electricity costs were so great – $500,000 in one 1-hour peak demand period – that GMP was subsequently able to offer the Powerwalls to consumers at just one-fifth of their normal price – $1,500, or $15 a month – in exchange for being able to use some of the storage at certain times.[89]

GMP customers pay $55 a month or an upfront payment of $5,500 for the Powerwalls or $65 a month (or $6,500 to purchase) for Enphase batteries. The utility manages the battery and draws energy when needed. Customers receive a $13.50 credit on their monthly bills and the advantage of having backup power when problems arise. Another program option is to "Bring Your Device." In this option, customers buy batteries on their own and sell a set amount of power to the utility during peak periods.

GMP's use of 3,000 Powerwalls installed in customers' homes, along with utility-scale batteries, resulted in more than $3 million in reduced grid and electricity costs for customers in 2020.[90] GMP's program design includes an incentive of up to $10,500 toward a home battery purchase in addition to usage payments. In addition, the utility's "Frequency Regulation Pilot" now allows Powerwall owners to share electricity with ISO-New England during high-demand times.

Orange and Rockland Utilities' Virtual Power Plant

SunRun and other installers and third-party aggregators can do the work to connect utilities with residential batteries through VPP programs. For example, Sunrun is working in New York State to bundle 300 of its Brightbox residential battery systems to deliver power when called upon by Orange & Rockland Utilities (O&R). Sunrun simplifies things on both sides — utilities only have

[89] "Win for Virtual Power Plants and Aggregations in Australia," July 26, 2018, Microgrid News, https://www.microgridknowledge.com/distributed-energy/article/11430348/win-for-virtual-power-plants-and-aggregations-in-australia

[90] "Utilities are taking the reins in the Northeast and asking for customer-sited storage," Kelly Pickerel, November 5, 2021 https://www.solarpowerworldonline.com/2021/11/quick-to-halt-stand-alone-solar-utilities-are-asking-for-customer-sited-storage-in-the-northeast/

to work with one aggregator, and customers don't have to go searching for incentives. Through this O&R partnership, Sunrun dispatches power to the utility when it's needed most, and Sunrun customers initially receive a discounted battery for joining the VPP and then earn compensation for participating.[91]

VPP Utility Ownership Model: Unlike the BYOD program design, other VPPs – and the Glendale Water and Power proposed VPP – take another approach. Instead of the consumer owning the batteries, utilities can own the batteries. In this model, they pay consumers a fee for siting the batteries at their homes or businesses. What else do participants get? They get solar bragging rights – the curb appeal of solar on their homes – and the use of the batteries for energy resilience during power outages. Participants need not invest. They get solar and storage for free! "Their systems" are part of the utility's infrastructure.

OhmConnect

Because consumers, unlike large industrial power users, have difficulty monitoring their energy use in real time, utilities have paired up with software providers such as OhmConnect. The company helps households curb power usage by installing devices which enable real-time monitoring of energy use, allowing them to remotely adjust thermostats and appliances during peak hours.

OhmConnect was founded in 2014 with the goal of becoming the nation's largest clean energy provider. Oakland based, it builds virtual power plants. The company, which controls over 200,000 devices across California, Texas and New York, hands out prizes for its stellar load-shedding participants including Peloton bikes, $3,500 Costco gift cards, and invitations to Major League Baseball games.[92]

During California's September 2022 heat wave, Ohm was cited as one of the reasons that the State avoided rolling blackouts. Ohm's virtual power plant, made up of hundreds of thousands of members' appliances, provided a demand response service, cutting power in households throughout the PG&E, SCE, and SDG&E service territories. Ohm sent six million communications to its 200,000+ active members who toggled smart energy devices and saved 1.5 GWh during the peaks of the nine-day heat wave, and earned $2.7 million in rewards.

[91] Utilities pilot DER Programs: https://www.power-grid.com/der-grid-edge/utilities-pilot-der-programs-to-shave-peaks-reward-customers/#gref
[92] Use Less Power, Get a Peloton, https://www.bloomberg.com/news/articles/2022-07-21/energy-firms-offer-pelotons-and-gift-cards-to-encourage-power-savings#xj4y7vzkg

Here's how it works: The grid (actually the CAISO) contacts Ohm. Ohm sends an SMS or email to members. Ohm members reduce energy use; they automatically power down. For their actions, members get rewards – either credit, cash, eligibility to enter contests to win raffle prizes, and to be able to buy technologies in the Rewards Marketplace.

For their participation, members can routinely earn hundreds of dollars each year. Members can also get referral rewards. One member earned $41,000 in one month by referring accounts to Ohm. During the California heat wave in 2020, the CAISO paid Ohm ~$300,000 for one day as Ohm "activated" its 150,000 members at that time. There are nine regional power markets in the United States and Canada. Ohm bids a quantity of energy at a specific price. If accepted, Ohm contracts to deliver and gets paid. It then rewards its members.

South Australia Virtual Power Plant

Commencing in August 2020, Tesla initiated an install of a 5 kW rooftop solar system and 13.5 kWh Powerwall battery at each Housing SA premise at no upfront cost to the tenant. As South Australia's largest virtual power plant, the battery and solar systems can be centrally managed collectively delivering 20 MW of generation capacity and 54 MWh of energy storage.[93] Currently, Tesla is still registering tenants.[94]

VPPs in New England Forward Capacity Auction

In 2019, Sunrun was the first company to win a contract to supply its VPP capacity to a wholesale power market. Sunrun competed head on with other generators in ISO New England's 13th Forward Capacity Auction (FCA) and won a contract to provide 20 MW of capacity to the ISO beginning in 2022. The contract is significant because it demonstrates how local energy resources can compete with centralized power in highly price-sensitive wholesale power markets. The auction is designed to procure resources for electricity demand three years in the future. FCA 13 met needs for the 2022-2023 delivery year.[95]

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[93] Tesla South Austrailia Virtual Power Plant, https://www.microgridknowledge.com/distributed-energy/article/11429915/big-win-for-local-energy-first-virtual-power-plant-snags-contract-in-us-wholesale-capacity-auction

[94] Tesla South Australia, https://www.tesla.com/en_au/sa-virtual-power-plant

[95] "Big Win for Local Energy: First Virtual Power Plant Snags Contract in US Wholesale Capacity Auction," Feb 12, 2019, Microgrid Knowledge, https://www.microgridknowledge.com/distributed-energy/article/11429915/big-win-for-local-energy-first-virtual-power-plant-snags-contract-in-us-wholesale-capacity-auction

Selling into wholesale power markets is an exciting program design option. It means that customers with battery storage and electric vehicles can strike contracts with providers other than their main retailers to provide power to the grid when needed. The auction was also notable because it closed with the lowest prices in six years. The preliminary clearing price across New England was $3.80/kW/month. Last year's capacity auction cleared at $4.63/kW/month.

Sunrun's participation in the ISO's capacity market marks a first for a solar power company, as well as for wholesale markets. Sunrun was able to participate as a "hybrid" resource — one that combines the output of solar panels on thousands of houses rather than a single, centrally located facility — because of new federal requirements to create a level playing field for all resources, including battery storage and resources that receive state-sponsored subsidies. ISO New England was one of the first regional markets to comply with the rules, issued in 2018 by the Federal Energy Regulatory Commission.

For capacity market purposes, Sunrun bid its future Brightbox capacity based on the times of day during the year that New England experiences peak demand. That means Sunrun resources will respond to dispatch signals sent by the ISO, but Sunrun customers will still have backup power available if they need it.

Australia: Tesla and other proponents of virtual power plants and demand management schemes scored a significant win in 2018 after the country's main energy market rule maker gave its support to the idea that they can compete freely on the wholesale electricity market. The decision by the Australian Energy Market Commission is likely to encourage new players in the market to aggregate solar and battery storage installed in homes and businesses.[96]

Having such mechanisms will be a blow to the major incumbent generators, particularly those who rely on the existence of peak pricing events and the subsequent demand for market caps to underwrite their power plants.

Sonnen Community New York Virtual Power Plant

In July 2021,sonnen, a smart residential energy storage provider owned by Shell and that prefers no caps in its name, announced the launch of the sonnen Community New York Virtual Power Plant. Through the program,

[96] "Win for Virtual Power Plants and Aggregations in Australia," Microgrid News, July 26, 2018, https://www.microgridknowledge.com/distributed-energy/article/11430348/win-for-virtual-power-plants-and-aggregations-in-australia

sonnen will supply solar plus storage to 200 homeowners at a discounted rate with the vision to provide renewable energy and a dispatchable resource to the NYISO energy market.[97]

Tesla 2022 Voluntary Program in California

In 2021, Tesla announced the details of a plan to use its Powerwall integrated battery system in California as part of a VPP to support the electric grid during record high temperatures over the next few months that are expected to increase energy demand.

Customers could opt into the program, but would not be compensated for participating. Instead, Tesla framed the program as a "public good" to support the California grid. Currently, the utilities in California ask customers to voluntarily reduce energy use through their behavior during specific hours of the day. Tesla's program essentially automates that same concept for utilities.

"While customer compensation for this program is a possibility in the future, in the meantime customers are encouraged to participate in the program and mobilize the excess capacity of their Powerwall systems," says the company's website.

Hawaiian Electric Virtual Power Plant

In July 2021, Hawaiian Electric launched a program allowing residential and commercial customers to get a cash rebate for adding energy storage to solar arrays. In exchange, the customers opt into a VPP program to use or export the power from that storage during two peak hours of the day.

Six months in, nearly 1,800 families had heeded the call and have signed up as of August 2022.[98] Once the batteries are up and going, that amounts to 10 megawatts of committed capacity. The goal is for 50 megawatts added capacity by summer 2023.

Home battery product prices cluster around $10,000 for a typical 5-kilowatt unit, plus the costs of installation. Hawaiian Electric went through several stages of pricing, initially experiencing a lack of participation due to limited incentives and canceling the NET metering program, except those who are grandfathered in prior to cancellation of the program.

[97] Sonnenusa website: https://sonnenusa.com/en/
[98] Hawaii…How's That Going? October 6, 2022, Canary Media. https://www.canarymedia.com/articles/batteries/hawaii-is-paying-home-battery-owners-to-help-the-grid-hows-that-going?

October 2022, Hawaiian Electric pays Battery Bonus participants enough to cover a substantial portion of the cost: Participants get an $850-per-kilowatt upfront bonus when they commit to the program for 10 years. They also earn a $5-per-kilowatt monthly bill credit for the duration of their participation. A 5-kilowatt battery thus nets $4,250 upfront and a total of $3,000 in monthly credits over a decade. The utility pays the customer for each kilowatt-hour of electricity exported during the program at the same rate they would pay to buy power. This rate is only guaranteed for the first three years.

Feedback from the industry partners is that this three-year guaranteed rate will not be enough to entice the number of customers they need to meet the Island's 100% renewables goals. They point out that those customers with grandfathered net-metering benefits made up 85.6% of participants who signed up through August.

The Hawaiian Electric utility will continue to assess the program, and is considering altering the program in June 2023 to additionally incentivize participation through a BYOD program.

Feature: Honolulu, Hawaii

Honolulu, Hawaii, is a leader in sustainability thanks to financial and personal investments from the local government, organizations, and residents.[99] Its dedication to clean energy, local food production, waste reduction, and a "green workforce" shows what's possible when a city prioritizes mission-based initiatives. Honolulu has been focused on sustainability and climate change since receiving a grant in 2016. It was then that it established its Resilience Office. [ck]

One of the central initiatives of the Resilience Office is the Oahu Resilience Strategy, which aims to address "long-term affordability and the impacts of a climate crisis that is already driving islanders from their homes." Hundreds of ideas were gathered from the community. Those concepts were narrowed down into 44 actions.

Bill 2 was signed into law by Honolulu's mayor at the end of 2020. It addressed parking requirements for new developments. The bill also supports walkable neighborhoods and cleaner transportation options, such as biking and public transportation. Its goal is to make housing more affordable since constructing and maintaining parking is a hidden cost for renters, according to an analysis by the Ulupono Initiative.

Permitting: Reducing the energy burden is a key focus area of Honolulu's Resilience Office. In

[99] "How Honolulu, Hawaii is Working Toward Sustainability," Business Insider, Apr 14, 2021 https://www.businessinsider.com/honolulu-hawaii-sustainability-climate-change-renewable-energy-2021-4#new-performance-based-regulations-could-lower-energy-bills-for-residents-6

December 2021, the City enacted Bill 58 to streamline the permitting process for residential clean energy products, such as solar power, energy storage, and electric vehicle chargers. The goal is to cut down on the costs and time it takes to install solar systems.

Bill 65 establishes an energy benchmarking system, requiring Honolulu to create and report energy and water use benchmarks for City-owned buildings. The rule is estimated to save the City $7 million over the next decade. The bill also specifies that the City will transition to 100% renewable energy and become carbon neutral by 2045.

Performance-Based Ratemaking: As another initiative aimed at reducing energy bills, Hawaii's Public Utilities Commission approved a new Performance-Based Regulation Framework in late 2020. The new structure provides financial incentives for the electric company to meet certain goals, like creating savings for lower-income customers and reducing greenhouse gasses. It also separates the utility's profits from capital investments, creating a cost-of-service approach.

Southern California Edison VPPs with Swell and Sunrun

Southern California Edison (SCE) adopted an initiative to incentivize its customers to participate in a VPP program by offering "GridRevenue" for those that offer their resources during peak hours. The effort is in collaboration with Swell Energy. This is in addition to SCE's program with Sunrun in which the utility is setting up a 300-home VPP. [100]

SunVolt, by SunPower, is another similar program… to coordinate the charge and discharge of batteries and sharing electricity with the utility while reserving enough backup power for the home use. Customer will be alerted, can choose to decline, or preset system for backup.

Richmond Advanced Energy Community

The Richmond Advanced Energy Community is a comprehensive project in Richmond, California aimed at reducing emissions and bringing local grid reliability, safety, and energy efficiency to Richmond.[101] The project includes a Virtual Power Plant operated by Marin Clean Energy (MCE).

[100] "We're having a virtual power plant moment," Sarah Golden, July 30, 2021, Green Biz, https://www.greenbiz.com/article/were-having-virtual-power-plant-moment

[101] MCE Virtual Power Plant to Benefit Disadvantaged Richmond Residents and Businesses, MCE News, https://www.mcecleanenergy.org/mce-news/mce-unveils-plans-for-virtual-power-plant-to-benefit-disadvantaged-richmond-residents-and-businesses/

The Advanced Energy Community (AEC) brings together a variety of partners including the project developer, ZNE Alliance, and ALCO Building Solutions, Ecoshift Consulting, Energy Solutions, mPrest, Richmond Community Foundation, THG Energy Solutions, TRC, and ZGlobal.

Richmond, which is also considered an underserved community, will get 20 commercial and industrial DER deployments as part of the project, in addition to plans for 100 residential sites. The project includes $4.9 million in funding from the California Energy Commission, and will rehabilitate abandoned homes with energy efficiency retrofits and establish a Virtual Power Plant.

Those involved with the program will also create an AEC resource center and toolkit that can help other California communities with the energy technologies and help implement similar projects throughout the State. Lancaster, California, is another community undertaking an AEC.

The Zero Net Carbon Ready (ZNCR) homes program will leverage the Social Impact Bond to finance several ZNCR demonstration projects in partnership with the Richmond Community Foundation and MCE. The ZNCR Program will implement six diverse ZNCR packages in both limited retrofit and major renovation scenarios for up to 100 Residential Projects. ZNE Alliance, a non-profit and one of the partner groups, is also working with the City of Lancaster on an Advanced Energy Community.[102]

Commercial, Industrial, and MUSH Sector

Demand Response Programs

Oklahoma Fast-Response Grid Services

Voltus, Inc. ("Voltus"), the leading distributed energy resource (DER) software platform, has partnered with Chesapeake Energy Corporation to enroll 10 megawatts in the Southwest Power Pool Operating Reserves (OR) market. [103]SPP OR is a fast-response, ancillary services market that pays businesses like Chesapeake to reduce electricity consumption in response to a market signal, driving down electricity costs for neighboring communities, and supporting the reliability of the electric grid.

[102]ZNE Alliance, https://www.znealliance.org/aec
[103] Voltus DER Software Platform Partners With Chesapeake Energy. Business Wire, August 10, 2022, https://www.businesswire.com/news/home/20220810005289/en/

California Energy Commission Load Management Programs

The California Energy Commission is leading initiatives in load management.[104] Load management aims to reshape a utility's demand shape (eg, when electricity is used over the course of a day). This goes beyond reducing peak load and also encourages energy use when clean energy is plentiful. Automated load flexibility can reduce or delay the need for new electrical supply capacity (like power plants), reduce fuel consumption and reduce emissions, and lower long-term economic costs.

Demand flexibility and load management can be accomplished through automation, with appliances and devices that respond to signals that incentivize smart energy use: Customers can shift when they use electric service to take advantage of cleaner and cheaper electricity. Buildings and water can be pre-cooled or pre-heated. Battery charging can be timed to serve the needs of the grid, including reducing peak demand. Electric vehicles can be charged at times that help the grid, while ensuring the vehicle has enough charge to get owners where they need to go. Consumers can set dishwashing, laundry, and many other services to be automatically scheduled based on the electricity cost or greenhouse gas content. Devices can respond to other signals, including peak-demand emergency alerts. The right incentives can be provided through utility rates that vary with time.[105]

Emergency Load Reduction Program

The Emergency Load Reduction Program (ELRP) is a five-year pilot program to pay electricity consumers for reducing energy consumption or increasing electricity supply during peak periods. It was launched on March 21, 2022.[106]

ELRP is intended to act as an insurance layer on top of existing resource adequacy programs. Its reliability planning is separate from the CAISO wholesale market. The ELRP gives power operators tools to address unexpected power system conditions. It is designed to compensate customers for voluntarily reducing demand on the grid when called upon to do so. This can be done by cutting loads. Diesel back-up generators (known as "BUGs") can also be used for load reductions but must comply with their air quality permits. Electric vehicles can also be used to provide power.

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[104] Load Management Rulemaking (ca.gov), https://www.energy.ca.gov/proceedings/energy-commission-proceedings/load-management-rulemaking

[105] Source: CEC Final Staff Report, Analysis of Potential Amendments to the Load Management Standards, November 2021.

[106] Fact Sheet on Emergency Load Reduction Program (ELRP), https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/demand-response/emergency-load-reduction-program/elrp_factsheet_061721b.pdf?sc_lang=en&hash=BF131757B2A281B27FFAE46B68069A23

The program period is May - October; the program time frame is 4 pm - 9 pm. There is a one-hour minimum program duration and a five-hour maximum. Participants will be called upon a maximum of 60 hours per year. The program has no consecutive day constraints. It is triggered as a last resort. Follows a CAISO Alert, Warning, or Emergency (AWE) declaration. It is different from Flex Alerts that are now day-ahead events. ELRP enrollees may be called upon the day ahead or day of. Note that for any ELRP event, enrolled customers may choose not to participate. If they cannot participate for whatever reason they will not be penalized. There is no stick… just a really juicy carrot!

Demand Side Grid Support

In August of this year (2022), the California Energy Commission released guidelines for the Demand Side Grid Support program (DSGS). Like ELRP, it pays up to $2,000/MWh – or $2.00 per kWh – for capacity at times of peak demand, at those times when the grid is most threatened by consumption exceeding supply.[107]

DSGS was initiated by Assembly Bill 205. It authorized the program with a $200 million budget. Who's eligible? Retail suppliers defined by Public Utilities Code Section 398.2. It defines retail suppliers as, "an entity that offers an electric product for sale." This includes local public utilities." But explicitly excluded are Investor-Owned Utilities, Community Choice Aggregators. Some say that this was designed for municipal utilities.

GWP officials are well aware of the program. In fact, GWP has already been in touch with both the California Energy Commission about the program, as well as the Southern California Public Power Authority (SCPPA). What GWP took away from these discussions is that GWP is not eligible. Why? Because GWP is not part of the CAISO. Instead, GWP is part of LADWP's balancing authority. Since DSGS events are triggered by CAISO alert levels, they surmised, there would not be a suitable trigger for Glendale.

In August 2022, the California Energy Commission formally adopted the guidelines for its new Demand Side Grid Support program. It provides incentives of $2,000/MWh, equivalent to $2/kWh. The program was initiated by AB 205 with a $200 million budget.[108]

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[107] Demand Side Grid Support Program, https://www.energy.ca.gov/programs-and-topics/programs/demand-side-grid-support-program
[108] Demand Side Grid Support Program Guidelines, California Energy Commission, August 2022, https://www.energy.ca.gov/programs-and-topics/programs/demand-side-grid-support-program

DSGS Program Eligibility: Eligible DSGS providers include: a. Retail suppliers as defined in Public Utilities Code (PUC) Section 398.2, except for investor-owned utilities, electric service providers, or community choice aggregators under the jurisdiction of the California Public Utilities Commission. b. Federal power marketing administrations.

Eligible Participants: A customer or aggregator of customers located in California of a DSGS provider is eligible to receive incentives under the DSGS program if the participant's account with the DSGS provider is not:

- Eligible to participate in supply-side demand response, or emergency load reduction programs offered by entities under the jurisdiction of the California Public Utilities Commission.
- Receiving payment or accounting for the same reduction in use of electricity through any other utility or state program.
- Cogeneration facilities with a power purchase agreement. DSGS providers may include additional eligibility requirements for their participants as appropriate. .

SMUD - PowerDirect® Automated Demand Response Program

PowerDirect® integrates automated response capabilities into EMS, lighting and HVAC systems and pays up to $5 per kW of reduction.

This technology automatically scales back a customer's energy use when demand for electricity is at its peak. Participants receive up to $125/kW of automated energy reduction, or qualify for incentives that will offset up to 100% of the PowerDirect technology and equipment cost.

Program Overview: PowerDirect® provides incentives and technical assistance for non-residential customers to install and / or program equipment at the customer's facilities that allows for automated demand response load reductions without customer intervention. When SMUD needs the load reduction, customers receive a signal via the Open ADR communications protocol. ADR is intended to provide a fully automated process using secure Client/Server architecture between SMUD's demand response automation server (DRAS) and the customers virtual end node (VEN).[109] SMUD recognizes business partners on its website.

[109]SMUD Power Direct Automated Demand Response Program, https://www.smud.org/en/Business-Solutions-and-Rebates/PowerDirect-Technology

LADWP Demand Response Program

LADWP's Demand Response (DR) is an incentive based, voluntary energy management program for businesses that helps reduce their utility bills during times of peak power demand, ensuring the continued reliability of power for Los Angeles.[110]

LADWP will determine when a DR event is called based on peak demand for power and resource availability. Participating customers will be notified through email or telephone, and they will initiate their own DR curtailment procedure to achieve a predetermined amount of energy reduction (kW shed). After signing up, businesses may request a complimentary consultation to review energy usage and areas of possible curtailment specific to their type of business. Each DR participant controls, defines, and plans the curtailment for the DR event. The adjustment will relieve stress on the electric grid and ensure power reliability for all.

This energy management program is based on the following parameters:

- A maximum of 12 DR events per season
- Limit of one DR event per day
- Maximum of 4 consecutive hour per event

To participate in the DR Program, businesses must meet following criteria:

- Have an existing Building Energy Management System
- Be able to curtail load by 100 kilowatts (kW) or more for each DR event
- Be able to adjust operations to participate during the DR season – June 15 to October 15
- Be able to adjust operations between 1:00 pm and 6:00 pm PST for at least four hours
- Be able to participate with day-ahead or two hour advance notification

The Demand Response (DR) Program offers financial incentives for participation, including event and capacity. The event incentive is determined based on the number of events and the amount of energy (kWh) reduced during the DR season ($0.25/kWh). Incentive is received based on committed kW curtailment capacity with a minimum 50% performance during the DR Events. If an event is not called during a given month, capacity incentives are guaranteed.

[110] LADWP Demand Response Program, https://tinyurl.com/LADWPDR

- $8/kW monthly capacity payment during DR season, June 15 - October 15, for day-ahead notification.
- $12/kW monthly capacity payment during DR season, June 15 - October 15, for 2-hour advance notification.

Other Benefits: Benefits of energy management to businesses are numerous and contribute to the reduction of greenhouse gas emissions and carbon footprint. Adjustments made by customers during DR events may include:

- Adjust global temperature set point (GTA)
- Pre-cool the building envelope
- Limit demand of electric equipment (i.e. chillers)
- Duty cycle air-cooled package units (i.e. 10 min on/10 min off)
- Reset static set point pressure controls
- Dim or curtail selected lighting zones
- Reduce variable fan speed (VSD/VFD)

Other adjustments can be made. Participants have the option to opt out of each DR event. As part of the DR Program, participation is voluntary; however, the number of opt outs should not exceed two per DR season without jeopardizing enrollment.

Since 2015, LADWP has offered the Demand Response program to commercial and industrial customers. Many took advantage of this offering and saved 3,044 MWh and about $4 million in incentives.

Marin Clean Energy: Peak FLEXmarket Program

The FlexPower Market program is a "first of its kind" innovative program that provides tools to measure hourly reductions in energy use and allows Marin Clean Energy (MCE) to compensate aggregators working locally with customers to reduce peak demand.[111] Payments are made directly to participating aggregators and project developers such as OhmConnect, CLEAResult, and Swell, on the basis of energy impacts delivered during peak hours. The incentives are available June - September.[112]

[111] MCE Peak FLEXmarker Program, https://www.demandflexmarket.com/mcepeak.html
[112] "MCE Peak FlexMarket Program Inspires Statewide Adoption," CAL-CCA News, Dec 7, 2021, https://cal-cca.org/local-mce-program-inspires-statewide-effort-to-prevent-summer-blackouts/

MCE program staff report the program is unique in that it pays based on performance on an hour-to-hour basis, but also that it combines two traditionally distinct categories of demand-side efforts: energy efficiency and demand-response.[113] The result is that program providers who traditionally focus on one category or the other are looking to combine them for the best results.

The first includes energy-efficiency providers like CLEAResult and Ecology Action, which traditionally earn money by reducing customers' overall energy consumption. The second are demand-response providers such as OhmConnect and Wexus, which are paid for load reductions when the grid is under stress. Participating companies earn financial rewards both for general efficiency gains and for quick-responding load reductions, and they can pass savings along to participating customers. The size of the rewards companies earn depends on how valuable their reductions are to the grid during different hours of the day and different seasons of the year.

The program has been so effective that in December 2021 the CPUC approved a $150 million program based on its success. MCE partners with RECURVE[114] to manage the PeakFLEX market program.

- Pays up to $2/kWh as its "Event Price"
- Net peak, 7 - 9 pays up to $0.05/kWh
- Peak 4 - 7, pays $0.015/kWh

RECURVE is managing the expansion of the FLEXmarket Program. Utilities currently participating in the program are PG&E, Marin Clean Energy, East Bay Community Energy, Sonoma Clean Power, BayRen, and 3C-Ren. Eighty-nine providers are listed as participants in the FlexPower Market. The program is expanding through Northern and Central California.

Best Practices - Distributed Energy Resources

Residential

Solar

[113] California Has A Plan To Pay Efficiency Providers To Help Prevent Blackouts. Canary Media, Nov. 2021, https://www.canarymedia.com/articles/energy-efficiency/california-has-a-plan-to-pay-efficiency-providers-to-help-prevent-blackouts
[114] RECURVE website, https://www.recurve.com/

The most common arrangement for consumer-owned solar systems is to "conventionally" interconnect using Net Energy Metering (NEM). This allows consumers to size systems based on annual production, and to give and take with the GWP system. EcoMotion recommends that GWP maintain NEM at a high values for customers.

This means having a vision. GWP must use NEM and the customer partnerships that it forges to support grid operations. It means that GWP must not follow the California Public Utilities Commission (CPUC) path which grossly de-incentivizes solar. While not final, and a controversy in states across the nation, at stake at the CPUC is the excess generation export rate. This determines how much credit a solar generator gets for pumping excess in the grid. Other factors being considered include monthly, non-bypassable charges.

Utilities have had the option to add incentives on top of the a) federal tax credit, and b) the NEM incentives. Utility incentives have been expressed as dollars per watt of solar, eg $2.00/watt. GWP was one of the first utilities in California that started offering incentives for installing solar (in 2001) and also the last California utility with a solar incentive program up until the middle of 2021. At that time, there was a concern that offering incentives for consumer-owned solar would compete with the Sunrun program.

EcoMotion's suggestion is to provide cash incentives when paired with storage. Effectively, the participant pays for the solar – receiving NEM and Investment Tax Credit benefits. GWP provides an incentive in the form of dispatchable storage. Consumers that are space constrained will be able to participate in Community Storage to get the full solar + storage cash incentive. Any solar system added without storage will receive no cash incentive.

Imperial Irrigation District NEM Program:

Net Energy Metering (NEM) is a program designed to benefit Imperial Irrigation District (IID) customers who generate their own electricity using solar, wind, biogas fuel cell or a hybrid of these technologies ≤ 1000 kW[115]. The NEM program uses a smart meter to track the "net" difference between the amount of electricity produced and the amount of electricity consumed during each billing period. The program is offered on a first-come, first-served basis until the generating capacity in the program reaches 5% (50 MW) of IID's peak demand.

[115] Imperial Irrigation District NEM Program, https://www.iid.com/home/showdocument?id=6052

IID's meter records the amount of energy (in kWh) delivered by IID to the customer's premise, called Net Consumption. It also records the amount of energy (in kWh) generated by the customer's generating system which was not consumed by the premise and thus returned to the IID electrical grid, called Net Generation. The difference between these two amounts is what IID will utilize to create the customer's monthly bills. Should Net Generation exceed the amount of Net Consumption in any given month, that excess will be tallied and given to the customer as credit at IID's current retail rate at the end of the customer's 12-month period.

The NEM program is currently available to residential, commercial, industrial, agricultural and water pumping customers who receive electrical service directly from IID and who install and interconnect an eligible generating system.

An eligible generating system is powered by solar, wind, biogas, fuel cell or a hybrid of these technologies; less than 1 MW in total nameplate rated capacity (CEC-AC); and located on the customer's premises and interconnected to operate in parallel with IID's electrical system.

Education and Resources

San Jose Clean Energy: Residential Solar Assistance

San Jose Clean Energy (SJCE) has a helpful "Going Solar" website.[116] It includes multiple services: online permitting process; how to check your roof; and incentives. There is a specific incentive for employees of businesses residing in the SJCE area.[117] It also has an automated permitting process to save money and time to approve projects. The SJCEs webpage also provides information on programs for low-income customers. It partners with GRID Alternatives[118] and utilizes funds through Solar On Multi-family Affordable Housing (SOMAH)[119] to pay for solar.

Low Income Solar Assistance Programs

Holy Cross Energy "Sustainable Solar" Program

Holy Cross Energy provides an income-qualified community solar program called "Sustainable Solar." The program takes energy from two

[116] SJCE Going Solar, https://sanjosecleanenergy.org/going-solar/
[117] Bay Area Sunshares Program, https://www.bayareasunshares.org/
[118] GRID Alternatives San Jose, https://www.gridsolar.org/sanjose/
[119] SOMAH, https://calsomah.org/

arrays at Cooley Mesa Operations Center and sells it to members who need it most. There are 90 spots on the program. The program covers up to 50% of electricity bills. Participants are chosen by lottery of those who apply. Program is available to homeowners and renters in single family homes, apartments and mobile homes. Participants are enrolled for two years.[120]

OC Goes Solar Non-Profit Partnership

OC Goes Solar is a non-profit that works with GRID Alternatives, the City of Irvine's "Solarize Irvine" Program, and has done projects in Santa Ana and other cities. According to staff at OC Goes Solar,[121] one problem with these programs is the program does not pay for repairs on old roofs or if the house needs upgrading. Some local CCAs/utilities are providing funds for upgrades so the residents can take advantage of the federal and state incentives.

LADWP Shared Solar Program

Shared Solar enables residential customers living in multifamily dwellings (apartments, condominiums, duplexes) to fix a portion of their electric bill against rising utility costs for 10 years, as well as support renewable energy, help create local jobs, help reduce the carbon footprint of LADWP's generation portfolio and lessen the impact of global warming.[122]

Program participants subscribe for either the minimum of 50 kWh or the maximum of 100 kWh of energy on a monthly basis. The 50 or 100 kWh of electricity is supplied by new solar power plants constructed in or near the LA basin and is billed at a fixed Shared Solar Program (SSP) rate. An added benefit is that if you move, your subscription moves with you as long as your next home is a multifamily unit and within LADWP's service territory.

The program is open to City of Los Angeles electrical customers that have a rate schedule of R1A-Standard Residential, R1D-Low-Income, or R1E-Lifeline; has an electric service account in good standing associated with a multifamily dwelling unit; and has not participated in LADWP's Solar Incentive.

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[120] Holy Cross Income Qualified Solar, https://www.holycross.com/income-qualified-solar/
[121] Conversation with staff at OC Goes Solar on 10/3/2022
[122] LADWP Shared Solar Program, https://www.ladwp.com/ladwp/faces/ladwp/residential/r-gogreen/r-gg-ressolar/r-gg-rs-sharedsolar?_adf.ctrl-state=vnqskz2ck_68&bca42600)&&_afrLoop=1442412843194388

Community Solar

Community Solar is an option for those that want to go solar, but that don't have the right place to put solar, or that don't have the right circumstance. For instance, renters have a major disincentive when it comes to solar. In other cases, a home is in the shade of a ridgeline or tall buildings. In another scenario, the homeowner may be planning to move in 2 - 3 years.

Community Solar programs have been developed that allow for participation, even when these kinds of barriers are at hand. Customers can subscribe to blocks of power, without long-term commitments. The solar farms are being built in optimal solar conditions, and the systems are fully maintained. Community Solar has lots of benefits, and if structured so, they can share those benefits between their program participants and utility operations.

Clean Energy Collective, Colorado

The community solar model developed by the Clean Energy Collective in Colorado was a marked success. It was a virtual net metering arrangement for owners who "had a piece of the rock."[123] Note that after developing ~200 projects, the CEC filed for bankruptcy due to insurmountable issues with its primary investor, First Solar. The projects live on, and the model still makes sense.[124]

The CEC's program design was elegant in its simplicity. Homeowners and businesses could buy whatever amount of panels that they wanted. That capacity was then net metered (virtually) with their electricity bills. As such it was like a behind the meter community solar, the consumers getting the full benefits of solar without having it on their own roofs. Perfect for renters. And when a community solar owner moves, he or she can sell his or her shares.[125]

California's ruling on community solar has put a damper on its adoption. The program design treated community solar as a traditional power generator, limiting the amount that utilities can pay for the output of a community solar farm. Instead of valuing its output at a retail rate – as is the case with the Colorado model – the California PUC limited the value to a wholesale value. Community Solar now is being treated like another power plant. As a result there are virtually no deals done.

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[123] https://ecomotion.us/wp-content/uploads/2016/01/Community-Solar-Plant-White-Paper-1-10-12.pdf
[124] Personal communications, Paul Spencer, Founder and former CEO, Clean Energy Collective, October 2022.
[125] EcoMotion Community Solar Design Options and Innovations White Paper, https://ecomotion.us/wp-content/uploads/2019/01/EcoMotion_White-Paper_Community-Solar-Design-Options-Innovations.pdf

There is no reason for GWP to follow the California investor-owned utilities' failed attempt with community solar, especially when there is a highly viable model – the Colorado model – to emulate. The Colorado model allows consumers to invest – in whatever increments they can afford – and to reap all the benefits of solar that they would if it were on their own rooftops.

SMUD ran an interesting program in which its members subscribe for blocks of green power generated at its solar farm co-located with a turkey farm. The program was so successful that the initial offering was fully subscribed with 700 residential SolarShares customers. Other customers were invited to join a waiting list and enroll when current customers drop or move out of the territory. The program ran until 2016 when the price of solar generation prompted SMUD to develop a Commercial SolarShares Program.[126]

New Jersey Clean Energy Program Community Solar Energy Pilot

Solar Landscape is celebrating its first pilot year with eight new Community Solar installations bringing 20 megawatts of power to 3,000 homes.[127] Solar Landscape is working in partnership with the State of New Jersey, in planning to bring 46 more projects for the second pilot expected to provide 50 megawatts to 10,000 homes.

A requirement of the State program is that more than 50% of the projects have to serve low to middle-income households. The solar is placed on large properties such as warehouses, churches, municipal buildings, and schools and is managed by Solar Landscape. Residents who subscribe to the program save a minimum of $15 per month off their electricity bill, contribute to a cleaner New Jersey, and can exit the program whenever they want. Solar Landscape is a member of the EPA's National Community Solar Partnership which has a goal of powering five million homes with community solar by 2025.[128]

[126] SMUD Commercial Solar Shares Program, https://www.smud.org/en/Going-Green/Commercial-SolarShares
[127] Solar Landscape, https://www.solarlandscape.com/news/solar-landscape-energizes-the-final-installation-of-its-community-solar-energy-pilot-program-year-one-portfolio
[128] DOE Solar Parter, https://www.energy.gov/communitysolar/national-community-solar-partnership-goals

San Jose Community Solar Program

San José Clean Energy announced the success of its first community solar program. Solar Access demonstrates SJCE's commitment to providing affordable clean energy resources to residents who need it most. The program offers more than 800 customers 100% solar energy at a 20% discount, which can be combined with other monthly discounts for up to 55% savings. The average Solar Access customer is saving $32 per bill and some save over $100 each month.

The program enables customers who rent their home, cannot afford to install solar, or whose home is not suitable for solar to benefit from utility scale clean energy at a discount. SJCE sources the solar energy for customers and there is no solar panel installation or equipment required. Eligible customers can apply to be added to the program's waitlist and as spots become available, customers will be enrolled on a first come, first served basis.[129]

SMUD Community Solar Program

Donors/customers pay extra on their SMUD bill to purchase solar arrays for nonprofits and low income houses.[130] SMUD developed partnerships with nonprofit organizations and low-income housing organizations such as Habitat for Humanity to help empower the community with renewable energy. Customers can volunteer and learn workforce training installing projects if they like.

- Community Solar Sponsor, for $5 per month
- Community Solar Leader for $10 per month
- Community Solar Champion and arrange for a special donation for projects

Energy Storage

Given the increased frequency and intensity of storms throughout the nation, climate change related, many consumers are seeking energy resilience. The traditional path is to install generators… Most generators in CA are powered with natural gas. Other larger generators are diesel powered. These exacerbate the problem and continue burning of fossil fuels. What a

[129] San Jose Clean Energy's Solar Access Program Reducing Energy Bills by up to 55%, https://www.sanjoseca.gov/Home/Components/News/News/4360/4699.
[130] SMUD Community Solar, https://www.smud.org/en/Going-Green/Community-Solar

sorry do-loop… We need generators because of climate change… we burn more fuels and increase the problem. Solar and storage to the rescue.

Generac's business is booming in California[131] as generators are being installed at a hearty pace. And relative to solar, they are cheap. But, solar paired with batteries can not only provide resilience, they can also have day jobs… and work the power market daily for consumer and utility benefit. How? They store inexpensive power… and use the stored power during peak periods. This is called energy arbitrage. But it results in cut loads, less peak demand.

Energy Resilience / CAL-CCA

CAL-CCA is the membership organization for Community Choice Aggregators in California. It publishes a "Resiliency Initiative" documenting the combined resilience efforts of CCAs in California.[132]

"As de-energization becomes the norm in California, CCAs are uniquely positioned to rapidly advance local energy resilience initiatives such as microgrids to keep critical facilities on line, and locally sited distributed energy resources (DER) like solar and energy storage to help prevent future wildfires and grid outages".

Several Highlights

Partnering For Resilience: Resilient Home EBCE, Peninsula Clean Energy, and Silicon Valley Clean Energy issued a joint RFP for 30 MW (10 MW for each CCA) of behind-the-meter storage targeting disadvantaged and low-income communities. In July 2020, the three CCAs announced an agreement with San Francisco-based Sunrun to install up to 20 MW of emission-free solar and battery backup power to 6,000 households. Sunrun gives a $500 rebate to EBCE homeowners. Peninsula Clean Energy and Sunrun give $1,250 after installation. The program uses "buying power" to negotiate a price.

(MCE) Energy Storage Program: In June 2020, MCE launched a new Energy Storage Program to deploy 15 MWh of dispatchable behind-the-meter battery energy storage systems to MCE customers over a two-year period. MCE's Energy Storage Program offers customer-sited storage solutions for backup power and resiliency, which will be owned by the customer. MCE will leverage these battery resources to also provide valuable grid services in support of its mission

[131] Generac News for Investors, https://investors.generac.com/news-releases/news-release-details/new-generac-24kw-generator-powers-more-costs-thousands-less
[132] CAL-CCA Resilience Initiatives, https://cal-cca.org/wp-content/uploads/2021/04/CCA-Resilience-Initiatives-April-2021.pdf

for reducing GHG emissions and maintaining low costs, along with helping customers reduce their energy costs.

As part of its Energy Storage Program, MCE is helping customers to apply for SGIP applications and has established a $1.5 million bridge fund to help reduce upfront and out-of-pocket costs for customers who wish to install an energy storage system. As of April 2021, MCE had submitted 144 residential and 8 nonresidential SGIP applications for its customers.

Non-VPP Storage

This discussion covers energy storage systems that are not controlled by the load serving entity. They are independent. They are for consumer benefit. And, while not all the time, they are largely peak coincident… and should be encouraged!

United Power Community Energy Storage System

United Power is a rural electric cooperative in Colorado. The 4 MW Tesla Lithium-ion battery installation was provided by Engie North America. The primary purpose of the energy storage system is to provide front of the meter (utility side) demand clipping. Energy produced through the day, and particularly renewable energy, will be stored throughout the year and dispatched at peak times. Like a community solar program, customers will subscribe to the program, but instead of getting credits for generated power, they will get credits to offset their peak demand. United Power estimates that the system will save over a million dollars annually in wholesale capacity charges. It is also expected to be a valuable asset in relieving grid stress during times of high demand as well as making the grid more efficient.

The 4MW/16MWh storage unit also allows United Power cooperative to respond to future changes and growth within the cooperative's grid. It's the largest of its type in Colorado and one of the largest in the nation.[133]

Connecticut's Energy Storage Solutions

The Energy Storage Solutions program is a statewide electric storage program for customers of Eversource and United Illuminating in Connecticut. The nine-year program, in place through 2030, will serve

[133] The United Power website, https://www.unitedpower.com/innovating-energy

both commercial and residential customers. The goal is to establish 1,000 MW of energy storage by 2030.[134]

Average upfront incentives for residential customers will initially be ~$200 per kilowatt-hour (kWh), with a maximum per project incentive of $7,500. Commercial and industrial customers will also be eligible for upfront incentives, with a maximum incentive of 50% of the project cost. Residential, commercial, and industrial customers will be eligible for performance incentive payments based on the average power an electric storage project contributes to the grid during critical periods.

Eversource and United Illuminating customers will be eligible for additional incentives if they are low-income customers, customers in underserved communities, small businesses, and/or customers who experience the most frequent and longest duration storm-related outages.

SMUD Storage Incentives

SMUD has a voluntary program, My Energy OptimizerSM, which allows customers with storage only, or solar and storage to earn financial incentives for allowing their battery storage unit to contribute energy during peak times.

There are three levels customers can choose, the more SMUD can access the battery, the more customers get paid.

- Starter - SMUD pays $50/kWh for energy exported during an event up to $500
- Partner - SMUD pays $150/kWh for up to $1,500
- Partner + - SMUD pays $250/kWh for up to $2,500

There is a one time connection fee for adding solar or storage to the grid.[135] Also, customers get a small ongoing amount for solar they send back to the grid (7.4 cents/kWh is the current rate.

Hawaiian Electric Battery Bonus program

Hawaiian Electric's Battery Bonus program provides a cash incentive to support energy storage for an existing or new rooftop solar system. Hawaiian Electric will pay a cash incentive and provide bill credits for customers on Oahu and Maui to add energy storage to an existing or new rooftop solar system. These incentives will help move Hawaii toward its goal of 100% clean energy by 2045

[134] Energy Storage Solutions Program, https://portal.ct.gov/PURA/Electric/Office-of-Technical-and-Regulatory-Analysis/Clean-Energy-Programs/Energy-Storage-Solutions-Program
[135] SMUD Battery Storage For Home: https://www.smud.org/en/Going-Green/Battery-storage/Homeowner

and add more renewable resources to the grid as Hawaiian Electric retires generators fired by fossil fuels.

The Public Utilities Commission has capped the program at a total of 50 MW supplied from storage on Oahu and 15 MW supplied from storage on Maui. Customers accepted in the program for the first 15 MW of committed capacity on Oahu and Maui receive $850 per kilowatt. This steps down to $750/kW and then $500/kW in subsequent program phases. Participants also receive a $5 per kW monthly peak capacity payment for the 10-year duration of the program. The payment is offered as a bill credit.[136]

So far, as of August of this year, 1,784 customers had signed up for the Hawaiian Electric Bonus Program. Once they all get their batteries installed and verified, that will amount to 10 megawatts of committed capacity supporting the grid. The goal for the program is to deliver 50 megawatts by the Summer of 2023.[137]

Customers not in the company's Net Energy Metering Program will receive a fixed monthly bill credit for energy exported to the grid for three years. For these “Non-NEM” customers, the credit is an amount equivalent to the respective retail rate for electricity exported during the two-hour period.

Community Energy Storage

The California Public Utilities Commission (CPUC) has broadly defined community storage as storage connected at the distribution feeder level, associated with a cluster of customer load. The services these types of systems could provide include (1) capacity for excess generation from distributed energy resources (DERs), (2) integration of higher penetrations of intermittent renewable resources (through, e.g., power quality regulation and “smoothing”) or (3) backup power during outages.[138]

Sacramento Municipal Utility District (SMUD) - Energy StorageShares program

SMUD’s new Energy StorageShares pilot program is the first virtual energy storage program in the US. StorageShares allows SMUD’s commercial customers to invest in an off-site battery storage system and enjoy energy cost savings without placing batteries at their

[136] https://www.hawaiianelectric.com/products-and-services/customer-renewable-programs/rooftop-solar/battery-bonus
[137] Update on the Hawaiian Bonus program, Canary Media, October 5, 2022 https://www.canarymedia.com/articles/batteries/hawaii-is-paying-home-battery-owners-to-help-the-grid-hows-that-going
[138] “Community Energy Storage,” Utility Dive, March 7, 2018, https://www.utilitydive.com/news/community-energy-storage-what-is-it-where-is-it-how-does-it-work/518540/

facilities.[139] Eligible commercial customers make an up-front payment to SMUD for program participation. In exchange, they receive a monthly on-bill credit that will allow them to have a return on their investment. Much like a community solar program, the energy storage systems are aggregated and placed by SMUD at an optimal location which allows them to charge from the grid and dispatch energy to the grid. Naturally, SMUD will take advantage of all the renewable energy flooding the grid during the day. The customers get the benefit of batteries without having to place them onsite. They don't need to worry about maintenance, or degradation, or software controls which are all operated by SMUD.

Shared Costs and Benefits: Each share provides 1 kilowatt of demand charge reduction savings that is credited monthly on the customer's bill over a 10-year term. The value of the credit is not static over the 10-year term of the participation contract; instead, the value will change over time based on SMUD rate changes. The demand savings from a share represents the savings an on-site battery would have provided to the customer for demand charge reduction. Share prices in 2020 range from $475 - 520 per share depending on the customer's electric rate class.

Accessing the program: Customers interested in Energy StorageShares are bound by the following eligibility requirements:

- Customers must have actively been considering the adoption of energy storage for demand charge reduction.
- Customer share acquisition is limited to no more than 50% of the customer's peak demand within the most recent 12 months.
- After joining Energy StorageShares, the customer is not allowed to install on-site energy storage for further demand charge reduction, or they will be expelled from the program. This provision is required to ensure that the customer does not "double-dip" on demand charge reduction savings.

Once enrolled in the program, participating customers receive a monthly on-bill credit. That way, just as the value of a behind-the-meter battery increases when demand charge rates rise, the benefits that a share provides will also increase when demand charges increase.

SMUD has begun work to procure a new, 4MW/8MWh utility-scale battery—interconnected at the distribution level—that will provide the initial 4,000 shares for the Energy StorageShares program. This is SMUD's first utility-scale battery that will help implement the utility's long-term

[139] "SMUD's Energy StorageShares program" Renewable Energy World, Sept 24, 2020, https://www.renewableenergyworld.com/storage/smuds-energy-storageshares-program-the-first-virtual-energy-storage-program-in-the-us/#gref

plans to meet the energy storage needs, projected to be almost 250 MW by 2030. When the battery is not being used to support local infrastructure needs, SMUD may also rely on it to provide local grid services, participation in the Energy Imbalance Market, capacity/resource adequacy, energy arbitrage, ancillary services and PV smoothing.

The StorageShares program is being implemented based on the initial 4 MW battery, but additional sites are being evaluated. Current considerations include a potential locational need for 9MW/18MWh of battery storage in 2022 to defer the construction of a new substation and add an additional 9,000 StorageShares to the program.

Melbourne, Australia Battery Storage Network

The City of Melbourne has embarked on an ambitious programme to create a connected network of mid-sized batteries located in neighborhoods around the City. The idea is to store energy during low demand and return it to the grid when demand is high. Called Power Melbourne, the vision is about reaching carbon-free goals and economic development.[140]

Commercial, Industrial and MUSH Sector

Solar

Solar for commercial follows a similar set of options, beginning with net energy metered solar. Then community solar, feed-in tariff solar, and local utility-owned solar on municipal buildings and sites. Glendale has at least a few unique sites including landfill solar and hillside solar.

Solar Partnerships - Local governments are also leveraging corporate buying power to support clean energy deployment. For example, the Municipal Authority of Electricity Georgia (MEAG Power) added 80 MW of solar to its portfolio for the first time on behalf of 49 local government members. A portion of the solar output, 26 MW, will be assigned to local Walmart stores across 14 Georgia cities. [141] The solar potential of Glendale residential rooftops according to Google's Project Sunroof in 2019 was 483 MW.[142]

[140] "3 urban energy innovations with global implications," World Economic Forum, May 12, 2022, https://www.weforum.org/agenda/2022/05/3-urban-energy-innovations-with-global-implications/
[141] RMI Cities Broke Clean Energy Records, https://rmi.org/ways-us-cities-broke-clean-energy-records-in-2021/
[142] Notes Jan 2022 Kate Unger, Glendale Environmental Coalition.

Avista Energy Solar Select® for Commercial and Industrial Customers

The Avista Energy Solar Select® program was so popular at launch it sold out in a day.[143] The program provides commercial and industrial electric customers in Washington the opportunity to acquire solar electricity and the associated Renewable Energy Certificates (RECs) with no additional costs. The array is located in central Washington, in the heart of Adam's county, and includes more than 80,000 panels across 200 acres, estimated to generate 48,500,000 kWh of electricity annually, enough to power up to 4,000 homes.

The project was built and developed as a part of growing demand from large business customers and both state and federal incentives were used to bring down the cost for the 60 customer participants. Customer participants include a mix of businesses across Washington state, including City of Spokane, Huckleberry's, Inland Imaging, Hotstart, and Gonzaga University.

Sacramento Municipal Utility District "Holistic" Solar + Storage Rate

SMUD has announced that as a result of a "collaborative journey" that it has established a new Solar and Storage Rate (SSR) for all residential, commercial, and agricultural customers. The new rate has drawn negative criticism from the Solar Rights Alliance.[144] The group refers to SMUD's use of a "flawed" 2020 study to justify the holistic rate and reports that SMUD is not paying enough incentive for battery adoption (amounting to $500 for purchase incentive only or $2,500 if SMUD controls 75% of battery usage).

SMUD's Solar and Storage Rate replaces its Net Energy Metering (NEM) rate and is said to more accurately and equitably reflect the true cost of solar for when it is imported or exported to the grid (7.4 cents/kWh). SMUDs solar customers prior to March 2022 will continue to collect NEM compensation until 2030. The rate makes clean energy technologies, such as rooftop solar paired with battery storage, accessible to more customers. SMUD refers to the new rate as a "holistic" approach meeting carbon-reduction goals, goals that benefit all ratepayers, and goals that encourage solar plus storage adoption on a wide scale.

[143] Avista Energy Solar Select Program, https://www.myavista.com/energy-savings/green-options/community-renewable-options
[144] Solar Rights Alliance response to SMUD Solar/Storage Rates, https://solarrights.org/inside-smuds-proposal-to-gut-rooftop-solar/

Prior to making this decision SMUD reports it conducted a thorough technical study[145] to calculate the value provided from 3 different perspectives. The value to ratepayers (who do not own solar) the value to society (in terms of pollution, mitigating climate change, and use of space), and the value to solar customers. A wide-array of value costs was considered. For instance, "societal" values included avoided land loss to utility scale solar ($0.004/kWh), avoided criteria pollutants (approximately $0.008/kWh), avoided water usage, (estimated at up to $0.001/kWh).

The study (in 2020) clarified that under the old NEM system, the value for all ratepayers of solar and solar + storage was not cost-effective. The cost of solar or solar + storage was said to be $0.03 - $0.07 per kWh depending on how they were valued against other SMUD resources. The cost of compensation paid to NEM customers was approximately $0.12 per kWh, resulting in a net cost to other SMUD ratepayers of approximately $0.05 to $0.09 per kWh. This was calculated to an estimated annual cost to SMUD ratepayers in 2020 of between $24 and $41 million. SMUD uses a combination of incentives and various programs to reach all customers. The program also includes partnership agreements between solar + storage customers and SMUD to dispatch these systems to increase their value for all SMUD ratepayers and help reduce costs.

SMUD - Solar for Business

- Contractor stipends from $1,000 to $5,000 of the cost. Assume this may be shared with client.
- Option 1: Purchase solar
    - SMUD offers two types of financial incentives for business customers to install solar electric systems. One is based on the system's expected performance, and is a one-time upfront buy-down. The other is based on the actual electricity produced over the first five years.[146]
- Option 2: Lease solar
    - If owning a solar electric system is not an option for a company, SMUD encourages customers to consider a lease or power purchase agreement (PPA). In these agreements, the solar vendor is responsible for installing and maintaining the equipment as you enjoy the electricity it produces.

Request for Offers (To SMUD):

[145] SMUD Value of Solar and Solar + Storage Study Technical Report, September 2020, https://www.smud.org/-/media/Rate-Information/NEM/VOSstudy.ashx
[146] SMUD Solar For Business, https://www.smud.org/GOING-GREEN/Solar-for-Your-Business#Solar-Basics-for-Business

- Periodically, SMUD will release an RFO for solar energy sold to SMUD. It can also be an Unsolicited offer.[147]

Puget Sound Energy "Green Direct" Program

Green Direct is a ground-breaking program designed to provide PSE corporate and governmental customers the ability to purchase 100 percent of their energy from a dedicated, local, renewable energy resource, while providing them with a stable, cost-efficient solution.

Business partners have their logos listed on the website. There are currently 34 logos of businesses supporting the first project: The Skookumchuck Wind Energy Project.[148]

Community Solar

Programs of Scale: In 2012 EcoMotion published a white paper documenting the significant impact of Community Solar Plant (CSP) models.[149] In the following few years the Community Solar movement burgeoned. EcoMotion wrote a second white paper summarizing the expansive impact to the local CSP solar movement.[150] Two programs were highlighted as programs of scale. They were sophisticated CSP program designs that maximized utility and consumer benefit. The two programs represent two different models, the ownership model, and the subscriber model.

The SMUD SolarShares® Subscriber Model

For almost a decade the Sacramento Municipal Utility District SolarShares® program had the distinction of being not only the nation's largest Community Solar Plant but also the first municipal utility district to promote the concept. In 2008, the program debuted with a 1 MW CSP built on a turkey farm southeast of Sacramento. Within six months of opening the program sold out its capacity, and kept customer retention above 95%.

Since its inception, the program has remained almost fully subscribed. Interested new customers joined a waiting list and enrolled when existing customers opted out or left the territory. In the SolarShares® model participants would buy blocks of solar capacity in one-half

[147] SMUD Lease and RFO, https://www.smud.org/GOING-GREEN/Solar-for-Your-Business#Solar-Leases-for-Businesses
[148] PSE Green Direct, https://www.pse.com/green-options/Renewable-Energy-Programs/green-direct
[149] EcoMotion White Paper, Community Solar Plant, https://ecomotion.us/wp-content/uploads/2016/01/Community-Solar-Plant-White-Paper-1-10-12.pdf
[150] EcoMotion White Paper, Community Solar Design Option/Innovations, https://ecomotion.us/wp-content/uploads/2019/01/EcoMotion_White-Paper_Community-Solar-Design-Options-Innovations.pdf

kilowatt increments, up to 4 kW, and pay a fixed monthly fee for as many years as they continued to participate. The fee for 0.5 kW was $10.75/month. The generated output was credited to participants' utility bill at the full retail rate.

SolarShares® was essentially a green pricing program model. While SMUD offered a conventional green pricing program made up of a variety of renewable sources from different places, SolarShares® was 100% solar and 100% local. The plant was built with panels and components made in the USA.

Its design was made to protect non-participating ratepayers from the risks and costs associated with the CSP. But just as non-participating ratepayers were protected from increasing in marginal costs, CSP participants, and early adopters especially, would benefit from future technology, materials, and design cost decreases. As an added benefit, since monthly fees remain flat even as utility prices escalate, participant benefits will increase as the years go by.

In 2017 SMUD reported it had developed a commercial SolarShares® program to help business customers meet their sustainability goals.[151]

The Clean Energy Collective Ownership Model

Counterpoint to the subscriber model is the Clean Energy Collective ownership model. Participants within this model own the system by direct purchase and receive a bill credit for the kWh their panels produce. Since participants own a quantity of panels rather than a set capacity, they receive credits on a variable basis, as panels produce more in the summer months than the winter months. The Clean Energy Collective monetizes the Federal Investment Tax Credit, utility and government incentives, and accelerated depreciation up front, thus making a participant's initial buy-in more affordable and thus more attractive as an investment.

Clean Energy Collective built its first pilot project in El Jebel, Colorado in 2010. Located within the Holy Cross Energy service territory, the 77.7 kW system went online with 19 participants. After accounting for the ITC, incentives, and depreciation, the initial investment ranged between $2.15 to $3.15/watt. In return, participants receive a bill credit of $0.11/kWh of generated electricity, a rate negotiated by the Clean Energy Collective on behalf of participants

[151] SMUD 2017 Annual Year-in-Review Report, https://www.smud.org/-/media/About-Us/Reports-and-Statements/2017-Annual-Report/Year-in-Review.ashx

and which escalates as utility rates increase. Other features of the Clean Energy Collective ownership model include a 50-year ownership agreement with maintenance and performance guarantee, full transferability of ownership, and free monitoring and bill credit function through RemoteMeter® online portal.

Building on the success of the El Jebel pilot, Clean Energy Collective built an 858 kW array at the Garfield County Airport in Rifle, Colorado. At the time it was the largest community-owned solar plant in the nation, and the opening ceremony was attended by then-governor Bill Ritter. To meet increasing demand for access, the Garfield County Airport plant expanded by 500 kW. The below table provides a snapshot comparison of the two models.

Comparison of Models of Scale Case Studies

	SolarShares	Clean Energy Collective
Year Built	2008	2011
System Size	1.25 MW	858 kW
System Site	Wilton, CA	Rifle, CO
Participating Utility	Sacramento Municipal Utility District	Holy Cross Energy
Host Site Type	Ground mount	Ground mount
Participant Shares	0.5 kW to 4 kW shares	Up to 120% of annual electricity use
Program Length	20 years	50 years
Cost to Participate	0.5 kW share $129/year	As little as $525
Compensation	Bill credit; 800 kWh / 0.5 kW solar	Virtual credit for kWh production on utility bills
Ownership	Third party	Customer owned
RECS	Held by utility	Purchased by utility

The Clean Energy Collective Today: After developing ~200 projects, the CEC filed for bankruptcy due to insurmountable issues with its primary investor, First Solar. The projects live on. The Clean Energy Collective was re-established and the originator, Paul Spencer is the CEO. The company is now in 15 states, and has multiple partners. According to the website,[152] "CEC is a new idea in power generation that is building, operating and maintaining community-shared

[152] Clean Energy Collective website, https://cleanenergycollective.com/

clean energy facilities. CEC is pioneering the model of delivering clean power-generation through medium-scale facilities that are collectively owned by participating utility customers. CEC's proprietary software automatically calculates monthly credits for members and integrates with the utilities' existing billing system."

SolarShares Commercial Program

SMUD developed a commercial SolarShares® program to help business customers meet their sustainability goals.[153] SMUD built an 11-megawatt solar farm at Rancho Seco that provides clean, non-carbon power to the Golden One Center and state office buildings.

Solar shares for large commercial customers took off in 2017, jumping from 10 megawatts in January to 113 megawatts at the end of the year. Among those signing SolarShares agreements with SMUD in 2017 were the California Department of General Services; Apple; Sacramento Area Regional County Sanitation District and Sacramento Area Seer District; Gekkeikan-Sake; City of Sacramento; Los Rios Community College School District; and the San Juan Unified School District.

Neighborhood SolarShares® for Developers and Builders

Neighborhood SolarShares allows developers and builders of new single family and multifamily homes to secure utility-scale solar from SMUD to meet the solar mandate from the 2019 California Building Standards Code (effective January 1, 2020).[154] The program offers the following benefits:

- Home builders achieve the solar mandate at no cost
- Utility bill holders will save $10 per kW of SolarShares per year ($10 - 40 on average)
- No homeowner solar maintenance, or output degradation
- SMUD maintains and operates the solar system on behalf of the customer
- Supports the local economy since all utility-scale solar installations are located in SMUD territory

[153] SMUD Commercial Solar Shares Program, https://www.smud.org/en/Going-Green/Commercial-SolarShares
[154] Neighborhood SolarShares for Developers, https://www.smud.org/en/Business-Solutions-and-Rebates/Neighborhood-SolarShares-for-developers

Feed-In Tariff Solar

The Feed-In-Tariff is known to have catalyzed the solar industry. It is a policy tool to promote renewable energy sources, usually to encourage small-scale local producers of energy In exchange for an above-market price for what they deliver to the grid. There have been mixed results in its implementation.[155] The German FIT model is one of the most successful. In Germany, FIT policy has resulted in a largely decentralized system of energy production. Over 1.6 million solar projects have been installed in a country of less than 40 million households.[156]

Germany's success spurred rapid adoption of renewables in Europe, with more than 41 nations – from Portugal to France, Italy, Denmark, the Czech Republic, and South Korea, and states and utilities having emulated the German model, using FITs to stimulate renewable power production**.** Unlike the "net metering" provisions that are common in the United States, and that limit solar system size to annual consumption of a particular meter, the feed-in tariff allows for participants to maximize solar production at a particular site.[157]

Spain had a promising FIT program. Spain, in 2007, was eager to fulfill its commitments to renewable energy so the government guaranteed generous subsidies for any company that met its aggressive deadlines, to install solar by September 2008. It guaranteed rich fixed electricity rates of up to 44 euro cents per kWh. Spain planned on 400 MW of installations and received an overwhelming 1,200 MW of applications. The program was too rich and was canceled, sending ripples far and wide.[158] More recent FIT initiatives in the United States have paid reasonable prices and have been successful in attracting developers.

Current German Rooftop PV Tenders

Germany's Federal Network Agency (Bundesnetzagentur), completed a fourth rooftop solar tender that resulted in an average price of 0.0884 Euro. A tender is a solicitation process whereby governments and other financial institutions invite bids for large projects that must be submitted within a finite deadline.

The solicitation received bids with a total capacity of 767 MW. Ultimately authorities selected projects from 300 - 750 kW in size, totalling 201 MW. Prices ranged from $0.085 - 0.092/kWh.

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[155] Investopedia, What Is A Feed-In-Tariff, https://www.investopedia.com/terms/f/feed-in-tariff.asp
[156] The case for state solar feed-in-tariffs (FITs) in the USA, https://blogs.nicholas.duke.edu/env212/the-case-for-state-solar-feed-in-tariffs-fits-in-the-usa/
[157] Bringing an Effective Feed-In-Tariff To California Policy White Paper, EcoMotion, November 7, 2008: https://ecomotion.us/wp-content/uploads/2016/01/The-Solar-Santa-Monica-White-Paper-on-Feed-In-Tariffs-11-6-7.pdf
[158] Spain's Solar Market Crash Offers Cautionary Tale About Feed-In-Tariffs.Greenwire, August 18, 2009, https://archive.nytimes.com/www.nytimes.com/gwire/2009/08/18/18greenwire-spains-solar-market-crash-offers-a-cautionary-88308.html?pagewanted=all

First such solar tender by Germany was last July for 168 bids and 213 MW of capacity. Selected were 114 projects totalling 152 MW with an average price of $0.071/kWh.[159]

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Feed-In Tariffs today: Feed-In Tariff programs continue to help increase distributed energy resources, benefit customers, help jurisdictions meet their carbon-reduction goals, and create local jobs.

LADWP's Feed-in Tariff (FiT) Program

LADWP's FiT program was launched in 2013 when the Board approved the 150 MW FiT Program.[160] The program allowed for the construction of solar installations on commercial, industrial, nonprofit, multifamily, government, warehouses, carports, and unbuilt land within the City of Los Angeles. Through the FiT program, anyone who invests in solar (i.e., local building owners, solar developers, and third parties) can sell the electricity generated by their solar array back to LADWP at a fixed price for up to 20-years. It consists of a 35 MW set pricing component (SetFiT) offered at $0.145/kWh and a 30 MW competitively bid component. (BlockFiT) not to exceed $0.145/kWh and $0.115/kWh for landfill gas technology.

Already the largest FiT program in the nation, the LADWP FiT program reached nearly full capacity in September 2019 and authorized a 300 MW increase from 150 MW to 450 MW shortly after. This expansion updated several important aspects of the program, including increasing the single project capacity limit from 3 MW to 10 MW.

As of 2019, LADWP's FiT program has generated over $500 million in new solar investment for the City of Los Angeles and is projected to reduce 68,500 metric tons of greenhouse gas emissions annually once all projects are interconnected.[161]

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[159] "Germany Concludes Fourth Rooftop PV Tender with an Average Price of 0.0884E", PV Magazine, August 24, 2022, https://www.pv-magazine.com/2022/08/24/germany-concludes-fourth-rooftop-pv-tender-with-average-price-of-e0-0884-kwh/?utm_source=dlvr.it&utm_medium=facebook

[160] LADWP FiT Program, https://tinyurl.com/LADWPFeedInTariff

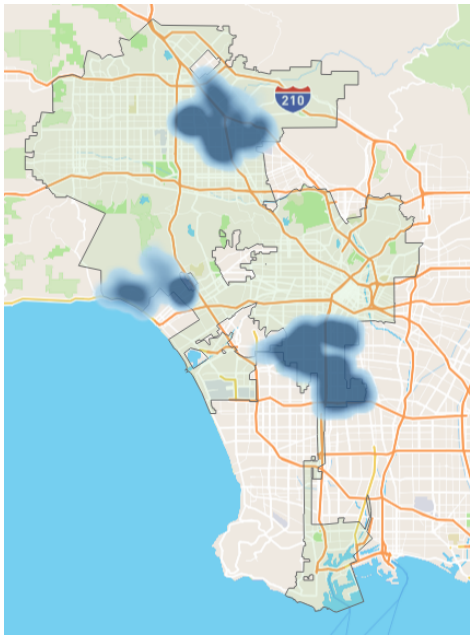
[161] Comparing Germany's and California's Interconnection Processes for PV Systems . NREL white paper, July, 2011, https://www.nrel.gov/docs/fy11osti/51814.pdf

LADWP vs GWP FIT Program Price Comparison as of 10/2022 – Solar Only				
LA Project Capacity	LADWP (In-Basin)	GWP Capacity	GWP Peak	GWP Non-Peak
30 kW - 500 kW	14.5 cents/kWh	Up to 1.4 MW	11.5 cents/kWh	10.3 cents/kWh
> 500 kW - 3 MW	14.0 cents/kWh			
> 3 MW	13.5 cents/kWh			

LADWP's FiT+ Pilot Program expands on the existing program to further promote the use of locally generated solar energy and to ensure the deployment of energy storage projects. This pilot focuses on areas of the city with the need for local energy capacity (with less transmission capacity) and with environmental justice concerns.

LADWP shows a map of the FiT+ Zones, and can be found at the FiT + Zones page[162] or at the link below, using the password FiT+PilotZones*. Detailed explanations of the FiT+ Zones and the associated maps can be found in Section 3.5 of the FiT+ Pilot Program Guidelines.

FiT+ Pilot Zones Map[163]



[162] LADWP FiT Plus Pilot Program, Feed-in Tariff Plus (FiT+) Pilot Program (ladwp.com)
[163] LADWP FiT and Pilot Zones Map, https://public.tableau.com/profile/ladwp.clean.grid.la#!/vizhome/FiTPIlotZones/UserGuide

Gainesville, Florida FIT Program

The City of Gainesville in Florida was the pioneer in the implementation of a long-term feed-in-tariff model to purchase solar electricity generated by privately owned systems located in the public utility's service territory, accelerating the investments in renewable energy.[164] Based on the German model, the City implemented the feed-in-tariff program using 20-year agreements with suppliers. This program was funded by the electricity ratepayers through an increment in the electricity bill. Gainesville adopted this renewable energy policy in 2009 to diversify its generation portfolio, respond to community demands and meet carbon reduction goals, and discovered in this program a tool to expand distributed renewable generation, help reduce carbon emissions in the City.

The program provided a rise from near 300 kW of solar energy installed capacity in 2008 to approximately 20.5 MW by April of 2014 (18.55 MW through FIT and 1.99 MW through net metering), and this deployment of more than 260 installations created a solar market in the region and contributed to sustained construction and solar employment through a difficult economy. The program ended in 2013 but the price list was as follows:[165]

Gainesville Electric Feed-In-Tariff Program

	20-year Fixed Rate*	Capacity (DC peak kilowatts)	Mounting Configuration
Class I	$0.21/kWh	10 kW or less 10 kW or less	Rooftop or over pavement Ground mount
Class 2**	$0.18/kWh	> 10 kW to 300 kW >10 kW to 25 kW	Rooftop or over pavement Ground mount
Class 3***	$0.15/kWh	> 10 kW to 1000 kW	Ground mount

*For projects approved and installed in 2013.

[164] Implementation and Results of Solar Feed-In-Tariff in Gainesville, Journal of Energy Engineering, February 2017, https://ascelibrary.org/doi/10.1061/%28ASCE%29EY.1943-7897.0000373

[165] GRU FIT Program Page, https://www.gru.com/AboutGRU/Content/SolarFIT.aspx

This significant success in the adopted scheme turned Gainesville into a global leader in solar energy installed capacity per capita, surpassing more mature markets such as the state of California. Using some lessons learned from Gainesville's experience and from dozens of nations across the world, similar feed-in-tariff programs have been adopted in larger municipal utility markets and some states. Also known as CLEAN in some U.S. jurisdictions (Clean Local Energy Accessible Now), municipal utilities including Palo Alto, Sacramento, Ft. Collins, Long Island Power Authority, and Los Angeles have similar programs, as does the State of Vermont.

City of San Diego and The Clean Coalition

Clean-Coalition.org partnered with the City of San Diego to provide a Feed -In Tariff program like a program modeled in Germany, with a focus on removing barriers to meet big solar goals.[166]

The City of San Diego also worked with Clean-Coalition to develop a Solar Siting Survey. The survey conducted with NREL, examined possibilities of 1 MW or more solar projects throughout San Diego.[167] Currently, the San Diego FIT program is offered by San Diego Community Power.

Marin Clean Energy Feed-In Tariff

Marin Clean Energy (MCE) reports it offers one of the most competitively priced FIT programs in California. The FIT Energy price range is $50 - 80/MWh for projects and is determined by the number of program participants. Projects can be sized between 1 and 5 megawatts and must have storage. Other requirements: They must meet local labor and living wage/IBEW/MCE agreements and be on pollinator friendly solar-arable land. MCE offers $7/MWh extra for non-solar innovation. The Tariff Program has 11 participants currently.[168]

Energy Storage

Ten CCAs Partner For Energy Storage

Ten Community Choice Aggregators (CCA) formed a joint powers authority for the purpose of pooling buying power. The first of many purchases is an innovative 8-hour Lithium-ion storage technology. The JPA, called California Community Power, authorized the 15-year contract for

[166] Clean-Coalition FITs, https://clean-coalition.org/feed-in-tariffs/
[167] San Diego Solar Siting Survey Summary, https://www.sandiego.gov/sustainability/clean-and-renewable-energy
[168] Marin Clean Energy FIT Program, https://www.mcecleanenergy.org/feed-in-tariff/#FITPlus

69MW/552MWh of energy storage from LS Power's Tumbleweed project in Kern County, California beginning in 2024. There are seven CCAs participating in the project — the first in their joint request for proposals, or RFP, for 500 MW of long-duration energy storage.

Community Energy Storage

Connecticut - Community Energy Storage Solutions

Connecticut's Public Utilities Regulatory Authority (PURA) launched its Energy Storage Solutions, a statewide electric storage program for all Eversource and United Illuminating (UI) residential and commercial and industrial (C&I) customers.[169] The program aims to foster a more reliable and resilient electric distribution system, especially for vulnerable communities.

The Connecticut Green Bank, along with electric utilities Eversource and UI will administer the project, which is set to run from 2022 through at least 2030 with targets divided into three-year tranches.

The first tranche will look to install up to 100 MW (50 MW residential, 50 MW C&I) by 2024. Then, 100 MW (50 MW residential, 50 MW C&I) between 2025-27, and 280 MW (140 MW residential, 140 MW C&I) between 2028-30. Pros: 580 MW of storage by 2030 throughout the State. C&I get up to 50% off price. Partnership with Connecticut Green Bank.

Utility-Owned Local Solar

Another important source for solar power is utility-owned local solar. While solar may well be inexpensive in the desert, buying locally means having local resources that are not dependent on already-congested transmission. Locally owned solar means solar on City owned rooftops, parking lots and other sites leased by the utility. Hillside solar has been considered.

These systems are mini-power plants. Unlike NEM solar, local solar resources can be profitable. They can be low-cost sources of generation that boost system reliability. And they can of course, read must… be paired with storage so GWP can use these resources when they are most valuable, offsetting expensive avoided cost power.

Currently, the consultant Black & Veatch is analyzing Glendale distribution grid feeders to establish possible PV system sizes that can be added (without system upgrades) based on

[169] "Connecticut Launches Incentives For Behind The Meter Batteries," PGRID Int., Jan 1, 2022, https://www.power-grid.com/energy-storage/connecticut-launches-incentives-for-behind-the-meter-batteries/

location. The project involves ranking sites for development and prioritizing based on return on investment. Other values such as avoidance of cost, could be considered. The IRP assumed 10 MW of solar and storage on City sites.

Brownfield Solar

Brownfield solar can help local governments achieve their climate goals while repurposing previously developed land. Glendale's Scholl Canyon, and the upcoming closure of the landfill there, provides options for GWP and its solar pursuits.[170]

As part of Houston's Climate Action Plan, the Sunnyside Solar Project is expected to become the largest landfill solar project in the United States. This project's 52 MW of solar panels will be able to power 5,000 homes and offset about 55,000 metric tons of CO2 each year.[171]

Columbus, Ohio, will transform a closed landfill into a nearly 50 MW solar park. These two projects are both expected to be completed and operational in 2022.

Brownfield solar can also be a good choice for aggregation deals between peer municipalities in the same area. Ann Arbor and Pittsfield Township in Michigan together planned a 24 MW landfill solar project that will offset 100 percent of the current municipal electricity usage for Pittsfield Township and allow Ann Arbor residents to subscribe and offset their energy use with local, renewable energy.[172]

EPA Landfill Methane Outreach Program

The EPA's Landfill Methane Outreach Program (LMOP) is a voluntary program that works with industry stakeholders and waste officials to reduce or avoid methane emissions from landfills. LMOP encourages the recovery and beneficial use of biogas generated from organic municipal solid waste. The program provides a national network. Members can join a listserv, access an information database, attend webinars and see current examples. Currently, there are local programs listed including The City of Whittier, The Los Angeles Department of Sanitation Los Angeles County, Los Angeles BKK Corporation, Los Angeles Operating Industries, Inc., and Orange County Waste and Recycling.[173]

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[170] RMI-Brownfield Renewables, https://rmi.org/ways-us-cities-broke-clean-energy-records-in-2021/
[171] Sunnyside Energy Community Solar, https://www.solarunitedneighbors.org/sunnyside/
[172] Solar Panels Offer Landfills Second Chance at a Useful Life. Waste Today, Aug 19, 2021, https://www.wastetodaymagazine.com/article/solar-panels-landfills/
[173] EPA Landfill Program, https://www.epa.gov/lmop

Amesbury Landfill Solar Plus Storage (Amsbury, MA)[174] Project is 16 Acres, 4.5 MW PV & 3.8 MWh Li battery. Landfill ground mount array. Project online Dec 2019. Expected to produce 5,600kW/2MWh. The City of Amesbury is expected to save around $4 million in municipal spending on energy over 20 years.

Haverhill Solar Farm @ Haverford Landfill (Haverhill, MA[175] Project is 3.9 MW PV, turning one section of a long-vacant, 55-acre landfill into a solar farm producing 3,919,000 kilowatt hours per year, powering about 500 homes. City's net revenue will be approximately $3 million over 20 years.

Solar Landfill Project (Spanish Fork, Utah[176] Project is 27 acres in size; its 4.7 MW PV will generate enough clean energy for ~3,000 homes. The project uses Solar FlexRack's Series B cast-in-place ballasted mounting solution on a 27-acre landfill site that was unsuitable for commercial development, solving the problem of unstable ground development.[177]

Fuel Cells and Microturbines

2021 APPA Awards: DER/Hydrogen Fuel Cell/EV Charging

Orlando Utility Commission (OUC) received a 2021 AAPA award for developing a "nanogrid" test site decarbonizing the grid through direct-coupled solar PV and battery storage with electric vehicle chargers. The OUC partnered with the DOE to integrate a green hydrogen system for back-up out of an electrolyzer, hydrogen storage tanks, and two fuel cells. The nanogrid is said to provide real-world testing of new technologies at a scale that allows OUC to gain valuable operational data, with lower investment risk.[178]

[174] Amesbury Landfill Solar Plus Storage Project, FHWA, https://www.fhwa.dot.gov/ipd/project_profiles/ma_amesbury_landfill_solar_plus_storage_project.aspx
[175] "Work begins to convert old Haverhill landfill to solar farm, bring money to city," https://www.eagletribune.com/news/haverhill/work-begins-to-convert-old-haverhill-landfill-to-solar-farm-bring-money-to-city/article_de486ae0-58a6-5b3e-aee2-2fb5fecd67aa.html
[176] "Utah landfill converted to 4.7-MW solar project with Solar FlexRack's concrete ballast foundation," Solar Power World, July 12, 2021, https://www.solarpowerworldonline.com/2021/07/utah-landfill-converted-to-solar-project-with-solar-flexracks-concrete-ballast-foundation/
[177] 3 additional landfill examples shared in notes Jan 2022 Kate Unger, Glendale Environmental Coalition.
[178] DER/Hydrogen Fuel Cell: https://www.powermag.com/nanogrid-could-hold-key-to-clean-energy-future/

Bloom Energy Announces Hydrogen Powered Fuel Cells

Solid oxide fuel cells (SOFC) can run on natural gas, 100% hydrogen, or a blend.[179] When there is excess electricity production from solar, the fuel cells can produce hydrogen with an in-unit electrolyzer. Then, when electricity is needed, the fuel cell can generate electricity by consuming hydrogen and producing water as a byproduct. This is a cost-effective source of electricity with high energy-efficiency compared to combustion. It is more efficient than combustion technology, and can handle hydrogen blends with a higher efficiency than via combustion. SOFCs can be used with biomethane generated at the local wastewater treatment plant. One major advantage of solid oxide fuel cells is that they have virtually no criteria air pollutants, unlike combustion units, so they are better for local air quality.[180]

The Reliability Dimension

PSPS and Generators: The primary purpose of this analysis is to see if there are solutions for Glendale's upcoming capacity crunch. Are there things that can be done now to prepare for this coming summer, and the next, and for the summer of 2025? Meanwhile, energy resilience and reliability are on consumers' minds. Investor-owned utilities have been granted the authority to shut down parts of the grid during Public Safety Power Shut-offs (PSPS) events to protect from wildfires started by utilities' electrical equipment during high wind and heat events. Defeated consumers are looking for their own solutions for energy resilience. Many are installing generators, banking that natural gas lines will be functional when the electric grid fails. (Gas grids historically fail only 5% of the time that electricity grids fail.)

Microgrids: Others are building microgrids for resilience. GWP consumers may soon be following this trend. Microgrids can be used for daily operations – to support the grid – and in emergency operations for their host sites. Far from threatening, consumer-owned microgrids may well be a very good thing for GWP to prepare for and to ride through the Summer of 2025. Without policies and tariffs that encourage microgrids, and GWP's consumers' investments in reliability, consumers may ultimately defect from the grid, choosing to generate, store, and manage their own energy use. Without effective policies and programs, this defection could lead to the "death spiral" in which utilities lose customers, their costs now borne by fewer and fewer consumers, whose rates rise, in turn causing more defection.

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[179] "Bloom Energy Announces Hydrogen Powered Energy Servers.." June 27th, 2019, https://www.bloomenergy.com/news/bloom-energy-announces-hydrogen-powered-energy-servers-to-make-always-on-renewable-electricity-a-reality/

[180] Notes, Jan 2022 Kate Unger, Glendale Environmental Coalition.

Vehicle Grid Integration

California's EV Leadership

California is the largest car market in the world. California's emission targets set the standard for other states to follow as will its pledge to ban all sales of new internal combustion automobiles by 2035. Automobile companies are adjusting and are retooling their car lineups to abide by California's statutes. Almost all legacy car manufacturers are adding electric vehicle options, and there are brand new EV manufacturers selling new lines, like Rivian and Polestar. Electrification and the push for EV vehicles and the wider implementation of Electric Vehicle Supplying Equipment (EVSE) are necessary for the State of California, and for the country-at-large to achieve decarbonization targets to mitigate climate change due to greenhouse gas emissions.

California municipal utilities and investment owned utilities have rolled out generous infrastructure programs for commercial and residential customers. In addition, the California Public Utilities Commission (CPUC) has worked with the State's utilities on special rates to give incentives for EVs, mandating that EV rates do not impose demand charges through 2025. Moreover, California utilities have offered rebates for customers who purchase used or new electric vehicles; and they have offered rebates for EVSE and the necessary infrastructure to support its installation.

State lawmakers have recognized that in order to be a leader in EV adoption, customers should be incentivized to dip their toe into a nascent technology. California has offered further incentives to households, businesses, schools, and municipalities for EVs and EVSE: the California Clean Vehicle Rebate Project, California Clean Vehicle Assistance Program, Beneficial State Foundation, California Vehicle Retirement Consumer Assistance Program, Electric Vehicle (EV) Rebate Program, CARB Bus Replacement Grant, CEC Bus and EVSE Grant, CaleVIP Electric Vehicle (EV) Charging Station Incentive Program Support, local Air Quality Management District (AQMD) incentives, Low Carbon Fuel Standard Program, and CARB Emission Reduction Grants. In addition, financing mechanisms like PACE can be used to finance EVSE.[181]

California has been a leader in EV penetration; the State's EV incentives paired with the federal tax credit have aided early adoption. According to a 2020 S&P Mobility report, California leads the country in EV penetration. The Golden State now accounts for 39% of all EVs registered

[181] Alternative Fuels Data Center, https://afdc.energy.gov/laws/all?state=CA3

nationwide.[182] And according to the Department of Energy, in 2020, California had the third highest number of public chargers per capita with 72 EV chargers per 100,000 people.[183]

The EV Challenge and Opportunity

Glendale has over 220,000 cars on the road.[184] It is likely that 95% of the cars are idle most of the day. Moreover, many fleet vehicles and school buses are routinely idle, some during peak demand hours of 4 - 9pm when the workday customarily ends. As EV penetration grows in Glendale, GWP has a major opportunity, an untapped resource, to put in the toolbox to address its resource constraints.

Managing the EV Load

Glendale Water and Power (GWP) like other California utilities has offered incentives for greater EV adoption. GWP has done this by providing incentives for EV chargers. GWP has also installed chargers for city and public use. As of November 2022, GWP has installed 23 city-owned EV charging stations and plans to add an estimated 74 additional charging stations by June 2023.

Providing incentives for chargers has been an early and smart means to support customers' EV purchases and to begin to manage the growing and potentially huge load that EVs represent. Without control, EVs could become a huge charging challenge for utilities.

In addition to the charger rebates and the incentives for off-peak charging, GWP has an online EV customer awareness platform with information on local, state, federal rebates and funding sources, an EV charging station map, information on available EVs, and home charging options. GWP has also hosted multiple Electric Car Guest Drive events for residents to test drive and learn more about electric vehicles. Other GWP EV efforts include providing a grant to the Glendale Police Department to purchase two electric motorcycles, a grant to the Glendale Library Arts and Culture Department to purchase an electric bookmobile, and piloting a solar-powered, transportable, off-grid EV charging station.

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[182] "A handful of states are driving nearly all U.S. electric car adoption," Axios, Aug 1, 2022, https://www.axios.com/2022/08/01/states-ev-electric-cars

[183] "Vermont had Highest Number Electric Vehicles," FOTW 1169, January 18, 2021, https://www.energy.gov/eere/vehicles/articles/fotw-1169-january-18-2021-vermont-had-highest-number-public-electric-vehicle

[184] Estimate is extrapolated from Los Angeles County DMV data.

GWP's Existing EV Programs

GWP EV Charging Station Rebate Program

GWP provides rebates to commercial and residential customers toward the purchase of Level 2 EV charging stations. Commercial or multi-unit dwelling customers who purchase and install EV charging stations can receive up to $6,000 for each charger and with incentives capped at $50,000. Residential customers who install a charger can receive up to $599. Applications must be submitted no later than four months from the date of purchase. Rebates are available on a first-come, first-served basis until funds are exhausted.[185]

The results: GWP has spent $256,917.57 on this program from 2017 - 2022 and has enrolled 255 customers. Starting in July 2021, funding for this program is now covered by the California Air Resources Board (CARB) Low Carbon Fuel Standard (LCFS) Program.[186] In 2020, GWP partnered with CARB and local EV dealerships to provide a point of sale rebate of up to $1,500 through the State's Clean Fuel Rewards program. Since November 2020, 2,948 customers received a Clean Fuel Reward incentive. CARB temporarily reduced incentives to $0 in September 2022. Incentives may be increased in the future.

GWP's "Bring Your Own Charger" Program

In July 2022, GWP implemented Sagewell's "Bring Your Own Charger®" EV Load Shifting Program.[187] GWP pays $8 monthly incentives to customers for charging off peak. The program allows GWP to shift load 365 days per year, not just during peak, which helps maximize beneficial grid impacts year round.

Participants enroll on their smartphones. In a report to Massachusetts's Department of Energy, Sagewell says the program has a 95% off-peak charging rate.[188] No hardware involved. Utilities can be up and running in 30 days. This program has been previously implemented in Braintree, MA and resulted in an award-winning project.

In the BYOC approach, an EV driver schedules their EV to charge during off-peak periods using their vehicle's on-board charging timer, completes a 7-minute enrollment web form, uploads a

[185] GWP EV and Charger Incentives, https://ev.glendalewaterandpower.com/incentives
[186] Data is directly from GWP
[187] GWP Peak Charging Rebate Program, https://gec.eco/gwp-off-peak-charging-rebate-program/
[188] Sagewell's "Bring Your Own Charger" Pilot Report, December 15, 2019, https://www.mass.gov/doc/sagewell-bring-your-own-device-peak-demand-grant-program-report/download

picture of their charging schedule, and signs the program participation agreement on their mobile device. In return,they are paid a monthly incentive for charging off-peak. BYOC works with any charger (smart, non-smart, level 2), and any vehicle make and model. The program also provides a how-to guide for scheduling the most popular makes and models of EVs.

Bring Your Own Charger requires no hardware to be installed by the participant. The program leverages existing EV charging timer features, utilizes advanced metering infrastructure (AMI) installed by utilities and uses Sagewell's SageSight SM AMI meter data analytics software. BYOC uses whole-home AMI data to measure results and doesn't require additional sub-meters or time of use rates. The hourly interval meter data from smart meters is analyzed daily by SageSight SM which looks for EV charging signatures. SageSight was customized for this project to maximize the speed and accuracy of EV monitoring processes.

Options to Augment GWP's EV Program:

- Identify and upgrade vulnerable distribution areas of the grid to support EV charging
- Introduce EV rebates targeting equity such as an EV rebate for used electric vehicles
- Introduce an EV infrastructure program for commercial customers similar to IOUs
- Offer or Mandate EV Time of Use Rates
- Offer a rate comparison tool on GWP website to aid customers
- Hold off on EV rate demand charges until at least 2026
- Experiment with EV Rate dynamic pricing

San Diego Gas and Electric: Dynamic TOU Rates for EV Charging

SDG&E piloted dynamic pricing for EV chargers in its Power Your Drive Pilot, and it was proven to curb demand and GHG emissions.[189] Drivers use a dynamic pricing mechanism called Rate-to-Drive (RTD) where they can set the maximum price that they are willing to pay for electricity through a smartphone

[189] SDGE Power Your Drive Research Report, April 2021, https://www.sdge.com/sites/default/files/regulatory/SDG%26E%20FINAL%20Power%20Your%20Drive%20Research%20Report%20April%202021.pdf

application. If the VGI rate exceeds this threshold price while the driver is charging, their vehicle will automatically stop charging, providing a responsive mechanism for reducing load on the grid during peak hours. Drivers can choose to override the automatic throttling of charging if the VGI rate exceeds their threshold. Participants typically override their threshold in situations where they need to charge regardless of the cost.

All charging stations in the Power Your Drive Pilot are served on a dynamic rate, an electric rate with an hourly price that reflects grid conditions and renewable energy generation. The rate's hourly pricing enables far more granular price signals than standard TOU rates.[190] The pricing periods for TOU rates change only infrequently; the VGI rate periods of high and low prices can vary hour to hour based on the needs of the grid.

The dynamic rate consisted of several components: A base rate that recovers the cost of operating the transmission and distribution system and administering Public Purpose Programs, among other costs; the California Independent System Operator ("CAISO") day-ahead energy price, with a day-of adjustment; an hourly adder charged during approximately the top 150 hours of annual demand on the California grid; and an hourly adder charged during approximately the top 200 hours of annual demand on a customer's individual distribution circuit.

Fully 40% of the drivers enrolled in this pricing mechanism have not specified a maximum price threshold. Approximately 10% selected thresholds above $0.40 per kWh, and 50% of drivers elected pricing limited up to $0.40 per kWh. Energy under $0.20 per kWh represented 90% of the total energy consumption for drivers overall. No-threshold drivers have more charging sessions compared to groups with higher limits.[191]

Drivers appear to shift their charging behavior in response to high price periods. When asked through SDG&E's survey 44% of drivers (80 out of 180 responses) indicated that they have delayed charging in response to high prices "many times." Drivers utilizing RTD billing are notably more successful at avoiding charging during high price periods than drivers at RTH sites, suggesting that the VGI rate is more effective at encouraging grid-friendly charging when it is directly served to drivers at SDG&E- owned charging stations.

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[190] Ibid.
[191] Ibid.

It is recommended that GWP continue to adjust and fine tune all of its incentive programs to change consumer behavior as the utility learns the results and uptake of its programs. This is especially important for its EV programs as the market is growing and developing so fast. For example, GWP can adjust the rebate amount for its Off-Peak EV Charging Rebate if enrollment lagged or make the incentive amount dynamic. Sagewell's "Bring Your Own Charger®" EV Load Shifting Program is accessed through an online portal. As such, the program offers dynamic prices during DR events.

SmartCharge Program, Consolidated Edison
In Partnership with FleetCarma and ChargePoint

Participants receive a FleetCarma C2 device and receive $150 upfront for installing and activating it. The C2 device collects the customer's charging data and makes it available to the utility and the customer. Participants can compare their charging activity with that of other EV drivers nearby, which acts as an additional gamified incentive to increase participation. Rebates are awarded to participants when they join, keep the C2 device plugged in, and refer others to the program.

Fleet-owning customers are encouraged to participate, and their savings can be substantial. For example, the New York Department of Citywide Administrative Services projected in 2019 that it could potentially, "earn up to $150,000 per year for charging its EVs overnight by participating in the program."[192]

Proactive Infrastructure Upgrades

GWP can utilize advanced AI (artificial intelligence) forecasting technology to strategically identify areas of its grid that need distribution upgrades. Adding EV Charging and Building Electrification loads can trigger necessary upgrades to the distribution system. Electrification can create long wait-times for customers who are upgrading from 100 amp or less to 200 amp or more electrical service. Proactively upgrading infrastructure will decrease administrative friction for customers who are new adopters of electrification. Through positive word of mouth and positive experiences, customers will feel as if it is easy to transition to new decarbonization technologies. SMUD has trailblazed this proactive infrastructure approach, and has made customer satisfaction and buy-in a priority.

[192] Smart Charge New York, https://www.smartchargerewards.com/smartchargenewyork/

SMUD Identifying Distribution Upgrades for EV Charging + Building Electrification

Sacramento Municipal Utility District proactive plans investments in the distribution system by predicting where upgrades will be needed. SMUD wants to identify where these upgrades will likely be needed in advance, to cut down on wait times and unhappy customers, and get the distribution system ready for inevitable electrification. Most utilities don't have granular visibility on sizes of electrical services of customers. So the current project is to create estimates of existing service sizes based upon other available data (age of building stock, permits for building upgrades) and estimates of where upgrades are most likely to occur next, using demographic information and machine learning. Then, the utility can make smarter investments in distribution systems and upgrade service sizes in advance of customer requests (the utility usually has to pay for some or all of these service upgrades anyway, when the customer requests it; better to be proactive).[193]

2020 APPA Award Winner:
DEED Public Power Electric Vehicle Planning Toolkit and Guidebook

American Municipal Power, OH teamed up with Smart Electric Power Alliance (SEPA) to create a DEED Public Power Electric Vehicle Planning Toolkit and Guidebook. The EV Toolkit is a user-friendly, intuitive resource for APPA member public power agencies to obtain insight into the preliminary economic impacts of electrification efforts with their internal fleet vehicles, and increased loading on residential distribution system service transformers under various EV charging scenarios.

The EV Toolkit also provides increased awareness of EVs and associated market trends; supports the preliminary evaluation of customer engagement and EV charging management options when creating a program; provides insight into the potential timing at which proactive steps are best taken for maximum economic impact; and supplies accurate data and useful resources to support preliminary EV planning activities.[194]

[193] "SMUD, DERs and its Customers," Sepa Power, June 29, 2017, https://sepapower.org/knowledge/smud-ders-customers/
[194] AMP Develops EV Toolkit with Deed Funding, APPA, https://www.publicpower.org/periodical/article/amp-develops-ev-toolkit-public-power-with-deed-funding

2018 APPA Award Winner
"Braintree Drives Electric" Electric Vehicle Marketing and Incentive

Braintree Electric Light Department (BELD) MA - Electric Vehicle (EV) marketing program is one of the first marketing-focused EV programs by a public power utility. The program is designed to use community based social marketing and grassroots tactics to increase EV adoption. Since the start of the program, the number of resident EV's in their service area has increased from 10 to 55, awarding Braintree the highest EV per capita adoption rate among area municipalities with similar demographics, and competitive with the rates seen in significantly more affluent areas. Additionally, Braintree's Bring Your Own Charger program provides incentives to customers who charge during off-peak hours, mitigating the impact of EV peak load charging.[195]

EV Load Shifting Programs

Geotab Energy's "SmartCharge Rewards"

Another EV load shifting program that doesn't require a smart charger, in-car device, or other hardware is Geotab Energy's SmartCharge Rewards program. It has been implemented in New York by Consolidated Edison, in Oregon by Portland General Electric, in Arizona by the Salt River Project, and in Canada by three other utilities[196] It's a gamification-based program managed through vehicle-side data and there is no expense of hardware installation. Data is gathered from the vehicle itself. Enrollment is high, reportedly because EV drivers are treated like they are part of the solution. Customers feel like they are getting paid to charge their cars every night.

Duke Energy Florida Itron Off Peak Charging Credit Program

Duke Energy recently announced a program to distribute Itron's DER Optimizer that uses the demand response platform IntelliSOURCE. Itron's system uses telematics from Rolling Energy Resources that captures data from 16 car manufacturers. Itron taps data on charging from the

[195] Braintree Drives Electric, https://www.beld.net/BDE
[196] Smart Charge Rewards, https://www.smartchargerewards.com/sign-up/

car rather than from chargers, Ting explained, a process that should save money for utilities.[197]

Duke reportedly favored a behavioral program rather than an active one where the utility would be controlling chargers. Users pay $10 a month to charge during Duke Energy Florida's dual off-peak hours. Customers can charge twice during on-peak times and pay off-peak hour rates before the full on-peak cost kicks in the third time. Itron sends emails to customers with monthly summaries and other email notifications warning them if they plugged during a peak time. Duke Energy Florida hopes the program will attract 4,000 customers over the next four years.

California Residential EV Programs

PG&E's Empower EV Program - Electrical Panel Upgrades

PG&E's Empower EV program can offer eligible households up to $2,500 in financial incentives. PG&E will cover the cost of up to $500 for one Level 2 charger that is hardwired or plugs into a 220+ Volt outlet. PG&E will cover up to $2,000 per single-family household for panel upgrades completed by licensed electricians. No cost to enroll. Goal is to assist 2,000 households through this program. The customer must verify income eligibility, that his or her income is within 400% of the federal poverty level. The customer must have purchased or leased a new or used EV (fully battery electric or plug-in hybrid) in the six months prior to applying to this program. The customer must have used a licensed electrician for panel upgrade work and obtain documentation to verify the work is complete.[198]

SCE Used EV Rebate Program for Income-Qualified Households

Income-qualified applicants may receive $4,000 based on their household level of income for the purchase or lease of a pre-owned EV. To qualify, residents must participate in a government assistance program. Available for TOU rate or Tiered Rates. SCE offers a Rate Plan Comparison Tool for program participants.[199]

[197] "Utilities Pilot Der Programs To Shave Peaks," Reward Customers, PowerGRID Int., April 13, 2022, https://www.power-grid.com/der-grid-edge/utilities-pilot-der-programs-to-shave-peaks-reward-customers/#gref
[198] PG&E Empower EV Program, https://www.pge.com/en_US/residential/solar-and-vehicles/options/clean-vehicles/electric/empower-ev-program.page
[199] SCE Residential Rebates, https://www.sce.com/residential/ev-rates-rebates

LADWP Used Electric Vehicle Rebate Program

Rebates of up to $1,500 now available for qualifying used electric vehicles (EVs) purchased within 12 months of application submittal. The program offers up to an additional $1,000 rebate for applicants who reside in a home that is participating in the Lifeline or EZ-SAVE Low Income Customer Assistance programs, for a total rebate amount of up to $2,500, and not to exceed the applicant's total net cost. Note that one does not need to be an LADWP account holder to apply for the rebate, but the applicant's permanent residence must receive electric service from LADWP.[200]

To get the rebate, the vehicle must meet the following criteria: It must have been purchased within 12 months of application submittal, it must be featured on the approved vehicle list, and its must be a model year at least two years older than the calendar year of the application, but not older than eight years. For example, if the application is for a rebate in 2022, the vehicle model year must be from 2014 to 2020. Interesting policy, LADWP will only issue up to two Used EV Rebates for the same vehicle.

Riverside Public Utilities "Electrify Riverside"

RPU offers several opportunities for EV rebates and incentives:[201]

<u>Used EV Rebate:</u> Customers can get up to a $500 rebate for the purchase or lease of a used Battery Electric or Plug-in Hybrid vehicle made on or after July 1, 2021. Qualified low-income customers enrolled in RPU's SHARE program are eligible to receive an increased rebate of up to $1,500. The vehicle must be approved for highway application. (Electric scooters, electric bicycles, golf carts, neighborhood and low-speed vehicles are not eligible.)

The program applicant must be an active RPU electric customer. The EV must be registered at the address of the active RPU electric customer account. The EV must be purchased from a commercial, used vehicle auto seller. Applicants must be actively enrolled in the SHARE Program to be eligible for the increased rebate of $1,500. Low-income qualifications are based on the

[200] LADWP Used Electric Vehicle Rebate Program, https://www.ladwp.com/ladwp/faces/ladwp/residential/r-savemoney/r-sm-rebatesandprograms/r-sm-rp-usedev;jsessionid=sdgJjvpcjqgzQv9YSmRS7pt4FJT2ldY0WLrFy1pbxPrZWjPb2msFl!1582185623?_adf.ctrl-state=1az02207l1_4&_afrLoop=128397399516107&_afrWindowMode=0&_afrWindowId=null#%40%3F_afrWindowId%3Dnull%26_afrLoop%3D128397399516107%26_afrWindowMode%3D0%26_adf.ctrl-state%3Dfbxun51i1_4

[201] https://riversideca.gov/utilities/residents/rebates/electrify-riverside

SHARE Program, 200% of federal poverty guidelines. Maximum of one EV rebate per household every three years.

EV Level 2 Residential Charger Rebate: Electric vehicle drivers who install a Level 2 (240-Volt AC) plug-in charger at their residence in the service territory of Riverside Public Utilities, on or after July 1, 2021, are eligible for up to a $500 rebate. Guidelines of note: Level 2 charger must be a new unit. Level 2 (240V) chargers must be equipped with the SAE J1772 standard or Tesla connector plug and certified by a nationally recognized testing laboratory (or NRTL). All level 2 (240V) chargers must be wall-mounted at the electrical service address provided in the rebate application. Maximum of one (1) EV Charger Rebate per household every three years.

Time-of-Use EV Rate Meter Rebate: RPU customers have an opportunity to charge their electric vehicles using a separate Time-of-Use (TOU) meter provided by RPU. Eligible customers can receive up to a $805 rebate to cover the cost of the EV meter adapter installation, in addition to incentives available for the EV Level 2 Residential Charger Rebate.

Silicon Valley Power Electric Bicycle Rebate Program

Rebate amounts are 10% of the pre-tax cost of the eligible electric bicycle less any other discounts received, up to $300. Financial Rate Assistance Program customers receive an additional $100 for eligible bicycles with a pre-tax cost of $600 or less, and $200 for eligible electric bicycles with a pre-tax cost over $600. Rebates will be mailed as a check within 4 to 6 weeks after all required documents have been received.[202]

Pasadena Water & Power Residential EV and Charger Incentives

Customers can receive a rebate up to $250 when they purchase or lease a new or used plug-in electric vehicle (EV). Customers can receive an additional $250 bonus rebate if they purchase or lease an EV from a Pasadena auto dealer. Since Tesla relies on a direct-sale business model where the transaction is completed entirely online, the Pasadena auto dealer bonus will not apply. An additional $1,000 is available for customers participating in PWP's income-qualifying programs. Additionally, customers can receive a $600 rebate when they install a qualifying "Wi-Fi enabled"

[202] Silicon Valley Power Rebates, https://www.siliconvalleypower.com/residents/rebates-6214#:~:text=Purchase%20an%20electric%20bicycle%20and%20receive%20a%20rebate%20up%20to%20%24300&text=Income%2Dqualified%20customers%20can%20receive,in%20which%20they%20are%20received.

EV charger, or a $200 rebate when they install a standard (Non Wi-Fi) EV charger in their home.[203] PWP's non-residential electric customers can receive rebates of up to $6,000 per port for installing smart EV chargers.

Existing Federal EV Programs

A Federal Tax Credit (FTC) of up to $7,500 per vehicle is available for the first 200,000 PEVs from each automaker. FTC rules have changed with the passage of the Inflation Reduction Act (IRA). Provisions in the IRA prioritize incentives for vehicles assembled domestically. In 2023, the IRS will complete its rulemaking and implement detailed rules for the new tax credit; there could be limits on the incentive based on income or cost of vehicle as well.[204]

Existing State EV Programs

- Clean Vehicle Rebate Program: Administered by the Center for Sustainable Energy for the California Air Resources Board (CARB), the Clean Vehicle Rebate Project (CVRP) provides monetary rebates of up to $7,000 for the purchase or lease of new electric and plug-in hybrid vehicles.[205]

- Clean Vehicle Assistance Program: Also administered by CARB, this program is for low-income customers only and provides grants of up to $5,000 for the purchase or lease a new or used hybrid or electric vehicle. This can be combined with the CVRP as well.

- Carpool Lane Sticker: Qualifying PEV and Plug-In Hybrid EV owners are eligible to ride in the high occupancy vehicle (HOV) lane by obtaining a Clean Air Vehicle (CAV) sticker. A limited number of “Green Stickers” are available for plug-in hybrids, and an unlimited number of “White Stickers” are available for electric-only vehicles.

- Discounted Toll Lanes: Vehicles displaying a current DMV-issued CAV sticker may be eligible for a 15% discount on the I-10 and I-110 Metro Express Lane.

[203] PWP Residential Electric Vehicle program, https://ww5.cityofpasadena.net/water-and-power/residentialevrebate/
[204] Plug-In EV Credit, IRS, https://www.irs.gov/businesses/plug-in-electric-vehicle-credit-irc-30-and-irc-30d
[205] California Laws and Incentives, AFDC, https://afdc.energy.gov/laws/all?state=CA

California IOU Commercial EV Infrastructure Programs

SDG&E Power Your Drive for Fleets

Option 1: SDG&E Owned, No Cost Installation: SDG&E pays for, constructs, owns, and maintains all infrastructure up to the charging station. The customer pays for and maintains the charging stations.

Option 2: Customer Owned, Rebates to Reduce Installation Costs: SDG&E pays for, constructs, owns, and maintains all infrastructure up to the meter. Then the customer pays for, constructs, owns, and maintains "customer-side infrastructure" and charging stations.

SDG&E provides a rebate of up to 80% of the cost of "customer-side infrastructure." To be eligible to receive funding through the Power Your Drive for Fleets Program, fleets must first meet the four basic criteria: The customer must demonstrate commitment to procure a minimum of 2 electric fleet vehicles, demonstrate long-term electrification growth plan and schedule of load increase, provide data related to charger usage for a minimum of 5 years, own or lease the property where chargers are installed within SDG&E's service area and operate and maintain vehicles and chargers for a minimum of 10 years.[206]

Southern California Edison Charge Ready

SCE will provide the infrastructure upgrades needed for EV charging equipment to those who qualify. Participating sites must be located within SCE's service territory and be an SCE customer.
SCE will perform all the necessary utility-side of the meter infrastructure work.[207]

All participants will have the option to have SCE also perform the customer-side infrastructure work (sometimes referred to as the customer-side make-ready) at no additional cost to the participant, or alternatively, may choose to design, procure, install, and maintain the customer-side make ready infrastructure themselves and qualify to receive a rebate of up to 80% of the estimated costs.

Participants must operate and maintain the EV charging equipment for a 10-year duration. Installation of separate dedicated metering to measure EV charging station load and served by a Time-Of-Use (TOU) rate plan. Enrollment in a qualifying Demand Response program. The

[206] SDGE EV for Business, https://www.sdge.com/business/electric-vehicles/power-your-drive-for-fleets
[207] SCE Charge Ready Rebates, https://www.sce.com/evbusiness/chargeready/charging-infra-rebate

charging equipment must be equipped with a network service and the related usage and pricing information will be shared with SCE.

Pacific Gas & Electric EV Fleet Program

To be eligible for the EV Fleet program, an applicant is required to be a PG&E electric customer, including both Direct Access and retail customers, as well as customers receiving power from a Community Choice Aggregator. The applicant must own or lease the property and have the authority to install charging infrastructure at the site. All properties require easement allowance for their EV Fleet projects. The applicant must acquire at least two EVs, deploying a minimum of two medium- or heavy-duty electric fleet vehicles by 2024.[208]

Customers planning to have electrical infrastructure installed to support vehicles to be purchased in the future must provide a formal plan or mandate demonstrating the organization or entity's commitment to long-term electrification to justify future expansion and a schedule of anticipated load increase. PG&E will install electrical infrastructure to support vehicles the company has demonstrated a commitment to procuring within five years.

If the fleet receives funding through the EV Fleet program, the fleet manager will be required to provide data related to EV usage for at least 5 years after the chargers are installed and operational. The program requires a 10-year commitment in which the organization must agree to operate and maintain the EV charging equipment for at least 10 years. PG&E will provide the infrastructure upgrades needed for EV charging equipment to those who qualify. PG&E will perform all the necessary utility-side of the meter infrastructure work.

Vehicle Grid Integration Technology

Another method to reduce the additional demands of the electrification of vehicles is embracing VGI. Utilities usually think of EVs and electrification as additional demand, and load from the grid, but the batteries in EVs can provide services comparable to standard Battery Energy Storage Systems (BESS). Through VGI technology, electric vehicles are able to smooth facility energy demand by ramping charging up and down, store excess solar energy generated during daytime hours, charge other devices to provide an alternative source of energy, overall reduce grid demand, and provide energy directly to the grid.[209]

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[208] PG&E EV Fleet program, https://www.pge.com/en_US/large-business/solar-and-vehicles/clean-vehicles/ev-fleet-program/ev-fleet-program.page

[209] V2G Power flow Regulations and Building Codes Review, Idaho National Laboratory, September, 2012, https://www.energy.gov/sites/prod/files/2014/02/f8/v2g_power_flow_rpt.pdf

Electric vehicles are not only a mode of transport but also a distributed energy resource (DER). Vehicle Grid Integration (VGI) represents another DER asset for the City of Glendale, supporting the grid through providing demand response or ancillary services during times of grid stress and demand events.

Historically, vehicles have mostly had a singular use in American society: to get people and goods from one place to another. Outside of ridesharing, cars provide a benefit solely to its owner. Most gas-powered cars spend the majority of the day sitting idle while their owners are at home or work. But electric cars can do a lot when they're not moving. They are capable of having a day job – shifting loads and shaving demand. And batteries can back up a facility or home during a dark sky event. EVs can also assist with grid frequency balancing. Electric vehicles have the potential to provide all the services that a BESS can. With a bidirectional inverter, onboard vehicle inverter, the correct electrical infrastructure, and utility rules for interconnection, Vehicle Grid Integration is achieved.[210]

The good news is that as more consumers increasingly adopt electric vehicles in Glendale, more energy storage will be "under the hood" of automobiles that can be deployed for grid-serving purposes. Essentially any VGI-enabled electric vehicle, commercial or residential, with the right infrastructure, can operate just like a stationary battery energy storage system.

EV vehicles have typically 2.5 times larger batteries than residential sized BESS systems. EV batteries are substantially larger than typical home batteries, with capacity generally from 20 to 130 kWh, compared with 4.5 to 13.5 kWh for residential stationary batteries. Furthermore, in the table below, low duty and heavy duty vehicles have even larger battery sizes than EV compact cars. Electric school buses have capacities from 89 kWh to 321 kWh battery sizes.[211]

Given these much larger battery sizes, a pilot program in Glendale might well target and partner with commercial vehicle fleets given their large battery capacities. Larger vehicles also are better suited for meeting emergency load reduction targets because of their higher energy discharge potential.[212] In addition, they are often more predictably idle than residential vehicles and are easier to bundle for aggregators. Residential vehicles are more likely to be needed for an unforeseen trip.

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[210] Ravi SS, Aziz M. Utilization of Electric Vehicles for Vehicle-to-Grid Services: Progress and Perspectives. *Energies*. 2022; 15(2):589. https://doi.org/10.3390/en15020589

[211] Electric School Buses Available For Purchase, VEIC, https://www.veic.org/Media/Default/documents/resources/reports/types-of-electric-school-buses.pdf

[212] Ravi SS, Aziz M. Utilization of Electric Vehicles for Vehicle-to-Grid Services: Progress and Perspectives. *Energies*. 2022; 15(2):589. https://doi.org/10.3390/en15020589

VGI Automobiles and Battery Sizes	
Type of Vehicle	**Battery Sizes**
Nissan Leaf	40-60 kWh
Volkswagen ID	77 kWh
Ford F 150	131 kWh
Type A School Bus	89-160 kWh
Type C School Bus	101-321 kWh
Type D School Bus	155 kWh-220 kWh

Win-Win Value Proposition

Beyond a pilot program, the biggest driver to create a robust VGI economy depends on GWP's ability to set a VGI export rate or to create a Demand Response program that allows aggregators to utilize VGI technology.

Easy to use financial models should be available for customers who are considering V2G, which show the net benefits of participating in these service markets and highlight the optimal use cases for highest expected return on investment. With the shift toward active customer participation in ancillary services, it will be useful for customers who are not familiar with regional transmission organization/ISOs to have descriptions of such programs from their utility provider, because they already have an existing relationship with potentially vetted and approved aggregator vendors like Nuvve, Fermata or Mobility House.

Peak-Shaving Benefit

If vehicle ESSs could be charged during off-peak times and then discharged selectively to "shave the peak," the utility could potentially forgo the need to start up a peaking plant, which would save on operation and maintenance costs and yield significant environmental benefits. Peaking

power plants are sometimes used only for several hours per year. Utilities have strong predictive capability for peak load planning (mostly during the summer due to air-conditioning load). Theoretically, the ability to activate distributed storage, along with traditional demand response assets, provides a cost-effective and clean alternative to expensive and capital-intensive spinning "peaking plant" generators.

Utility Operating Reserve

The second category is the V2G system providing the operating reserve. The operating reserve is the generating capacity that is available to come online within a short time in cases of generator failure or other disruptions to the electricity supply. Operating reserve plants require quick response times, accurate power supply, and are typically used for short durations; these criteria match the capabilities of vehicle ESSs exactly. Utilities must have access to operating reserve plants for all 8,760 operating hours of the 6 year. There are two types of services, known as ancillary services, which apply to V2G systems and operating reserve – regulation and spinning reserve. Ultimately, the challenge here is that a sufficient number of EVs need to be available and connected to the grid with enough electricity stored in the battery to serve as a spinning reserve. The following is a list of studied opportunities for VGI storage assets to support utility operations

Potential VGI Capabilities for Utilities

- Electric energy time shift
- Electric supply capacity
- Load following
- Area regulation
- Voltage support
- Time-of-use energy cost management
- Demand charge management
- Renewables energy time shift
- Renewables capacity firming
- Wind generation grid integration
- DER in Virtual Power Plan

<u>Repurposing Car Batteries</u>: Old batteries in cars that are degraded, which is considered to be a round trip efficiency (RTE) of approximately 80-85%, can be bought by utilities and be further used to store excess energy that can be deployed to augment resource constraints. This idea is already seeing some traction. A startup called B2U (name of company) Storage Solutions has

set up an energy storage facility in California that stores enough energy in an array of 160 used Nissan Leaf batteries to power more than 90 homes a day.[213] Hyundai is partnering with a solar energy developer and a utility company serving San Antonio, Texas, to set up a similar facility.[214]

The secondary use market for post-electric vehicle redeployment into community energy storage or other distribution system support is a potential field that may offer the promise of additional life (and therefore offering yet another revenue source for customers). This could help justify a more aggressive use of an EV battery as a grid reliability service–utilities can make this case to consumers by creating an aftermarket for EV batteries.

For the aggregator/EV operator, VGI presents a new business opportunity in the electricity sector, including grid balancing services (in correlation with utilities, grid operators, and consumers) and renewable energy storage services (e.g., storage and minimization of curtailment and fluctuation).

The value proposition for residential and commercial utility customers are simple: Customers can use their car to offset the upfront cost of the vehicle, or make a profit on vehicle ownership through using their car for all of the services that a stationary BESS can. Furthermore, consumers could see a purchase of their VGI automobile as a way to protect themselves and their families from power outages or natural disasters, which are increasing in frequency due to climate change. Businesses factor in the same values when purchasing electric vehicle fleets. Commercial customers can offset the cost of EV fleets by using a V2G enabled fleet for reducing its utility costs, making money from participating in grid services, or using its fleet for resilience and offsetting the need for a generator or stationary BESS. The most far out application is vehicle to microgrid: one's car serving as the power plant for the Islanded home

California VGI Pilot programs

El Cajon Valley School District V2G Program

The pilot project enables eight electric school buses to put electricity back on the grid when needed such as on hot summer days. A collaborative effort between SDG&E, the Cajon Valley Union School District and locally based technology company Nuvve, this is the first vehicle-to-grid (V2G) project to become operational in Southern California.[215]

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[213] Company Makes Money Offering Energy Storage With Used EV Packs, Inside EVs, Nov 16, 2021, https://insideevs.com/news/548280/energy-storage-nissan-leaf-batteries/
[214] Partners To Recycle EV Batteries For Solar Energy Storage, Sept 09, 2021, https://pv-magazine-usa.com/2021/09/15/partners-to-recycle-ev-batteries-for-solar-energy-storage/
[215] SDG&E and Cajon Valley Flip Switch on First V2G Project, July 26, 2022, https://www.sdgenews.com/article/sdge-and-cajon-valley-union-school-district-flip-switch-regions-first-vehicle-grid-project

As part of the five-year pilot project, SDG&E installed six 60 kW bi-directional DC fast chargers at Cajon Valley's bus yard in El Cajon.[216] With the bi-directional chargers now in operation, Cajon Valley can participate in SDG&E's new Emergency Load Reduction Program (ELRP), which pays business customers $2/kWh if they are able to export energy to the grid or reduce energy use during grid emergencies.[217]

Nuvve's GIVe™ platform is the technology that allows electric school buses from multiple fleets to be aggregated into virtual power plants (VPPs) to provide electricity during times of peak load, while also leaving sufficient power for scheduled trips. During California's September heat wave, Nuvve's technology helped buses in the Cajon Valley Union School District to generate enough power during nine Flex Alerts to power 277 homes.

V2G Chargers Scaling for Residential Use

Nuuve is establishing a residential bidirectional charger that is slated for release in 2023. The charger is also suitable for municipal or commercial buildings too, but has a smaller discharge than Nuvve's Heavy Duty chargers. The Wallbox bi-directional EV charger (V2B, V2G) from Wallbox, called the Quasar 2[218] , is coming to market early 2023. Nuuve, which builds V2B chargers for U.S. driven buses and fleets, is partnered with Wallbox.[219]

Pacific Gas & Electric V2X Residential Pilot

PG&E proposes a three-year V2X Residential Pilot focused on spurring adoption of V2X (bidirectional technologies) for 1,000 single-family residential customers with light-duty EVs by 2023. The pilot would seek to demonstrate V2X light-duty EVs and show how this technology can reduce the total cost of EV ownership once barriers are overcome. The pilots would seek to prove out five value-streams: backup power in 2022; followed by customer bill management, system real-time energy, system renewable integration and EV export for grid services (such as system resource adequacy, system capacity) in 2023.

[216] In 2020, the EcoMotion team visited EL Cajon Valley School District to inspect its Level 2 Nuvve bidirectional chargers.
[217] "Nuvve Partners with SDGE to Allow Electric School Buses to Give Energy Back To The Grid..Through ELRP," Yahoo! Finance, July 19, 2022, https://finance.yahoo.com/news/nuvve-partners-san-diego-gas-130000070.html
[218] Quasar II DC Charger, Wallbox, https://wallbox.com/en_us/quasar2-dc-charger
[219] "Nuvve and "V2G" Featured as California Governor Signs Aggressive, World-Leading…Legislation," Fleet News Daily, Sept 27, 2022 https://fleetnewsdaily.com/nuvve-and-v2g-featured-as-california-governor-signs-aggressive-world-leading-climate-action-legislation/

PG&E proposed the following: reaching the customer sign-up target of 1,000 participants by the end of the second year (2023); implementing value-streams on an on-going basis; determining the value of bidirectional technology to customers and the electricity grid; achieving cost transparency of VGI technology deployments; and creating sustainable pathways for bidirectional vehicles to participate in vehicle grid integration services. The $7.5 million pilot would start in 2022 and end in 2024 with a rigorous evaluation plan in place to determine the value to the customer and the value to the grid.[220]

Pacific Gas & Electric V2X Commercial Pilot

PG&E proposed a three-year V2X pilot focused on spurring adoption of bidirectional charging fleets of medium- and heavy-duty (MD/HD) EVs that are interconnected and charge at commercial buildings. In this $2.7 million effort, PG&E intends to sign up 200+ bidirectional MD/HD EVs and charging stations to demonstrate the value of V2X MD/HD technology and show how this technology can reduce the total cost of EV ownership once barriers are overcome. The pilot would prove out five value-streams: backup power in 2022; followed by customer bill management, system real-time energy, grid upgrade deferral and EV export for grid services (such as system resource adequacy, system capacity) in 2023.

The pilot would address barriers such as lack of real-world experience; incremental costs for EVSE with V2X capabilities; lack of market signals for deployment; lack of information about costs; programs/rules that incentivize stationary storage but not EVs that export to the grid; lack of customer education and need for a system to aggregate pricing signals and communicate them to market actors.

PG&E proposed the following: reaching the sign-up target of 200 participating fleet EVs and EVSEs; implementing value-streams on an ongoing basis; achieving cost transparency of VGI technology deployments; determining the value to the electricity grid of bidirectional MD/HD EVs and creating sustainable pathways for these EVs to participate in VGI services.

The pilot would begin in 2022 and end in 2024. The pilot would pay up-front incentives of $2,500 - $3,000 and on-going participant incentive levels of approximately $151 per EV per month (or $1,812 per year). PG&E would increase upfront incentives by 20% in ESJ communities.

[220] Draft PUC Resolution, PG&E Requests Approval of Four V2G Pilots, April 7, 2022, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M456/K322/456322989.PDF

Pacific Gas & Electric V2M PSPS Microgrid Pilot

PG&E proposes that up to 200 EVs (residential and commercial) on the customer side of the meter will charge/discharge in a multi-customer microgrid to support community resiliency by 2027. The microgrid would also include solar as well as resources on the utility-side of the meter and would energize an isolated distribution line segment during a Public Safety Power Shutoff event and reduce or displace fossil generation. The $1.5 million pilot would demonstrate 1) customer adoption of Vehicle-to-Grid (V2G) technology for community resiliency; 2) value to a microgrid used during a Public Safety Power Shutoffs; and 3) integration of EVs into an existing microgrid funded under Electric Program Investment Charge (EPIC) pilot.

The pilot would address a number of barriers such as developing controls and other operational procedures to integrate EV resources into the micro-gird; technical capabilities; cost; and customer convenience. PG&E proposed the following: developing operational processes for multi-customer microgrids that utilize EVs to support balancing generation and load; demonstrating five to 10 bi-directional EVs; and launching a program with incentives for a maximum of 200 vehicles with the follow-on ability for EVs to participate in the future.

The pilot would begin in early 2022 with phase I. Phase II, with enrolment by up to 200 participants, would conclude by the end of 2023. Incentives would cover part or all of the costs of bi-directional charging equipment, home isolation devices, and communications.

Pacific Gas & Electric V2G Rate

Pacific Gas and Electric Company (PG&E) has received approval to establish the nation's first "vehicle-to-grid" (V2G) export compensation mechanism for commercial electric vehicle (EV) charging customers in its California service area. The V2G export rate promotes EV adoption by providing upfront incentives to help commercial customers offset fleet costs and delivers an innovative solution for these vehicles to export power back to support the grid during peak energy demand periods.[221]

The groundbreaking settlement agreement with the Vehicle-Grid Integration Council (VGIC), Electrify America LLC, and the Public Advocate's Office at the California Public Utilities

[221] "PG&E to Offer Nation's First Vehicle-To-Grid Export Rate for Commercial Electric Vehicles, businesswire," Oct 26, 2022, https://www.businesswire.com/news/home/20221026005808/en/PGE-to-Offer-Nation%E2%80%99s-First-Vehicle-To-Grid-Export-Rate-for-Commercial-Electric-Vehicles

Commission (CPUC) was adopted by the CPUC on Oct. 20, 2022. The rate is expected to increase participation from V2G school buses and other electric vehicles in response to near-real-time grid conditions and will be available to charging equipment paired with stationary energy storage systems, which can support the grid and provide backup power to charge vehicles during grid outages.

As part of PG&E's 2030 targets, the company is aiming to proactively prepare the grid for 12,000 GWh of EV-related electric load and improve processes to enable rapid, safe EV energization and interconnection. It's also working to enable 2 million EVs to participate in vehicle-grid integration applications, allowing EVs to be a cornerstone of both reliability and resilience.

The novel rate is to be implemented "as soon as practical" but no later than Oct. 1, 2023, the agreement states. Participating customers will be compensated for exports based on day-ahead hourly pricing. To encourage enrollment in the first 12 months, incentives will be offered to school buses and larger vehicles and be based on the equipment's size. EVs and chargers able to discharge up to 100 kW are eligible for $1,800 with electric buses getting $3,150 in incentives. Those with larger batteries can reap $3,750, with an adder for large electric buses and the incentive totaling $6,560.

City of Oakland V2B Pilot Program

The City of Oakland, California, will be the site of a vehicle-to-building pilot analyzing how zero-emission transit buses can maintain critical loads during emergency conditions. Funded by the California Energy Commission, the green energy project team involves the City of Oakland, Oakland-based public transit agency AC Transit, the Center for Transportation and the Environment, The Mobility House, New Flyer, Schneider Electric, and the West Oakland Environmental Indicators Project (WOEIP).[222]

Battery electric buses and hydrogen fuel cell-electric buses will provide backup power to the West Oakland Branch of the Oakland Public Library, where residents can shelter in the event of unhealthy heat or smoke conditions.

The project is expected to be in place by the middle of 2023; pilot activities will continue until 2025. It is funded through CEC's Electric Program Investment Charge program, which awarded the project $3.2 million in funding with a combined $400,000 in matching funds contributed by WOEIP and AC Transit.

[222] "Oakland Tests Electric Transit Buses For Resilience Vehicle to Building," UtilityDive, Oct 12, 2022, https://www.utilitydive.com/news/oakland-tests-electric-transit-buses-for-resilience-in-vehicle-to-building/633902/

The battery-powered buses will contribute six hours of backup power to the resilience center, while hydrogen buses will provide 11 hours. This project also marks the first time a U.S. transit agency will have the capability to use a hydrogen vehicle for V2B (vehicle to building) backup power.

National VGI Projects

National Grid and Beverly Public Schools V2G Demonstration Project

An electric school bus in Beverly, Massachusetts, successfully delivered power back to the electricity grid for more than 50 hours over the course of the summer using vehicle-to-grid (V2G) technology. This is the first time an electric school bus has been leveraged as an energy resource by the regional utility, National Grid in New England, and among the first instances in the United States that an electric school bus has supported the electric grid in this way.[223]

In conjunction with Highland Electric Fleets and National Grid, a Thomas Built Buses Saf-T-Liner C2 Jouley electric school bus equipped with a 226 kWh Proterra Powered battery system discharged nearly three megawatt-hours of electricity stored in the bus. National Grid utilized the energy stored in the electric school bus battery on 30 different occasions over the summer to lower demand on the grid during times of peak demand.

Thomas Built's Saf-T-Liner C2 Jouley with Proterra's bidirectional charging system managed the charging and discharging of the electric school bus back into the grid.By sending electricity back to the grid when demand for electricity was at its highest and most expensive, the school bus helped reduce local emissions and decreased the need for fossil fuel peaker power plants.

National Grid compensates participants in this program for their energy services, incentivizing the use of distributed energy resources to strengthen the local grid. Participation in National Grid's program marks an important step in closing the up-front cost gap between traditional diesel school buses and electric school buses, as revenue from vehicle-to-grid (V2G) programs offer a unique means to improve the economics of electric school bus ownership.

The average school bus transports students for approximately six hours a day, 200 days annually, and are otherwise parked or idled when not in operation. This is particularly true during

[223] "Massachusetts Electric School Bus Delivered Power Back To Grid for 50+ Hours," Green Car Congress, Oct 14, 2021 https://www.greencarcongress.com/2021/10/20211014-proterrav2g.html

summer months, when demand for electricity is often at its highest and clean energy stored in idled electric school buses can provide an energy resource to the grid.

In Beverly, Highland provided a turnkey, fixed-price subscription that eliminated up front cost, risk, and complexity of managing the electric school bus, and allowed Beverley to benefit from the V2G services provided by the bus through a lower subscription price. This type of public-private partnerships allows school districts to capture the value of a V2G program and fully unleash the potential of electric school buses.

Con Edison's White Plains Electric School Bus Project

ConEd's White Plains Electric School Bus Project involves five Lion electric school buses that have been serving White Plains School District since fall 2018. Each bus is charged overnight using a Level 2 charger. Con Edison cycles the bus batteries for grid services and to observe the viability of vehicle-to-grid models including impacts on battery. The project is a collaboration between Lion Bus, Nuvve, National Express, and First Priority.[224]

Con Edison installed the infrastructure necessary to charge and relay the power back into the grid free of charge. Nuvve acted as the aggregator and provided the charging equipment for the project. The model demonstrates that in the New York City area, V2G revenue could come from participating in several utility programs. Notably, school districts with electric school buses can earn rich rewards by participating in Con Edison's emergency demand reduction programs.[225]

Duke Energy Carolinas Vehicle Grid Integration Program

Duke Energy has filed for North Carolina Utilities Commission approval of a new demand response pilot program using electric vehicles that is expected to launch in 2023 for customers in the Duke Energy Carolinas service area.[226]

[224] "The Wheels on These Buses Go Round and Round With Zero Emissions, The New York Times," Nov 12, 2018, https://www.nytimes.com/2018/11/12/climate/electric-school-buses.html
[225] White Plains Electric School Bus V2G, Northeast Diesel, https://northeastdiesel.org/pdf/v2g/white-plains-electric-school-bus-v2g-project-a-kahn.pdf
[226] Illuminating Possibility: Duke Energy and Ford Motor Company plan to use F-150 Lightning Electric Trucks, Duke Energy News, Aug 16, 2022 https://news.duke-energy.com/releases/illuminating-possibility-duke-energy-and-ford-motor-company-plan-to-use-f-150-lightning-electric-trucks-to-help-power-the-grid

As part of the pilot program, Duke Energy will enroll up to 100 customers who lease electric vehicles including the Ford F-150 Lightning. Duke Energy will provide financial incentives to customers in the form of reducing lease payments for program participants – providing payments directly to the vehicle manufacturer – in exchange for allowing Duke Energy to draw energy from their EVs.

The pilot program will allow Duke Energy to draw energy up to three times per month during higher peak winter and summer months, and one time per month during the remaining months of the year, for testing and research purposes and to support the energy grid during peak usage hours. Stored energy drawn from the electric vehicles' batteries will help balance the power grid during periods of highest energy demand.

Program participants will need the necessary bidirectional charging infrastructure, which includes the Ford Charge Station Pro home charger and Ford's Intelligent Backup Power Home Integration System, which enables Ford F-150 Lightning customers to power their homes for three to 10 days in a power outage, installed in their home. Additionally, customers will need Ford's software package to enroll in the program.

As part of the pilot program, Duke Energy will analyze flows of energy between EV batteries and the power grid and work closely with Ford and other vehicle manufacturers to study the full functionality of bidirectional charging integration. The company will also make determinations about how future customer demand response programs around V2G technology might be structured to provide maximum benefits to both customers and the grid.

Green Mountain Power's V2G Program with Fermanta Energy

Green Mountain Power (GMP) is credited for its pioneering vehicle-to-grid charger program to reduce energy use on the grid during peak demand. GMP claims to be the first utility to install and successfully integrate this new charger technology with the grid and one of its electric fleet vehicles to draw energy from the car to help lower demands on the grid when peaks in energy needs occur. The program will show how electric vehicles and the clean energy they store can become a reliable source of power to reduce peak demands which will, in turn, save money and reduce carbon.[227]

[227] "Green Mountain Power Deploys V2G Charger to Reduce Demand on Grid," T & D World, Dec 9, 2020, https://www.tdworld.com/electrification/article/21149854/green-mountain-power-deploys-v2g-charger-to-reduce-demand-on-grid

GMP installed a bidirectional Fermata EV charger at its Colchester, Vermont, office. The charger is now drawing energy from the company's Nissan Leaf during peak periods. The vehicle is regularly used by employees, charges at the GMP office, and has joined the GMP's network of stored energy. GMP has also promoted storing energy in home batteries like Tesla's Powerwalls. For context, the Nissan EV battery holds about four times as much energy as one Powerwall, showing promise in the amount of energy storage that can be achieved using vehicles, especially as more and more Vermonters make the switch to EVs.

International VGI Projects

Nuvve's 2016 V2G Project in Denmark

In August 2016, Nuvve created the first Vehicle to Grid hub internationally in Denmark in 2016. The project is a collaborative effort between Nuvve, which is licensing UD-developed technology, Nissan, Enel, Danish Technical University, and the Danish grid operator, Energinet.dk. The project was called the Parker project. The combined costs of this pilot tallied approximately $10 million dollars. [228][229]

Nissan provided the cars for the Denmark effort. Enel is the maker and distributor of the V2G charging stations, and Frederiksberg Forsyning is the local fleet operator who purchased and is operating the cars. Nuvve licensed the V2G control and grid integration platform for use in Europe through UD's Office of Economic Innovation and Partnerships.

The initiative required that specialized charging stations be developed for use in Europe and included significant enhancements to ensure that the V2G technology integrates seamlessly with Denmark's electric power grid.

The electricity stored in the vehicles' batteries is controlled and aggregated by a centralized server. UD's Grid Integrated Vehicle computer software links multiple vehicles together, allowing them collectively to be viewed as a single "power plant." It's a complicated task that requires a lot of qualification and testing to local standards and regulations, provided by Nuvve, to officially identify, certify and register the aggregator and charging stations.

[228] "V2G Launches in Denmark," UDaily, Aug 29, 2016, https://www.udel.edu/udaily/2016/august/vehicle-to-grid-denmark/
[229] "V2G Global Roadtrip: Around the World in 50 Projects," Everoze, Oct 2018, https://everoze.com/app/uploads/2019/02/UKPN001-S-01-J-V2G-global-review.pdf

Nuvve's GIV DERMS system monitors the status of the electric grid in a given geographical area to determine whether the grid requires additional power or has excess power that needs to be absorbed.

Then, the GIV platform controls the V2G-equipped electric vehicles to help regulate the local power grid, while those electric vehicle owners earn money for this service. Based on short-term testing by the Danish grid operator in July, Poilasne estimates that on an annual basis, revenue per car would be approximately $1,445 (Euro 1,300) per year.

Approximately 10,000 cars participated in this program over two years. The cars used were a Nissan LEAF 30kWh, Nissan E-NV200 24 kWh, and a Mitsubishi Outlander 12kWh. The incentive for customers to participate was a mobility-as-service offer – a fee per month which provides charger and maintenance and tools to manage charging. V2G is used to reduce charging costs for consumers, with frequency regulation revenues reducing costs paid. Roll out limited by high taxes on EVs (no. of EVS went down in Denmark in 2017).

EDF - Nuvve V2G Project in the United Kingdom

EDF Energy partnered with Nuvve, to install up to 1,500 Vehicle to Grid (V2G) chargers in the UK. The chargers will be offered to EDF Energy's business customers and will be used at its own sites to provide up to 15 megawatts of additional energy storage capacity. That's the equivalent amount of energy required to power 4,000 homes. The stored electricity will be made available for sale on the energy markets or for supporting grid flexibility at times of peak energy use. Smart charging is expected to play a significant role in balancing the grid as the country moves towards wider adoption of electric vehicles.[230]

Using the V2G chargers, EVs give unused electricity back to the charger for customers to either use the energy themselves, send it back to the grid, or to participate in energy markets, providing savings on energy costs and generating additional revenues. EDF Energy is the largest electricity supplier to UK businesses and its partnership with Nuvve could see the largest deployment of V2G chargers so far in this country.

V2G chargers could help businesses generate revenues from vehicles that have previously only been a cost on their balance sheet – saving hundreds of pounds per vehicle a year. EDF Group and NUVVE have signed a strategic partnership agreement with a view to forming a joint venture to develop these solutions in Europe. The San Diego-based green energy technology

[230] EDF Energy and Nuvve Corporation announce plans to install 1,500 smart electric chargers in the UK, Press Release, Oct 30, 2018 https://nuvve.com/wp-content/uploads/2018/10/press_release_edf_energy_and_nuvve_corporation_announce_plans_install_1500_smart_electric_chargers_in_united_kingdom.pdf

pioneer has deployed V2G projects on five continents including the world's first fully commercial V2G hub in Denmark which has been operational for two years now.

Netherlands Case Study: Ajax Amsterdam FC and Mobility House

The Johan Cruijff Arena in Amsterdam, home to the Ajax soccer team, houses managed charging and V2G technologies that supplement the stadium's solar and battery storage system. During non-event days, The Mobility House opts the system into revenue-generating ancillary services such as frequency response, but during events such as Champions League soccer matches and Ed Sheeran concerts, bidirectional EVs and stationary storage stand ready to shave expensive load peaks and provide backup power if necessary.[231]

In the future, visitors who park in one of the stadium's 2,400 parking spots will be able to provide energy to the Arena with their EVs in exchange for monetary rewards or premium parking. Smart stadiums and similar use cases that require large electrical demand for short periods of time can use VGI to capture untapped monetary and operational value.

Cross-Cutting Programs

This report has presented a range of program ideas and examples from across the country, and in cases, from around the world. We have looked at energy efficiency in depth at municipal utilities, community-choice aggregators, and investor-owned utilities. Within the realm of energy efficiency, we investigate residential programs and then everything else, which in GWP's service territory means commercial, industrial, and MUSH sector programs. Same for load management, same for distributed energy resources.

This section of the report addresses programs that are not specific to any one sector. Instead, they are initiatives that cut across sectors. Outreach programs raise awareness throughout the community. Energy centers and incubators provide insights and guidance to all accounts. Initiatives that emphasize emerging technologies will often benefit multiple sectors. Green power programs can be accessed by all accounts. These programs, initiatives, rates, and other… they cut across sectors. They are cross-cutting. Here's a classic case:

DER Zones will be part of the Richmond Advanced Energy Community Project. The project area includes the largest refinery in the western United States. The program received a $4.9 million

[231] The Path to a Vehicle-to-Grid Future, SEPA, Feb 6, 2020, https://sepapower.org/knowledge/the-path-to-a-vehicle-to-grid-future/

grant from CEC, helping with retrofits and establishing DER sites… renewable energy, storage, smart thermostats, HVAC systems, electric vehicle infrastructure, refrigeration, and small devices connected to VPP. Marin Clean Energy (MCE) is operating the VPP and providing ists mDERMS platform, for the project. DER sites across industrial, commercial and residential areas.[232]

Outreach and Behavior-Change Programs

Being energy-efficient can be as simple as turning off the lights, or turning up the AC setting when not home. From a utility standpoint, it's about empowering people to act to save money, energy, and the environment. Well-designed campaigns motivate homeowners and businesses to reduce their energy use.

The International Energy Agency's 2021 report, "The Potential of Behavioural Interventions for Optimising Energy Use at Home" shows that campaigns can achieve a wide range of impacts in terms of amounts of energy saved. In the United States, some estimates suggest that up to 20% of home energy demand could be saved from behavioral changes. But things need to fall into place such as getting the message right and getting the message across, as well as campaigns to address crisis conditions.[233]

Adam Maxwell believes that utilities – which were once monopolies and fully protected – will certainly benefit by developing programs that tap private sector/free market successes. He refers to design principles that are ready for prime time with utilities. Rewards programs, for example, have been used by airline industries and others for years. Utilities have never given rewards…even to very long-term customers.… Hmmm. How about awards for being a great customer? How about an award for energy efficiency investments?

Rewards Programs

Silicon Valley Clean Energy, Leadership Awards

Several Community Choice Aggregators use their community connection to recognize businesses for emissions reduction and innovative contributions.

[232] "DER Systems Increase Energy Reliability for California Community Project," Energy + Environment Leader, June 21, 2022, https://www.environmentalleader.com/2022/06/der-systems-increase-energy-reliability-for-california-community-project/

[233] Empowering the People To Act, IEA, https://www.iea.org/commentaries/empowering-people-to-act-how-awareness-and-behaviour-campaigns-can-enable-citizens-to-save-energy-during-and-beyond-today-s-energy-crisis

Community Close-Ups is a publication of Silicon Valley Clean Power. It recognizes outstanding leadership in renewable energy and emissions reduction by individuals, businesses, and organizations that are driving green power development and adoption.[234] One example is for the company **"**Linked-In**".** SVCE hosts a Video – on caring for the community and choosing green power.[235]

Clean Power Alliance Community Benefits Grant Program

Clean Power Alliance (CPA) has an annual Community Benefits Grant Program in partnership with Cal Pine Energy.[236] Eligible candidates must be qualified 501©3 non-profit community organizations, within the CPA service territory, and addressing the priority focus areas. The priority focus areas of the program are listed as 1) Renewable Energy Research/Planning, 2) Clean Energy in Disadvantaged Communities, 3) Green Workforce Development, and 4) Energy and Environmental Education. The grant program reporting requirements are reasonable, which can be attractive to community programs, who often don't apply for grants because of the cumbersome reporting requirements. There is a 6-month and 1-year follow-up requirement which includes pictures and video, a statement of expenditures, and a project progress and wrap-up summary.

The City of Madison, Wisconsin Green Infrastructure

Madison, Wisconsin is addressing climate change with plans to reduce carbon emissions, use clean energy, and create "green infrastructure." The collaboration between the local government, organizations, and leaders gives residents opportunities to invest in and benefit from initiatives like green job training programs, workshops for local businesses, and making affordable housing energy efficient.[237]

Incubators

It's hard to imagine Glendale Water and Power having its own technology incubator… but might GWP share an effort with our neighboring utilities, such as Pasadena Water and Power and Burbank Water and Power? This is one of many ideas to consider as GWP works to develop

[234] Silicon Valley Energy Partnered with Linked In Community Impact video, SVCE, https://www.svcleanenergy.org/community-impact/
[235] Community Close-Ups, https://www.youtube.com/watch?v=3LQ0p0lBW7o&t=29s
[236] CPA Community Benefits Grants, https://cleanpoweralliance.org/calpinegrant/
[237] Advancing Cities, Business Insider Report, https://www.businessinsider.com/advancing-cities

a robust portfolio of programs. Perhaps GWP can share program delivery agents. Perhaps this has been done in other ways. We recognize that the Bob Hope Airport has been a tri-city operation for many years. How can we encourage local entrepreneurs to develop businesses that serve GWP's transition to a clean energy utility?

Silicon Valley Clean Energy has dedicated a portion of its website to green Innovation. It is divided into four categories: 1)Innovation Onramp, 2) Innovation Pilots, 3) Innovation News (blog), and 4) Local Hackathons. https://www.svcleanenergy.org/innovation/

Clean Power Alliance Sustainable Energy Incubator

Clean Power Alliance in Los Angeles has a program called the "Sustainable Energy Incubator" in partnership with the Local Government Commission (LGC).[238] The Sustainable Energy Incubator aims to engage Clean Power Alliance board members, staff, local member agencies, and other stakeholders to address emerging energy issues through educational workshops and direct support. It includes quarterly workshops, a video education channel on various energy topics, and technical support.

ConEdison Business Opportunities Ongoing Pilots

Con Edison New York is looking to inspire customers/businesses to innovate and save energy and money. "We're looking for ideas for new projects that will help our customers save energy and money, and help us get the most out of our energy grid".[239] The utility asks for submittals in multiple project areas. Categories include: Energy Efficiency Pilots, Thermal Energy Networks, Non-Pipeline Solutions, (to reduce winter peak day gas load), and Dynamic Load Management. The section contains examples of past successful pilots. Businesses can complete a simple form or send a proposal by email.

Expedited and Preferential Permitting

Expedited permitting is not an energy-saving measure per se, but by speeding up permitting processes, and easying this burden, soft costs can be reduced and thus retrofits and installations become more cost effective.

[238] The CPA Sustainable Energy Incubator, Clean Power Alliance, https://cleanpoweralliance.org/sustainable-energy-incubator/
[239] ConEd Business Opportunities, https://www.coned.com/en/business-partners/business-opportunities

Expedited permitting can be online, or over the counter. Another strategy is waiving permit fees for solar, which for example, eases the permitting cost. Expedited plan reviews for solar and other technologies also lower soft costs that often impede adoption of technologies. These strategies may be very important for deploying distributed storage in a timely manner.

SMUD's Expedited Permitting Program

SMUD uses an online expedited permitting process for all solar and distributed generation projects in partnership with PowerClerk 2 from Clean Power Research[240].
The online application process helps contractors speed-up permitting for simple installs.
The system is automated to include pull down menus from an approved eligible equipment list.
If the system is a more complex design, it gets sent to a Distribution System Planner, (over 10kW, anything with batteries, if initial review kicks up anything complicated).

On average, about 5,000 SMUD customers install rooftop solar every year and growth is expected to increase for the next 10 years. SMUD includes an instructional video on the three most common problems with solar installations.

All DG projects within SMUD's service territory are required to have a production meter. SMUD gives stipends to offset the purchase cost for the meter socket and AC disconnect. SMUD will install a PV production meter at no cost to the customer or contractor.

Silicon Valley Clean Energy eHub

SVCE's "eHub" is a one-stop online educational resource and has been recognized for educational impact and reach within SVCE's member communities. To help bring customers to the eHub site, SVCE has implemented comprehensive email and digital communications strategies resulting in nearly 300,000 customer visits and interactions since launch in fall of 2020. It includes an "Electrification Technical Assistance Program"[241] and a link to a "Best Practice Guide for Streamlining Electrification Services".

Developed by TRC Company and SVCE. As part of the development TRC interviewed officials in the thirteen SVCE member agencies, as well as contractors, industry advocates, and other

[240] SMUD Interconnection PowerClerk, SMUD, https://smudinterconnect.powerclerk.com/MvcAccount/Login
[241] Electrification Technical Assistance Program, All Electric Design, https://allelectricdesign.org/

practitioners. It identified effective existing practices as well as needs identification and roadblocks to implementation. The guide also contains suggestions for joining with other local jurisdictions, to maximize training and resource needs for local contractors and industries.[242].

Featured Utility: Austin Energy

Austin Energy is the publicly owned Texas utility in the State's capital, Austin. It is the country's 7th largest public utility, serving more than 500,000 customers and approximately a million residents. Austin Energy won the American Public Power Association's Smart Energy Provider award in both 2020 and 2021, which recognizes proficiency in energy efficiency and distributed generation for sustainable electric service.[243]

One facet of the utility's profile is the strong relationship with customers. Residential users can monitor usage and costs online, track energy use by day, month, or year, and compare usage to similar households. During times of grid stress, they can also receive outage alerts. Residents can log in to City of Austin Utilities Customer Care and see a projection of their next bill. They can also set email alerts to notify them when their bill approaches a threshold of their choosing. Residents can earn rebates on thermostats or get a larger bill credit if they enroll their thermostats as a "Power Partner" and allow Austin Energy to control them remotely.

Other residential programs help reduce the cost of weather stripping, incentivize energy star appliances and HVAC, and whole house energy improvements. Loans are available for as low as 1.99%.

Austin Energy also promotes a voluntary program called Power Saver Volunteers. Power Saver Volunteers take a few simple steps to help reduce the high demand for electrical power during peak usage times. These voluntary actions help Austin Energy avoid the need to build new power plants or purchase expensive electricity to meet peak demand.

Austin Energy no longer employs Net Energy Metering. Customers who have solar will be paid a flat "value of solar" payment of $0.097per kWh for energy exported to the grid. This roughly equals the cost of a kWh in the middle residential tiers. Most of the residential rates are below $0.15 per kWh. GreenChoice is the name of the voluntary program that allows customers to choose to get 100% green energy from Texas wind farms.

[242] Best Practices Guide For Streamlining Electrification Services, https://www.svcleanenergy.org/wp-content/uploads/2020/02/Best-Practices-Guide-for-Streamlining-Electrification-Permitting_Digital.pdf
[243] City of Austin Utilities website, https://coautilities.com/wps/wcm/connect/occ/coa/home

Smart Neighborhoods

Alabama's Reynold's Landing Smart Neighborhood

Alabama Power's Smart Neighborhood is a future-focused, energy-efficient community with homes that are rated 35%more efficient than standard Alabama homes being built today. Located in Reynolds Landing at Ross Bridge in suburban Birmingham, Alabama, Smart Neighborhood integrates high-performance homes, energy-efficient systems and appliances, connected devices and a microgrid on a community-wide scale for the first time in the Southeast.[244]

Smart Neighborhood uses leading-edge microgrid technology to support the community's energy needs. Made up of solar panels, battery storage and a backup natural gas generator, the microgrid is the first in the Southeast to support a residential community, a smart neighborhood with combined energy efficiency, solar + storage and smart systems.

Alabama Power partnered with homebuilder Signature Homes, researchers at Southern Company, U.S. Department of Energy's Oak Ridge National Laboratory and the Electric Power Research Institute, and technology vendors Carrier, Rheem and Vivint, among others.

Shenzhen, China: International Low Carbon City

Shenzhen is taking the lead in demonstrating innovation in sustainable urban transformation and future-orientated city planning through its ambitious International Low Carbon City (ILCC). This initiative aims to transform the previously manufacturing-based and carbon-intensive economy and built environment of Pingdi into a model of low-carbon, post-industrial urban revitalisation. ILCC maintains a focus on preserving and refurbishing existing buildings to the latest environmental standards whilst also pursuing new construction of cutting-edge, low-carbon buildings and urban infrastructure. As such, this initiative marks a significant shift from large-scale demolition and new construction centered modes of urban development. Also, involving extensive collaborations with the Dutch government and other international partners, futuristic green buildings and economic transformation is pursued whilst taking the utmost care to preserve the natural environment and cultural identity of the area.[245]

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[244] Urban Efficiency II-Alabama, Shenzhen, https://www.c40.org/case-studies/urban-efficiency-2-international-low-carbon-city/
[245] Urban Efficiency II: 7 Innovative City Programmes, https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000Mo5i/z8xF0YmnG3TNkgWkgrvbtLXL1NeW1YWT_1Q6DVdaHI8

- International Low Carbon City. Refurbishing old buildings and building cutting edge new buildings and urban infrastructure. Green roofs and green walls. Reducing heat island and air quality is a focus

Xcel Energy's Partners in Energy, Colorado and Minnesota

Xcel Energy created the Partners in Energy program in Minnesota and Colorado to help communities design and implement energy plans that include efficiency and renewable energy strategies. Initially, Xcel provided communities with information on their energy use, program participation, and market segmentation. Community leaders then partnered with Xcel to align community and utility programs and initiatives to promote energy efficiency among businesses, residents, and the local government.

Community engagement is an important part of the program. Appearing at local events, Xcel representatives educate residents and businesses about available programs and other community resources. Xcel also lets communities celebrate the success of their programs by helping to track and report the progress of energy efficiency programs. This collaborative effort improves the programs' delivery and participation rates and helps communities reach their energy goals. Tactics used included engaging community members in neighborhood-based targeted outreach, and marketing utility programs through existing local networks and information channels.

Retrofit Chicago

The City of Chicago created Retrofit Chicago to provide a central destination for energy efficiency services for commercial, residential, and municipal buildings. The Commercial Buildings Initiative is a voluntary effort among the city's largest commercial buildings to reduce their energy use by 20% in five years. The Multifamily Home Energy Savings Program is an effort to get owners and occupants of apartment buildings and condominiums to reduce energy and water use by installing free energy- and water-saving measures for interested tenants and owners.[246]

[246] Retrofit Chicago case study, http://www.cityofchicago.org/city/en/progs/env/retrofit_chicago.html

ComEd and Peoples Gas, the electric and gas utilities, were involved from the beginning, and along with additional public and private sector partners, provide building owner participants a combination of financial incentives, technical support, and public recognition.

These programs, coupled with the City's own efforts to save energy in municipal buildings, are helping Chicago meet its Better Buildings Challenge goal of reducing energy use by 20%. ComEd and Peoples Gas, meanwhile, are able to achieve large-scale energy savings to help them meet their policy obligations.

Tactics Used: Retrofitted particular municipal buildings and facilities; initiated challenge programs and competitions for households, businesses, and industries; identified a pipeline of ready-to-go projects; and created a one-stop shop for technical services coupled with utility incentives

Financing

National Energy Improvement Fund

The National Energy Improvement Fund (NEIF) was formed in 2017 as a benefit corporation (Certified B-Corp), operating as a multi-state, fully compliant, non-bank financial institution.[247]

NEIF works directly with multiple utilities in multiple cities/states offering an online application for financing. There is a residential and commercial program.

For residential customers there are 3 year, 5 year, and 10 year payback plans. Fixed interest rates currently range from 4.5% to 10.99 % APR. The minimum loan amount is $2,500 and the maximum loan amount is based on credit, up to $35,000. The program covers a whole list of qualifying improvements including lighting and conditioning, air conditioning, tank removal and replacement, roof upgrades, etc.

For commercial customers energy finance is offered to commercial, non-profit, and multi-family buildings.

[247] NEIF Program Details, https://www.neifund.org/commercial-program-pages/

Feature: SMUD - Complete Energy Solutions

The SMUD Complete Energy Solutions Program provides energy efficiency, Electric Vehicle Supply Equipment (EVSE), automated demand response and Go Electric consulting, incentives, and turn-key installation of qualifying equipment to small and medium business customers of Sacramento Municipal Utilities District with electricity demand less than or equal to 500 kW in peak demand.[248]

The program makes it user-friendly, with online applications, a toolkit, and handbook for download. The National Energy Improvement Fund (NEIF) is available as a finance option and works with contractors to allocate available funding. There is an extra "Bundle" incentive for customers who choose to do more than one retrofit at a time or upgrade from gas to electric equipment.

Qualifying businesses receive a free energy audit and report detailing recommended energy-saving measures, expected installation costs, estimated energy savings, financing options and rebate amount.

When the Customer decides to implement the Complete Energy Solutions recommendations, the Program will schedule or make prescreened contractors available to perform the work at a time that is convenient to the Customer.

Finally, Complete Energy Solutions will perform a follow-up inspection to confirm the quality of installation. After a successful installation, the Customer is responsible to the contractor(s) for the portion of installation costs not covered by the rebate, if any.

Tariff On-Bill Financing

This may not quite be ready for prime time, and it certainly requires the "big-rethink" on new sources of revenues for electric utilities, but it is worthy of putting on the radar. By financing major energy efficiency upgrades, like solar systems, in ways that attract participants, and high participation levels, solar and other efficiency measures can be widespread.

[248] SMUD Complete Energy Solutions website, https://www.smud.org/en/Business-Solutions-and-Rebates/Business-Rebates/Complete-Energy-Solutions-Program

Think of it this way. Utilities no longer have to pay the bill for energy efficiency programs. What if they pay for themselves? Financing logical investments is a wonderful direction for utility energy efficiency programs. Sure, it's hard to get customers to take out loans to pay for efficiency. But what if it is embedded in their bill? And what if the bill did not go up?

Tariff On-Bill Financing (TOBF) is seen as an important financial mechanism for low and moderate income (LMI) customers.[249] TBOF is considered one of the Flexible Financial Credit Agreements (FFCAs) that overcome hurdles, things like non-transferable solar subscriptions, credit scores, seasonal income fluctuations, product vendor skepticism and more. Through TOBF utilities use a tariff to enable customers to pay back the cost of a solar panel without credit or income-level conditions.

Utilities provide the capital for the solar asset. The tariff added to customers' electricity bills. "Ideally, the reduced electricity usage provided by solar generation leads to lower utility bills, even with the additional tariff." The solar investment is tied to the meter, so if the property is sold., the tariff is transferred … should be monitored to guarantee that the investments make sense. Most TOBF has been with energy efficiency measures, and mostly through "PAYS – Pay as You Save," a trademarked program utilities can use to serve as the framework for their TOBF programs.

According to NARUC, at least 110 utilities in 33 states offer some form of on-bill financing, including TOBF. Those utilities are made up of 76 member coops, 11 municipal utilities, and 29 Investor-owned utilities. As an example, Hawaiian Electric Companies has a TOBF program that enables LMI customers to pay back the cost of installing solar PV, solar water heaters, and other eligible clean energy upgrades with no up-front costs. Program is funded by Hawaii's Green bank, and customer payments are tied to the property, not the individual. Another example is the Roanoke Electric Cooperative in Virginia that uses PAYS to implement its TOBF program.

Featured Utility: Rappahannock Electric Cooperative, Virginia

Rappahannock Electric Cooperative (REC) is a member-owned utility that provides electric service to nearly 170,000 connections in portions of

RAPPAHANNOCK ELECTRIC COOPERATIVE
RELIABLE • AFFORDABLE • FOCUSED ON YOU

[249] National Renewable Energy Laboratory, Mobel Brief: Tariff On-Bill Financing, Kevin Wu, January 2022.

22 Virginia counties from the Blue Ridge Mountains to the tidal waters of the Chesapeake Bay.[250]

REC's messaging reflects a shared goal and community feel. The "Vividly Brighter" program page is an example, "You asked for new ways to save money and move our communities toward a brighter future. This is what led us to create Vividly Brighter - a suite of innovative products and services designed to improve lives and strengthen communities". The page offers video lessons "Top 5 Ways to Save This Winter", "Top 5 Ways to Save in the Summer" and covers topics from fans to thermostats to smart landscaping. Additionally, there are two "Energy Experts" listed with pictures, phone numbers and emails for energy advice. Members also have access to an extensive list of links and resources.[251]

REC is building a fiber-optic network to connect its substations, towers and offices. The Broadband program is listed under "Energy Savings". REC shares with users that broadband development helps reduce outages, helps the community connect to the latest technology, and is an essential part of economic development.

Green Power Programs

SMUD's Greenergy® Program

- Customers can choose more renewable energy, 200 kWh at $3 per month, 100% green at $10 per month. 100% green and local for $18 per month
- For residents and businesses

Customers can join SMUD's Greenergy® program for as low as $3 per month.[252]

Imperial Irrigation District Green Energy Rate Program

IID has developed a new Green Energy Rate Program that allows customers to designate how much renewable energy they wish to be served with.[253]

[250] REC website, https://www.myrec.coop/
[251] REC Vividly Brighter page, https://www.myrec.coop/save
[252] SMUD's GreenEnergy Program: https://www.smud.org/en/Going-Green/Get-Green-Energy/Residential
[253] IRR Green Energy Rate, https://www.iid.com/energy/rates-regulations/green-energy-rate-program

In 2018, IID will serve its customers with 35% renewable energy. Customers who elect participation in the Green Energy Rate Program, can choose to be served with an even greater percentage of renewables, up to 100%.

The program was launched during the last quarter of 2018. For participants, it is estimated that it will increase customers' per kilowatt-hour rate by $0.013 to $0.02. The monthly rate will fluctuate based on IID's cost to procure renewable resources.

The program is open to all electric customers, with an exception for customers who have installed on-site renewable systems or wholesale power customers receiving standby service. The District has allocated 5 megawatts in the initial offering of the program, however, additional megawatts may be added if customer demand warrants an increase.

Review of GWP Programs and Services

Chaptered in 1996, State Assembly Bill 1890 established the Public Benefit Charge (PBC) through which publicly owned utilities have funded customer-directed programs for over two decades. Since January 1, 1998, Glendale Water and Power customers have paid the State-mandated PBC fee on their electric bills.

The PBC was initially set at 2.85% of retail revenues. In response to increased State regulations and mandates, in 2008 the PBC fee was increased to 3.6% of retail revenues in response to the State SB1 local solar and other mandates. It has remained at this level ever since with fund used for programs serving one or more of the following purposes:

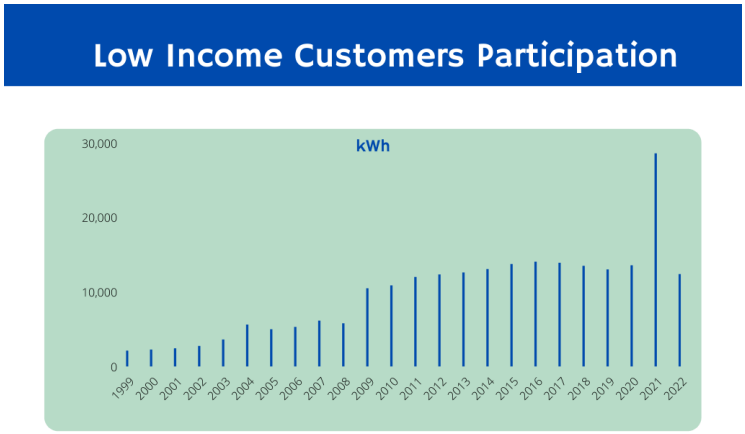
1. Services to promote energy-efficiency and energy conservation
2. New investment in renewable energy resources and technologies
3. Research, development, and demonstration programs
4. Services for low-income electricity customers, including rate discounts

Glendale Water and Power, like all load serving entities in the State of California, must abide by the law. California Senate Bill 350, authored by Senator Kevin de Leon and passed in 2015, called for doubling energy efficiency by 2030. Energy efficiency savings would be realized from utility programs, codes and standards, access to financing, behavioral programs, market transformation, and improvements in agricultural and industrial sectors. Efficiency is induced and comes from many places.

SB 100 was passed in 2018 and was also authored by State Senator Kevin de Leon. It mandates that retail electricity must be greenhouse gas emissions free by 2045. Energy Efficiency is the first resource in the “loading order” of marginal resource priorities. Promoting energy efficiency for GPW’s 90,079 meters is the local goal.

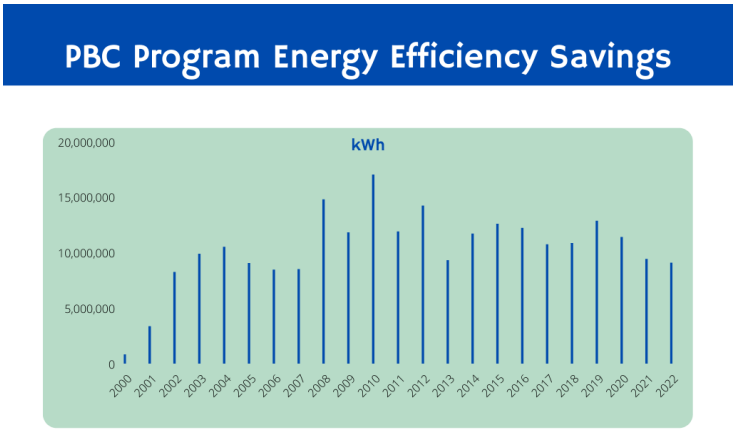
Track Record

Glendale Water and Power has a history in implementing energy efficiency programs. Many programs have been award-winning. GWP regards these largely as “public benefits charge” programs, mandated by the State. Since the inception of AB 1890’s implementation in 1997, GWP has been providing programs and services for its customers. That’s 25 years.Fully 61 programs have been run or are currently active. Here’s a chart that shows Low Income Customer participation in GWP’s PBC programs since 1999. Note that participation spiked in 2021 with the Glendale Water & Power Cares program that provided a one-shot bill subsidy related to covid.



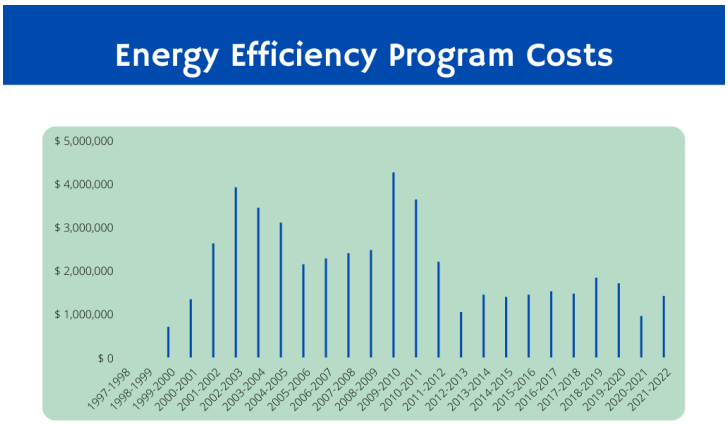
Savings from Programs

Savings: Since 2000, GWP’s PBC programs have resulted in total savings of 238,952,825 kWh, an average of ~10 million a year. The highest year of savings was in 2010 when the program portfolio achieved 17 million kWh in savings followed by $14.8 million in 2008. In 2022, the savings achieved was 9.0 million kWh.



Cost of Programs

The PBC programs' total cost through June 2022 has been $126,325,311, or an average of $5 million per year. The highest annual PBC program expenditure was $8.4 million in 2009-10. Of the $126 million total, 38% was spent on Energy Efficiency programs, or $48,628,577. Thus, GWP has spent less than $2 million per year on average supporting its energy efficiency programs for the past 25 years. Another $44 million (33%) has gone to support Low Income customers with efficiency and other services, nearly another $2 million per year. The remaining PBC funds have gone to Renewables 16%, RD&D 2%, and Administration 10%.



Interesting to note the overall cost per kilowatt hour. Take historical spend – $48,628,577 and historial savings of 238,952,825 kWh, and the result is $0.2035/kWh.

<u>Past Programs</u>: EcoMotion salutes GWP for having tried a wide variety of programs. More than 40 programs are no longer active, they are closed. Some past programs of note: $31,000 grants to Habitat for Humanity just in solar incentives, the Smart Home Solar Solutions program

provided rich solar incentives, the Green Allowance education program for energy and water conservation, Green Button Data, AC Peak Hogs, and Smart Home and Commercial AC Tune-Ups to cite a few. Cool Care provided incentives for landlords to upgrade refrigerators. Many of these programs seem worthy for reconsideration in a new and expanded portfolio.

Programs Highlights: Among the biggest programs over 25 years, $11 million was spent on Smart Home Solar Solutions, the solar incentives that are now not being offered. CoolCare cost a total of $3.4 million and was closed in 2012. Fully $19 million has been spent on $120 annual bill discounts for low income customers, another $11.9 million on senior care discounts of $144 annually. Smart Home rebates have cost $5.7 million over the past 25 years. There is a provision in place that allows for higher rebates for local purchases. Household assessments have cost $5.4 million and include giveaway efficient lights, water-saving devices, and water heater blankets. The Small Business Energy Savings Upgrade Program was closed in 2020. It offered up to $2,000 of no-cost measures, plus shared-savings contract with the vendor if interested for additional measures. The program cost GWP $9.1 million.

Solar in Glendale: GWP has a history of providing capacity-based, solar incentives for homeowners and small businesses. The program lasted 20 years, ending in 2021. At that time, Glendale had 1,930 interconnected residential solar systems, with a total capacity of 11.2 MW. Of these, 1,444 systems were incentivized with a total capacity of 8.7 MW. Also has a solar feed-in tariff program although it has not attracted a single participant. Thus far, about 106 energy storage systems since the program was launched in 2018 total capacity of 508 kW.

Current Statistics

In 2021, GWP's energy efficiency programs resulted in gross annual savings of 9,821,344 kWh, and 33,502,545 kWh of gross lifecycle energy savings. In round numbers, GWP programs are saving 10 million kWh each year. This compares with annual retail sales of 978,251 MWh. The energy saved – 9,821 MWh – represents approximately 1% of sales. Note that this level is consistent with forecasted levels; and is on par with other municipal utilities in California. In fact, GWP is consistently in the top 3 - 4 municipal utilities in terms of energy efficiency savings per retail sales. Covid hit hard. In 2021, GWP's energy efficiency programs resulted in only 308 kW of gross peak savings, compared to a peak of 331 MW. That 0.09%. That was due to a dramatic drop-off in the Business Solutions program. The prior year, GWP had achieved 6,199 kW of demand savings. In 2021, GWP earned retail revenues of $194,482,000. Energy Efficiency expenditures totalled $1,524,781, less than 1% of gross retail sales.

The California Municipal Utilities Association (CMUA) each year assembles an informative review of energy efficiency programs in California's public power sector. This includes municipal utilities and community choice aggregators. The Energy Efficiency Program Results by utility offers a useful comparison.[254] The biggest end-use categories for program funding were indoor and outdoor lighting, as well as cooling, and whole building programs. As the table below make clear, GWP is in the pack, accomplishing comparable results each with California municipal utilities.

Comparative Municipal Utility Energy Efficiency Performance

Utilities with over 50,000 customers	Customers	Retail Sales MWh	Retail Sales	Spent for EE Programs	% of Retail for EE Programs	Savings in MWh	% of MWh saved
Anaheim Public Utility	121,526	2,652,150	$328,440,000	$2,506,424	0.76%	10,458	0.39%
Burbank Water and Power	53,097	962,319	$149,846,000	$2,306,130	1.54%	4,899	0.51%
Glendale Water and Power	90,079	978,251	**$194,482,000**	$1,524,781	0.78%	14,051	1.44%
Imperial Irrigation District	159,822	3,515,689	$516,535,188	$2,907,797	0.56%	8,703	0.25%
LADWP	1,500,000	22,382,000	$4,200,000,000	$107,297,471	2.55%	113,949	0.51%
Modest Irrigation District	131,535	2,640,799	$381,593,605	$2,943,644	0.77%	13,673	0.52%
Pasadena Water and Power	67,566	942,266	$186,175,015	$2,417,947	1.30%	9,966	1.06%
Riverside Public Utility	110,951	2,113,574	$310,714,132	$2,951,320	0.95%	10,724	0.51%
Roseville Electric Dept	64,598	1,159,045	$162,656,977	$5,536,239	3.40%	10,184	0.88%
SMUD	644,723	10,415,276	$1,461,900,000	$37,459,268	2.56%	45,016	0.43%
Silicon Valley Power	58,701	3,593,748	$422,917,148	$4,734,082	1.12%	8,203	0.23%
Turlock Irrigation District	93,916	2,224,430	$308,292,632	$1,232,039	0.40%	5,056	0.23%

Source: Energy Efficiency in California's Public Power Sector: 16th Edition - 2022

GWP Existing Programs and Services

Digging in on GWP's Existing Programs and Services. Let's begin with a review of residential programs, followed by business programs, and community programs.

[254] Energy Efficiency in the Public Power Sector, 2022 Edition, California Municipal Utilities Association, Table 1, page 8.

Residential Customers

GWP's focus on residential customers is admirable. Just this past year, a new program was added to the line-up the Franklin Demand Response Program. This is the focus: cutting peak demand. The Franklin program has a residential sector component and also a commercial sector component. They are featured in the text below. Here is a current list of GWP programs and services for residential customers:

Programs and Rebates

- Peak Savings program
- Energy and Water Efficiency Marketplace
- Smart Home Upgrade Program
- Energy and Water Saving Rebates
- In-Home Display and Thermostat Program
- Tree Power Free Shade Trees
- Electric Vehicle Charging station rebates
- Off-Peak EV Charging Rebate program
- Laundry to Landscape Greywater System program
- Home Energy Reports
- Home Water Reports
- Net Energy Metering Program

Low-Income Programs and Rebates (Income Qualified)

- Utility Users Tax Exemption
- Helping Hand (one-time payment)
- Glendale Care (monthly discount)

Peak Savings Program

In 2021, GWP launched the Franklin Energy Peak Savings Program. This is residential demand response, a program designed to control and curtail loads during peak periods. The program is available to single and individually-metered customers, single family, multifamily, and small commercial customers with air conditioning units 5.4 tons or less in size.

In this program, residential participants agree to allow their air conditioners to be controlled remotely. It's a simple "opt in" program. It's completely voluntary and without drop-out

penalties. For participants, and with 24 hours of notice, GWP will automatically and slightly adjust temperatures on peak days, a maximum of 3 degrees. Prior to the event, a participant's smart thermostat pre-cools the home automatically, then lowers the temperature slightly during peak periods. Events last 2 - 4 hours.

If a customer has a smart thermostat, the Peak Savings program syncs with it. In that scenario, the participant gets a $50 signing bonus and an annual $50 bonus. If the customer does not have a smart thermostat, he or she is eligible for a $100 incentive and then discounts through GWP's online marketplace. In that scenario, the thermostat will be shipped and installed for free.

To participate in the program, a customer must have: landlord permission, an active electric account, wifi, and central air conditioning or a heat pump. Participants can opt-out of any event, though multiple opt-outs may end a customer's program enrollment. To date, program implementation is behind schedule. At the end of October 2022, nearly halfway through the four-year program, Franklin had enrolled 1,864 thermostats in the program, controlling 1,724 kW, with 29% of its four-year goal accomplished.

GWP Marketplace: The GWP Marketplace is a nice portfolio featuring high quality efficiency products presented with deep discounts. For example, a NEST thermostat is listed, discounted from a manufacturer's suggested retail price (MSRP) of $120 to $29.99 One can buy an Ecobee thermostat for $49.00 with the $100 discount. To date, there have been 834 thermostats and 1,237 other measures transacted on the marketplace.

GWP program material states that participants will likely save on their bill too by installing a smart thermostat. The program FAQ claims that installation and use of a smart thermostat can result in savings of 10 - 12% on heating and 15% on cooling costs, though "individual savings are not guaranteed".

Commercial Programs

GWP Business Customer Programs – Current Portfolio

- Benchmarking and Public Disclosure Program
- Business Energy Upgrade Program
- Peak Savings Program
- Feed In Tariff Program
- Business Energy Solutions Program

- EV Charging Station Rebate
- Glendale Fiber Optic Broadband Network
- Net Energy Metering Program

Peak Savings Partners

The Peak Savings Program is the Franklin demand response program for commercial customers that have demand greater than 50 kW. Furthermore, they must be able to reduce a minimum of 25 kW or 20% of peak load, whichever is lower. And they must be able to do so for a maximum of 60 hours of demand response program per year; up to 15 events per year and up to 4 hours per event.

The benefit for participants? The number one benefit is money. The program begins with a free facility site assessment to determine what loads can be cut and/or shifted during the June - October program period. After successfully applying for a specific load reduction, customers participate in a test event to confirm the committed peak load reduction.

All demand reduction strategy costs are the responsibility of the participant. Participants are financially rewarded with $50/kW for 4-hour program participants, $25/kW for 2-hour program participants. Participants are paid within 60 days of each program season. EcoMotion believes that these DR values are low and program uptake suggests that is the case: By the end of October, the commercial program had enrolled 22 service addresses with 545 kW under control, representing only 13% of anticipated program savings, again, nearing the halfway point in the program's four-year contract term..

Business Energy Program Managed by Willdan

The Business Energy Program is being implemented by Willdan, which bought Lime, the company that was successfully awarded a contract as a result of the 2018 Clean Energy Request for Proposals. Willdan and Franklin were the two firms that were successful in that RFP. Lime earned an $18 million, seven-year contract with GWP to deliver 36,500 MWh of savings.

The Business Energy Program is available for small, medium, and large businesses. It offers incentives that can be as high as 100% of costs. The program begins with a no-cost assessment, and then progresses to installation and savings.

The gist of the program is a "Direct Install" program for energy-efficient lighting and HVAC to reduce consumption. For business customers with demand <150 kW per meter the program a)

coordinates the assessment, b) develops proposals for customers, c) oversees Direct Install through subcontractors, and d) reports energy savings.

The Willdan program is a seven-year program with a planned, significant ramp-up in program years 3,4, and 5. Currently, the program is about one-fifth through its term… with 11% of the program total goal accomplished which exceeds Willdan's target thus far. By the end of September, Willdan had served 426 small and medium-sized customers, and two large customers delivering 3,950 MWh out of its 3,900 MWh two-year program goal. (The seven-year savings is anticipated to be 36,500 MWh). The program has also resulted in 524 kW of demand savings. That's 6.3% of the 8.32 MW program goal. Of course, efficiency and load management programs were retarded by Covid.

Conclusion

Over the years, GWP has done a good job of promoting customer energy efficiency. GWP has covered the bases nicely, offering services and incentives to all customer segments. Many of GWP's programs have been awarded by the California Municipal Utilities Association, Southern California Public Power Authority, and by the American Public Power Association. The portfolio has nice touches, like extra incentives for buying appliances and such locally in Glendale.

Guided by management, the City Manager, and the Glendale City Council, GWP staff has done a good job. When asked to rate GWP's efficiency programs, EcoMotion gives GWP a solid "B." EcoMotion likes the track record that speaks to experimentation and following veins of success. EcoMotion likes the current portfolio of programs and the umbrella that they provide. EcoMotion does recommend greater emphasis on reaping energy savings, and generation and storage benefits, from low income customers.

To put the B grade in perspective, EcoMotion would give a similar result to California's munis. They were directed in 1998 to provide public benefit in four forms, and they have delivered efficiency within that context. Now, utilities are developing load management and DER programs that go well beyond "public benefit," and provide bonafide energy and capacity resources to the grid.

GWP is now being asked to do a great job. It's time for A+ performance and results! Council and the community are asking GWP to dig deeper, much deeper,… and to concurrently reap much greater savings and slash GHG emissions, while electrifying mobility and buildings. That's a tall order.

Stepping up will require that GWP and its officials and staff take a leadership position, Most utilities spend less than 2% of their gross revenues on energy efficiency. And they save about the same amount, about 2% of sales. To really make a difference, to fully reap the benefits of this first loading order priority resource, GWP needs to be strategic and to spur investments on the customer's side of the meter. If invested wisely, these investments - new lighting, refrigeration, or HVAC – can yield returns for customers. They can serve as new sources of revenues for both customers and utilities. The realm of public benefits programs is alive… but now morphing as these customer resources are ever-more valuable capacity additions to the grid.

Strategic Considerations

This section of the report presents a number of strategic considerations for GWP, notably considerations that will affect power load, net of energy efficiency, demand response, and distributed energy resources.

Electrification

Before we get too far into this section, let's address a very big variable in the room: electrification. As the City of Glendale electrifies, that's all our homes, businesses, our cars, buses, and trucks there will be significant load growth.

These trends encompass "e-mobility" and "e-buildings." They are good trends for the environment and they are certainly trends that further challenge electric service providers. GWP has a tough road ahead, decarbonizing the existing load while welcoming new and significant loads that must also be decarbonized.

GWP's Two Challenges
Decarbonize Existing Power Generation
Decarbonize New E-Mobility and E-Building Loads

GWP's historical peak was 346 MW in 2017. In September of this year, 2022, and during an intense heat wave, GWP hit a peak demand of 331 MW. With electrification, GWP anticipates a peak demand of 450 MW by 2035. GWP can meet this peak by stacking resources. Everything is on the table, from voltage reduction to market transformation and consumer awareness and incentive programs.

Vehicle Grid Integration: One of the most encouraging strategic considerations for GWP relates to VGI, using cars, trucks, and buses as Distributed Energy Resources. Most cars operate less than 5% of the time. As our auto fleet becomes electric, their battery packs sit idle for 95% of the time. That idle capacity can be used to shore up the GWP grid during critical peak periods.

While fleets will likely be the first VGI participants – school buses, delivery vans, city buses and trucks, etc. – let's talk cars. A Chevy Bolt has 65 kWh on board. Using a 10 kW bidirectional charger, and assuming GWP can only access half of each EV's energy/capacity, we have 10 kW of power for 3.25 hours. Every 100 cars gives you a megawatt. If 1,000 cars are connected, that's 10 MW. If 2,000 cars are connected, that's 20 MW. There are over 220,000 cars in Glendale.

Building Electrification: Not so challenging for new construction, but building electrification – removing oil and gas boilers – will be very difficult in retrofits. Large buildings with large builders for space and water heating in particular pose major challenges. Utilities and/or governments need to have rebates/incentives available to respond to equipment breakdowns. At that time, the building manager will only need incentives to cover the marginal cost of energy-efficient models. Heat pumps for heating and cooling are a big part of building electrification. In some applications, geoexchange systems will allow buildings to heat and cool with highly efficient, ground-source heat pump systems. GWP must be poised to support electrification, and specifically efficient and tightly controlled electrification.

Transition Technologies

Two controversial transition technologies are generators and fuel cells. Today, they all run on fossil fuels. EcoMotion recognizes that there may well be push back to the use of any carbon-based generation source, even in transition. EcoMotion agrees that these are a decidedly second-choice option to carbon-free solutions. Already, GWP's generation mix is 69% renewable.[255] So why even consider these? The answer is to explore every option for capacity to meet the GWP's impending 2025 peak demand.

Generators: Generators that run on natural gas or diesel are carbon-based but may be important to powering through Glendale's 2025 peak demands. Currently Pacific Gas and Electric supports both generators – despite their carbon basis. (PG&E also supports battery packs.) While EcoMotion favors energy storage, generators may prove to be a valuable tool in Glendale to avoid black-outs.

[255] Personal communications, Mark Young, GWP General Manager, October 14, 2022.

Fuel Cells: Fuel cells are an interesting case. They allow GWP large customers to generate their own power, typically at less cost. In the case of Bloom Energy fuel cells, Bloom owns and operates and maintains the equipment. Institutional customers –like Home Depot – pay a "tolling rate" to use the fuel cells, and then they pay for natural gas to fuel the cells.

Bloom Energy's fuel cells can now run on 50% hydrogen. By 2024, its fuel cells will be able to run on 100% hydrogen.[256] Given that declining emissions trajectory, might it make sense to allow fuel cells in Glendale? They could help cut peak demand. The same could potentially be said for microturbines. They also provide heat that can be used for different customer processes.

The disadvantage of fuel cells, from a customer and a utility standpoint, is that they run as baseload resources and cannot cycle up and down. The Bloom Energy fuel cells at Home Depot and Dreamworks are 200 kW and 250 kW respectively. They are sized to provide baseload capacity to those facilities. They cannot be used to follow or meet the peaks.

One of the distinct advantages of fuel cells is that they work well in dense urban environments like Glendale. Compared to other DERs, fuel cells have a small footprint. For instance, a megawatt of solar requires 100,000 ft, over two acres of space. A megawatt of fuel cells requires only about 40 feet * 50 feet, or 2,000 square feet. Bloom is also developing stacked fuel cell configurations for dense urban environments.

Pricing Options

Let's discuss pricing for power and an option that GWP has not engaged: Mandatory Time of Use (TOU) rates. Sometimes these rates are referred to as Time-of-Day rates (TOD). TOU rates vary according to time of day, season, and day type - week or weekend.

There are three key variables to consider: First is whether to make the rates voluntary or mandatory. The second is the time period that rates climb high to discourage use, and how narrow that window of time is. Third, and of great importance is the price differential between the off-peak and the peak rate. The highest cost rates reflect the peak period, generally 4 - 9 PM in California.

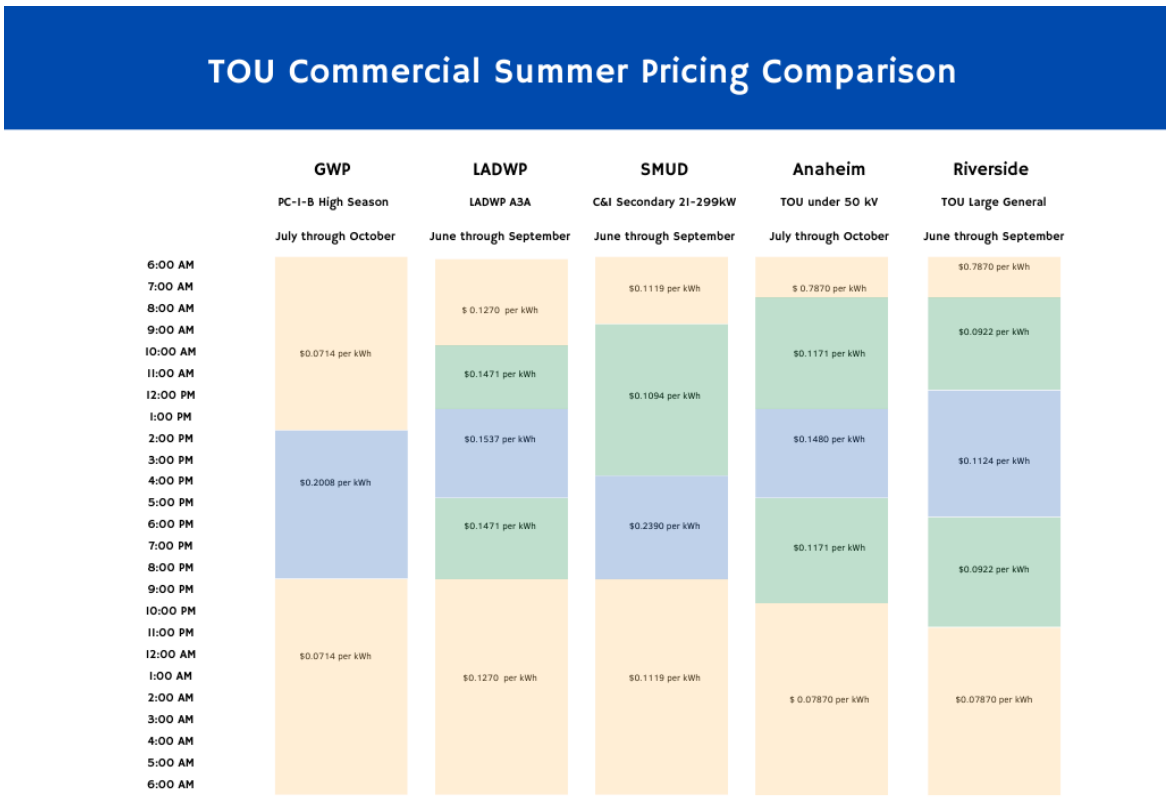
TOU plans support a cleaner power grid by encouraging energy use when renewable resources such as sun and wind are readily available during the middle of the day. When consumers use electricity is just as important as how much electricity they use. The evening "ramp" of utility

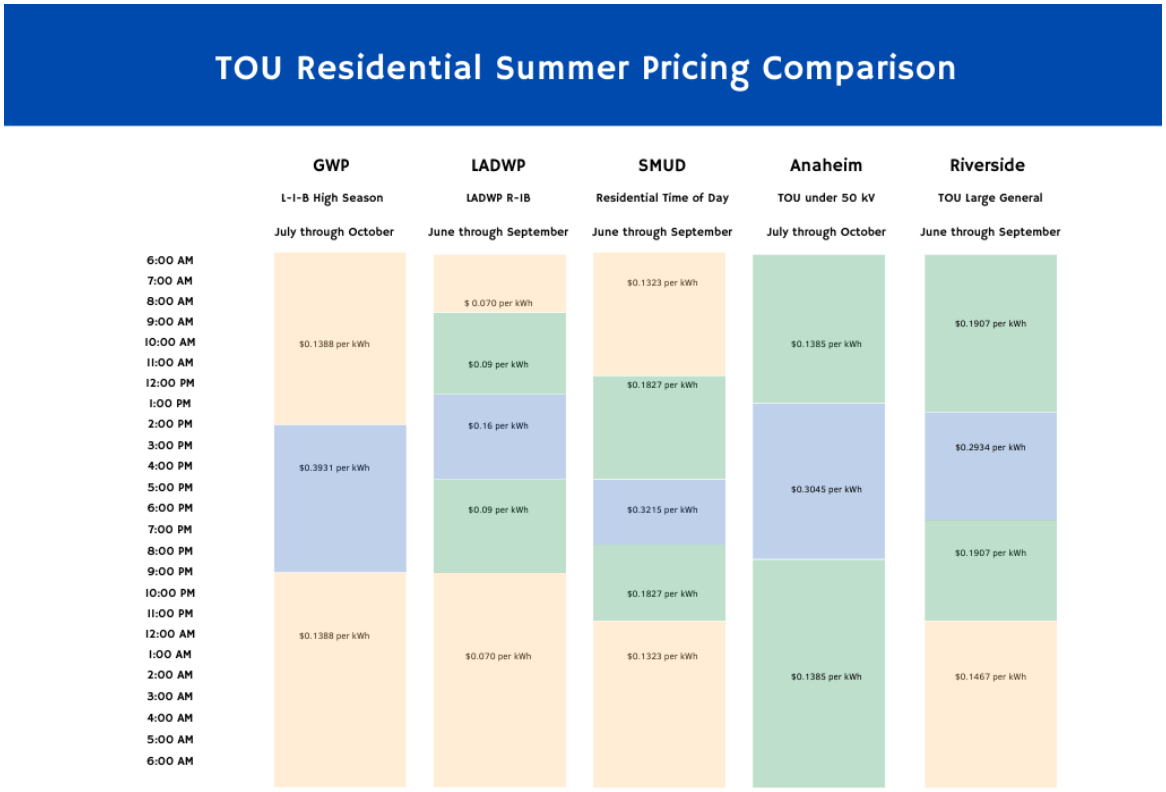
[256] Personal communications, Chris Kim, Bloom Energy September 2022.

resources as the sun goes down is of key concern, and the net result of the infamous “duck curve.”

Time-of-use ratemaking makes electricity more expensive during predictable periods of high demand when the electric grid is stressed and electricity is more expensive for utilities to provide. Flat rate customers who use more grid power during peak periods are underpaying for the costs of meeting that demand, according to Ahmad Faruqui, former Brattle Group principal. By shifting to times when electricity is cleaner and cheaper, TOU promotes a shift in consumer behavior. From a utility standpoint, TOU rates support renewable resources… for instance, by making power cheap when the sun is shining.

TOU is not new to California or to Glendale. In 2015, the California Public Utilities Commission (CPUC) voted to adopt the Residential Rate Reform. It included a requirement for all investor-owned utilities to automatically transition residential customers to a TOU plan. Customers could and still can opt out. The State’s three large investor-owned utilities have all been mandated to shift their customers to time of use rates. This began in 2020 and all IOU customers were transitioned by June 2022.





<u>Glendale TOU</u>: Time-of-use rates are not new to GWP. The tables below show the TOU rate windows used by GWP for its commercial and residential rates compared to other municipal utility programs. The largest customers with demands greater than 500 kW are required to be on the PC1B Commercial/Industrial TOU rate. TOU is voluntary for everyone else and staff report little interest in this rate option. Some large users with demands less than 500 kW have voluntarily adopted the PC1B rate. In total, there are 340 commercial meters on TOU rates, including customers on the L2B and LD2B rates.

GWP's limited uptake with voluntary TOU rates is not unique: The Holy Cross Energy (HCE) Time-of-Day experience is explained by its General Manager, Bryan Hannegan: *"With respect to Time-of-Use rates, our voluntary program only has 85 meters enrolled (out of 60,000) despite the impressive 4:1 peak to off-peak pricing spread. Rates at HCE range from ~6 cents per kilowatt-hour up to 24 cents! Granted we have not really promoted it heavily in our communications activities, but even a 10x improvement would still be a small fraction of our load. This is why most utilities wishing to shape their net load with rates are moving to a default TOU requirement (the California IOUs, Xcel-Colorado, and others)"*

Oklahoma Gas & Electric Gas and Electric Smart Hours

EDF presents a fact sheet that cites Oklahoma Gas and Electric. It performed a TOU pricing pilot in 2011 that provided TOU rates to 20% of households. This resulted in eliminating the need to build a 210 MW power plant. Subsequently, in 2012, the utility rolled out its SmartHours plan. It allowed customers to see their previous day's power use. It provided free smart thermostats and energy efficiency kits. It features a one-year, risk-free bill guarantee. Reportedly, OKG&E was was on track to enroll 20% of its 100,000 residential customers.[257]

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Sacramento Municipal Utility District (SMUD) tested TOU rates in 2012 and 2013. It determined that with TOU rates, the utility could avoid a 500 MW gas-fired power plant and save customers' money. SMUD's result was high levels of customer satisfaction, low opt-out rates, and significant load shifting... everything it was supposed to do.

SMUD's well-designed pilot was noted statewide. Subsequently, the CPUC directed California's investor-owned utilities to follow suit with pilot programs. The 2018 pilots involved over a half million consumer accounts, and of those, 90% continued to use the rate after the pilots were completed.

The literature on the effectiveness of TOU is scarce but instructive: Ahmad Faruqui found that residential customers reduce their peak usage by 6.5% for every 10% increase in the peak-to-off-peak ratio.[258] With AMI and automated solutions, this rises to 11%. EcoMotion reached out to Faruqui in August 2022 for a simple metric, and he responded that voluntary programs which are structured with a 3x peak price can attract 5% of customers.

On the other hand, while TOU may be beneficial to utilities, some ratepayer advocates question how well it works for consumers. Toward Utility Rate Normalization (TURN) says the benefits of TOU are not nearly as attractive for consumers as they are pumped up to be, noting that only 10 - 15% of those participating experience bill savings.[259] TURN found that there was no bill change for 50% of PG&E participants and that 40 - 50% of Edison participants had no bill change. On the other hand, TURN reported that 30 - 40% of participants experienced higher bills.

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[257] ELF Fact Sheet TOU, https://www.edf.org/sites/default/files/factsheet_time-of-use_0.pdf
[258] Personal communications with Ahmad Faruqui, retired, founder and CEO, Brattle Group, August 2022.
[259] "An emerging push for time-of-use rates…customer and grid impacts," Utility Dive, Jan 28, 2019, https://www.utilitydive.com/news/an-emerging-push-for-time-of-use-rates-sparks-new-debates-about-customer-an/545009/

Fort Collins Utilities Time of Day Rates

The City of Fort Collins has its own municipal utility. It provides four essential services:power and light, water, wastewater, and stormwater. It serves more than 75,000 customers. In addition to its standard rates, Fort Collins offers three different Time of Day rates for all standard, electric heat, and solar customers. It has a TOD estimator tool that it provides to interested customers so they can weigh their options.[260]

Fort Collins is home of Colorado State University. The Fort Collins utility boasts the lowest power rates in the State of Colorado, even less than Colorado's electricity cooperatives. Fort Collins has two levels of pricing, on-peak and off-peak. It has two seasons, non-summer and summer. Off-peak prices are about 70% less than peak prices. The utility promotes the notion that there are 19 - 20 off peak-hours each weekday, so it encourages its customers to shift power use to those periods to save money. As a result, customers use ~80% of their electricity during off-peak periods. The utility offers a shadow bill so that interested customers can see how they fare on their standard and TOU rate.

Real-Time Pricing

Also known as dynamic pricing, Real-Time Pricing (RTP) is a utility rate structure in which the per kWh charge varies each hour based on the utility's real-time costs to generate and/or buy wholesale power. This is also known as "dynamic pricing" and "Rate to Drive" (RTD pricing) . While complex, these carefully constructed price signals are considered by some to be the right method to adjust the power balance between supply and demand in smart grid systems. Nova Scotia and New York utilities offer RTP to large commercial and industrial customers.

A 2004 Lawrence Berkeley National Laboratory study conducted by Chuck Goldman provided a Survey of Utility Experience with Real-Time Pricing. Most of the dozens of programs presented use a similar risk mitigation strategy. They focus on Customer Baseline Loads (CBL). This is a level of power delivery determined to be baseline by the customer. For all usage below and up to this line, the customer pays for normal tariff. It's the marginal power use that is valued using RTP.

Several utilities have explored Real Time Pricing including B.C. Hydro, Kansas City Power & Light, Alabama Power, and Georgia Power. The latter two offered a suite of supplemental risk

[260] Personal communications, Randy Reuscher, Lead Analyst Utility Rates, Fort Collins Utilities, August 2022.

management products including price caps and price collars on blocks of power. Some utilities also have employed enrollment caps for RTP, for instance 150 MW.[261]

California utilities were directed by the California Public Utilities Commission to explore RTP in 2021.[262] The utilities installed 23,000 real-time meters, and the summer peak for these meters was reduced by 500 MW. SDG&E piloted an hourly dynamic rate for electric vehicle owners through its Power Your Drive Pilot Program.[263]

End-Use Pricing

Perhaps one of the most far-out pricing mechanisms for utilitie to earn revenues is based on end-use pricing. Instead of charging for the commodity, kWh and kW, in an end-use pricing model utilities charge for a service, be it light or space cooling/heating or torque or refrigeration. That's what consumers really want.

This concept of selling the end-use service is not new… in fact it was Thomas Edison's early vision for his Edison companies. As the means for generation became more efficient, as did his early appliances – the lightbulb – he postulated that the Edison companies could profit twice. His board, however, turned him down.

End-Use Pricing exists today in America in limited ways. For instance, some utilities such as LADWP continue to charge for street lighting services. French companies provide heat. These heat service companies are known as "chauffagistes."

EcoMotion's principal, Ted Flanigan, witnessed Gothenburg (Sweden) Energi's pilot end-use pricing program. If offered different temperature schemes for its customers throughout the year through a set of subscription options. One of the appealing aspects of End-Use Pricing is the serving utility's ability to employ different options if the price of electricity goes high. Gothenburg Energi maintains the option to add more insulation to a home to lower the heat cost it incurs, meeting a subscriber's set comfort levels. In this case, the responsibility for efficiency shifts from the consumer to the vested interest utility.

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[261] Lawrence Berkeley National Laboratory report on Real Time Pricing, 2004. A Survey of Utility Experience with Real Time Pricing, https://eta-publications.lbl.gov/sites/default/files/report-lbnl-54238.pdf

[262] "California Explores Real-Time Retail Pricing to Enable More Renewables," June 10, 2021, PV Magazine, https://www.pv-magazine.com/2021/06/10/california-explores-real-time-retail-pricing-to-enable-more-renewables/

[263] Power Your Drive Research Report, April 2021, https://www.sdge.com/sites/default/files/regulatory/SDG%26E%20FINAL%20Power%20Your%20Drive%20Research%20Report%20April%202021.pdf

Seizing Smaller Chunks of Capacity

Another strategic consideration relates to seizing smaller chunks of capacity. The distributed utility model inherently means smaller systems, and many more of them. GWP must be prepared for this.

To make the transition to a clean energy future, GWP will need to field everything from engineers to plan checkers, project managers, to legal counsel. All parties must be willing and even driven to address and overcome barriers to contracting for distributed solutions.

The new utility paradigm inherently involves more companies selling their wares, be they for small power plants or distributed generation or efficiency program services. Sometimes they will be less experienced, less creditworthy. But this is the path ahead, developing broad swaths of consumer-owned, utility-managed distributed energy networks will require considerable patience and flexibility from GWP.

EcoMotion suspects that GWP's legal posture has limited the advance of DERs in Glendale. A case in point is the Sunrun contract and its failed negotiations. The result: GWP lost 25 MW of capacity because it couldn't come to terms in a timely manner. Sunrun has consummated contracts with many other utilities including Southern California Edison.

GWP staff and officials are to be credited with seeking the most cost-effective solutions for Glendale. But with the Summer of 2025 looming large, GWP needs capacity. In the Sunrun case, perfection seems to have been the enemy of the good.

To become a truly progressive utility that embraces renewables fully, GWP will need to make sure that its expectations are realistic and that its posture is about building partnerships. Fully embracing energy efficiency, load management, and distributed energy resources will no doubt result in uncomfortable working conditions. Utilities are understandably uncomfortable working on customers' premises. There are legal issues and liabilities too. Can GWP be hamstrung? Of course not. GWP needs to find solutions to these challenges.

Recommendations and Potential

This section wraps three months of digging, analysis, and strategizing for Glendale Water and Power, and for the citizens and businesses of Glendale. Seven recommendations are presented.

But the primary observation is that GWP needs to undergo a culture shift. There needs to be a fresh start… a major infusion of enthusiasm, marketing and outreach resources, and professionals hell-bent on driving down energy use, especially peak energy use in homes and businesses throughout Glendale. There need to be specials on efficiency products and services, seasonal reminders, and attractive rewards plus consumer recognition.

To fulfill City mandates, the utility needs to embrace a new operating paradigm. While the transition may take years, GWP must position itself to be a utility that uses a healthy mix of renewable resources paired with storage, and that fully utilizes customer energy efficiency, carefully managed loads, and distributed, local, carbon-free energy resources.

EcoMotion stresses social equity, and that GWP must make sure to provide special incentives and services for low income customers. This covers building shell, appliance, and EV opportunities. These are all key elements in the new utility resource equation. For GWP to succeed, it will need the City to embrace and promote sustainability, both in policies and investments for all residents and businesses. There will be resources required in the transition… as well as vision and passion.

Seven Recommendations

#1: Fresh Start: Create a Movement

EcoMotion believes that GWP will need a fresh start and a fresh approach to supporting customer's energy efficiency, load management, and distributed energy resources. Easy to say, but GWP needs to start a movement, a groundswell of consumer – and prosumer – interest and action in Glendale. This is the toughest recommendation of all to carry out.

The movement has to be a movement of the people. It will be rooted in a comprehensive outreach campaign that taps and cultivates consumer action and civic pride. The movement needs leaders to speak out and live it. "Hey, it's cool to save by having a Tesla PowerWall!" "My EV helped our city avoid blackouts yesterday." "My new refrigerator has all the bells and whistles, and it's Energy Star!" Pretty cool. "I want a solar system too."

Just as Flex Your Power was (and has been) successful statewide, all Glendale residents, businesses, and institutions can be aware and thus part of the local peak power solution. That begins with a) awareness and b) pathways for consumer action. And GWP will meet that new-found interest with sophisticated market research, using advanced market segmentation to develop customized approaches for different market segments.

What does it mean, a movement? First and foremost, it takes people… leaders and followers. It's about tapping into highly rational behavior. GWP needs Glendale's power consumers to care about the City and our power resources and to be part of the equation that keeps rates in check and the lights on. Consumers are asked to participate for at least just a few hours a year. GWP's immediate focus is on load management and managing the peak, managing critical peak demand conditions for less than 100 hours per year.

Creating a movement can be coordinated with the Office of Sustainability as well as community groups to craft and execute an effective outreach campaign. It will make clear the challenges at hand and provide means for participants to feel good about their contributions. The campaign needs to cultivate civic pride, and pride in being ecologically sensitive. A media campaign will be used to boast about the City's greening.

#2: Adjust Pricing

There are several ways to adjust pricing through rates to encourage the transition to a clean energy future. A primary recommendation of this report is to institute mandatory Time of Use rates with at least 4x differential pricing. Studies have shown that mandatory rates can cut peak demand by 5%. To avert a public relations disaster, mandatory TOU rates must be rolled out with an effective outreach campaign. GWP will help consumers keep their bills constant if not lower after switching to Time of Use. Consumers need not be negatively impacted… in fact, they can save money.

EcoMotion recommends that GWP shift to mandatory time of use rates, but that this transition is handled with care. It must begin with a highly effective communication plan that makes the community's needs and benefits clear. This is a means for residents and businesses to cut their power costs. This pricing program is foundational to the broader Glendale greening initiative.

For the TOU roll-out, GWP will need an effective outreach and consumer awareness campaign. In terms of program design, and customer sacrifice, the goal is to tighten the peak period hours. And make sure to have large price differentials to send clear messages to participants. Then the program can be a win-win: the utility needs to generate and buy less peak power, and consumers cut their utility costs by shifting their use.

Additional Pricing Considerations

Real-Time Pricing: Real-Time Pricing – like the airlines use to price tickets – is dynamic and provides accurate price signals to consumers. RTP helps to avoid cross subsidies... and presents prices that accurately reflect power system conditions. EcoMotion recommends that GWP track RTP developments and consider initial pathways into this rate mechanism that can benefit both large consumers and GWP. Working together, and like TOU pricing, there may be a win-win possible.

End-Use Pricing: A third and quite far out rate consideration relates to advanced tariff structures such as End-Use Pricing. End-use pricing provides utilities such as Glendale Water and Power with a new means to charge for their services. Instead of selling the commodity (kWh), End-Use Pricing establishes tariffs for energy services such as comfort, torque, refrigeration, etc.

By embracing end-use pricing, GWP can find new means to charge for its services. Instead of selling the power commodity, GWP will be increasingly selling energy services. In this way, instead of efficiency being a cost, GWP will sell both energy as well as efficiency and energy management services. And as long as customers' bills remain constant, there may be a win-win solution at hand.

Reconsider Standby Charges: Another policy decision regarding rates and tariffs relates to the Standby Charges imposed by GWP in 2018 for all non-NEM, on-site customer generation. This directly impacted Glendale Community College's decision to invest in fuel cells to cut operating costs. The imposition of Standby Charges - which had not been anticipated – turned that project's economics upside down.

Note that the fuel cells' stacks are designed to be individually replaced during operations, without turning the units off, and never letting the units get below its firm capacity. As such, none of California's investor-owned utilities impose standby charges on fuel cells. The CPUC provided for an exemption from standby and departing load charges for fuel cell systems up to 5 MW in size. LADWP has minor charges that, according to Bloom Energy, do not impact the economics of the project.[264]

#3 Double Energy Efficiency

Doubling energy efficiency will not be easy, but is can be done by increasing incentives, digging in with low income customers, continuing to track down small businesses, and linking programs

[264] Communications with Tristan Becker, Bloom Energy, August 2022.

with decarbonization. This recommendation suggests using strategic means and rich, targeted incentives to boost customers' energy efficiency. GWP must practice creativity to develop attractive program offerings, specials and the like.

Efficiency is at the core of the infamous "loading order" of the State of California's priorities for its electric utilities. Efficiency lowers the overall demand profile, not just at peak periods, but throughout the day and year. Efficiency is inherently valuable to consumers: How can GWP support its customers to take advantage of advanced technologies and to use less power to achieve the same quality of life and functionality? This is the root of efficiency.

While GWP has run admirable energy efficiency programs for years, EcoMotion believes there is more to be done. Technologies always advance. Low income customers, as well as small businesses and seniors on fixed incomes tend to get left behind. Thus efforts need to be continued to provide these benefits to all GWP customers, and to address social equity issues head on. Careful market segmentation and advanced marketing strategies and precisely directed and even varying incentives can be used to promote efficiency in new ways.

#4 Ramp Up Distributed Energy Storage

While efficiency is good for the customers and good for the planet, load management is especially good for GWP and the plight to effectively prepare for the anticipated Summer of 2025 capacity crunch. How can GWP dramatically ramp up its load management efforts?

In 2020, prior to Covid, GWP achieved 6,199 kW of demand savings through its energy efficiency programs. With a projected system peak of 350 MW that's less than 2% of the peak. With the Franklin programs, that capacity has more than doubled. But there's lots more room for energy storage in homes and businesses. The Franklin demand response programs begin to address this but are behind schedule in delivery.

So how to increase load management in Glendale? Increase awareness, appeal to the public, and increase incentives. Doing so, EcoMotion estimates that there will be significant load management benefits from homes, businesses ,and institutions, as well as utility-owned storage.

#5 Encourage Distributed Energy Resources

The fifth recommendation relates to Distributed Energy Resources (DERs). EcoMotion recommends that GWP take this seriously, not as a fringe public benefits program, but as a

resource. Given impending capacity shortfalls, DERs break the conventional utility model. Given transmission constraints, both utility-owned and consumer-owned DERs offer a significant, partial solution. The most beneficial DERs store energy and help GWP beat the peak.

DERMS: One of the practical aspects of deploying lots of DERs is determining how to dispatch them. Imagine thousands of batteries, some linked to solar, others independent, scattered throughout the City. How can these be controlled? How can their host sites be assured of reserve capacity, and that they are fairly compensated?

Imagine thousands of vehicles lined to the grid, all with different power-sharing options. To manage both stationary and mobile batteries – to charge and discharge for maximum societal benefit, GWP will need a Distributed Energy Resources Management System (DERMS). Just as utilities have had SCADA systems to control power plants and distribution feeders, they will now have DERMS such as AutoGrid to manage tens of thousands of resources interacting with the grid. This can be outsourced. Firms such as Generac Grid services offer a management service, amalgamating programs like the Franklin demand response program, and integrating many programs impacts and distributed resources.

As previously discussed, allow consumer-owned microturbines and fuel cells to be part of the capacity crunch solution. These carbon-based DERs are not a top priority but can be in the mix with an eye toward conversion to hydrogen and ultimately green hydrogen.

As painful as it is for EcoMotion to recommend generators that burn either diesel fuel or natural gas, firing up generators for limited periods sure beats black-outs. If a handful of commercial and institutional accounts add generators, or allow GWP to control existing generators for limited peak period dispatch, that's peak-shaving capability. Generators can be used as a last-resort resort until they can be powered with hydrogen and ultimately green hydrogen.

#6 Meet the Solar Mandate with Storage

EcoMotion supports the City Council mandate for 10% of all customers in Glendale to be solar by 2027. The following is a strategy to make the solar mandate effective for GWP by adding similar storage capacity. For every kW of solar, GWP will invest in a kW of storage with four-hour duration.

EcoMotion recommends a five-point solar strategy. But in each case, there is the commonality that in order to get an incentive, every new solar system must be paired with dispatchable energy storage. By doing so, every solar kilowatt-hour can be used to offset GWP's peak

demand. Inversely, if every solar kilowatt-hour were not paired, GWP would end up exacerbating the "duck curve" that plagues California utilities. Worse, GWP would lose revenues due to solar... and it still would have to meet its peak... now with less cash to do so.

The Five-Point Solar Strategy

1. NEM Solar + Storage
2. VPP Solar + Storage
3. FIT Solar + Storage
4. Community Solar + Storage
5. Utility-Owned Local Solar

<u>#1 NEM Solar</u> Start with rooftop solar: EcoMotion recommends reinstating incentives for solar when paired with dispatchable storage. The storage must be controlled by GWP for dispatch during peak periods. The rest of the time, solar consumers can use their batteries – in conjunction with TOU rates – for energy arbitrage, dispatching at peak periods and avoiding peak period charges. In the event that there are space constraints on site, solar + storage NEM participants can use the community solar option.

EcoMotion recommends bucking the State of California trend towards NEM 3.0. It will likely impose fees and reduce the export credit that solar producers receive when exporting excess solar power to the grid. NEM 3.0 will retard solar uptake. EcoMotion recommends NEM 1.0 that is based on providing the full retail value for exporting to the grid. Between this NEM consumer benefit and the extension of the 30% federal Investment Tax Credit, solar is a good proposition in town. EcoMotion also recommends removing the limitation on customers' solar system sizes. Currently, customers can generate no more than their historical consumption. This can be lifted, allowing more solar energy to be generated in Glendale.

<u>#2 VPP Solar + Storage</u> While GWP was unsuccessful in consummating a deal for a cutting-edge Virtual Power Plant with Sunrun, EcoMotion recommends taking another swing at this, potentially with another vendor such as Swell and/or Generac, or even Sunrun. In some cases, the VPP can include customer sites that feature storage alone without solar. Thanks to the IRA, the Investment Tax Credit can be realized for stand-alone storage.

<u>#3 Feed-In Tariff Solar + Storage</u> For consumers that lack site load to offset with solar, EcoMotion recommends instituting a feed-in tariff that makes sense. While GWP boasts a FIT rate, it is so low (~11 cents/kWh) that not a single customer has participated. The solution appears simple: Increase the FIT rate.

Gainesville Florida had a $0.24/kWh FIT rate. LADWP has been partially successful with a $0.14/kWh FIT rate. Germany started with a $0.60/kWh FIT rate and quickly became the number one solar country in the world. GWP certainly need not go anywhere near that price! Whatever GWP's rate is, the design guideline is to provide incentives that attract participants. And unlike "conventional" FIT solar, in Glendale's case it must now be paired with storage.

Why would a homeowner use a FIT? Currently the NEM rules limit the amount of solar to meet –but not exceed – the prior year's annual consumption. But what if a homeowner – or a business – has excess roof space? Some can be used for NEM solar, and more can be added –profitably – using a FIT rate. EcoMotion recommends a robust commercial FIT program. Its rates may be less than the residential FIT rate, but again, its pricing must be sufficient to attract participants.

#4 Community Solar The fourth program recommendation to meet the solar mandate, is to offer a well-designed community solar program. Unlike the State of California community solar rules that have resulted in nearly zero participants. GWP must introduce a program that makes sense. EcoMotion recommends the Clean Energy Collective program design. Why? It works! It has worked for a number of Colorado and Minnesota utilities. That model essentially uses a virtual net energy metering arrangement for consumers that buy into the community solar program. They actually own panels...and their output, credited again at the full retain rate just like NEM solar.

#5 Utility-Owned Local Solar A fifth solar program recommendation is to fully tap utility-owned local solar. Utility-owned local solar can be installed on a) municipal buildings, b) hillsides and other open spaces, and c) at the Scholl Canyon Landfill.

#7 Create a Banner Vehicle Grid Integration Program

Recommendation #7 is to jump into the VGI space. This is a big space and potentially a big part of the solution to GWP's capacity woes. There are vendors right now, such as Nuvve, that are in the VGI business. They are aggregating electric vehicles to be able to cut demand. Ten thousand cars were hooked up in a pilot program in Denmark.

Nuvve is now working in San Diego to aggregate school districts – like the El Cajon Valley School District – which have electric buses whose battery capacity can be used to offset peak demand. The school district in partnership with Nuvve is participating in a pilot program with San Diego Gas & Electric's (SDG&E) Emergency Load Reduction Program (ELRP).

EcoMotion recommends that GWP step to the front of the line to contract with Nuvve or other providers to tap into VGI. GWP can launch a pilot program that can be scaled in coming years – as there are more and more EVs to aggregate. We recommend beginning with partnering with local fleets of buses, municipal trucks, and delivery services – then graduating to passenger vehicles to scale in coming years.

Capacity Scenario

The tables below summarize EcoMotion's estimated capacity potential for expanded Energy Efficiency, Load Management, and Distributed Energy Resources. It is merely one scenario that draws from many assumptions. The table presents estimates of participation rates and rough order costs of successful implementation of the recommendations presented in this report.

Based on assumed participation levels, made possible by serious utility and City commitment, EcoMotion finds that the seven recommendations can provide 104 - 126 MW of peak capacity over the next five years. Much of the work will be done by spurring consumer investments.

Summary of Potential Capacity 2023 - 2027

Fresh Start: Create a Movement	7.7 MW
Mandate Time of Use Rates	15.6 MW
Double Energy Efficiency	4.3 MW
Ramp Up Distributed Energy Storage	10.25 MW
Encourage Distributed Energy Resources	2.5 MW
Exceed the Solar Mandate, Add Storage	63 MW
VGI Scenarios: - Pilot - Phase 1 - Phase 2	 1 MW 8.5 MW 22.5 MW
Total Capacity with Pilot VGI	104.39 MW
Total Capacity with Phase 1 VGI	111.89 MW
Total Capacity with Phase 2 VGI	125.89 MW

Assumed Savings and Costs

1. Fresh Start, Create a Movement - 7.8 MW Asking the impossible? Yes? No? Bringing some life to the matter? Saving energy and managing energy wisely is important. The message needs to be interesting and widespread. GWP will need a strong team to implement this recommendation, perhaps as many as 10 professionals ranging from technical, to marketing, and administrative.

EcoMotion estimates that a well organized and effective outreach campaign, like Flex Your Power but something new and appealing to Glendalians, can result in significant capacity savings. It is assumed that 38,397 homes will participate over the five-year period – half of Glendalians - and will each cut their peak demand by 100 watts. EcoMotion assumes 2,000 watts on average per home on peak, thus a 5% cut in power use per home. Thus such a program results in peak capacity savings of 7.8 MW.

This approach can be highly cost effective from a utility standpoint. The costs are paying for a media campaign, which is estimated to be ~$1 million, including rewards and recognition efforts, as well as sufficient staff.

2. Adjust Pricing with Time of Use Rates – 15.6 MW At this time the TOU rate is only mandatory for GWP's largest customers. It is assumed that all 76,757 residential meters will shift (not cut) their peak demand by 5% on average. EcoMotion estimates that the average home/apartment participating will have a peak usage of 2 kW, thus a 5% reduction is 0.1 kW, or 100 watts. In aggregate, this results in a residential capacity savings of 7.6 MW.

Small and medium-sized businesses that must shift to TOU rates will also cut their use by 0.5 kW on average for a capacity savings of 7.9 MW. Note that this is a near-zero cost program from a utility perspective that could deliver 15.6 MW of peak capacity. Program costs include marketing and outreach, potentially a shadow billing program to show consumers how this new rate and their behavior stacks up to the old rate plan.

3. Double Energy Efficiency - 4.3 MW Energy efficiency is not GWP's primary concern at this time… beating the peak in the Summer of 2025 and beyond is. There may be capacity issues sooner. But consumers still have great benefit in investing in efficiency in their homes and businesses. EcoMotion recommends more direct install for low income and small business customers. EcoMotion recommends an approach for efficiency programs that is rooted in a) raising awareness, b) providing assessments and pro formas, and then c) providing incentives to get projects done. If increasing incentives in some program areas is important, then do it. But

overall, EcoMotion recommends continuing to flag opportunities for private-sector investments. Third party financing can also be promoted.

EcoMotion assumes that 7,676 homes will take additional efficiency actions thanks to a movement and campaign to tighten the City's footprint and peak demand. The program should focus on low income customers. We assume 2,000 low income customers will participate in these special $0.50/kWh incentives. Assuming that 7,676 homes, 2,000 low income customers, and 200 businesses participate, cutting their peak demands by 0.4 kW, 0.2 kW, and 4 kW respectively, there is another 4.3 MW of capacity. The efficiency gains are estimated to be 9,210,804 kWh annually, essentially a doubling of program activity.

4. Ramp Up Distributed Energy Storage - 10.25 MW it is assumed that 1,000 homes will get distributed energy storage – either to augment their existing solar or to serve as standalone systems. On average, each system will be 5kW/20kWh in size to support the grid, thus 5 MW in aggregate for 1,000 homes. EcoMotion anticipates 50 subsidized, low income customers will result in a total capacity of 250 kW. And it is assumed that 100 businesses will also participate, each with 50 kW of discharge capacity, for another 5 MW of capacity.

EcoMotion assumes that all storage in the seven recommendations will be incentivized by GWP… as long as it is dispatchable. For small systems, EcoMotion anticipates prices in the $4,000/kW range. For larger systems, EcoMotion uses $2,000/kW as a placeholder amount. Residents and businesses then get energy resiliency in the event of an outage.

Important to keep program design flexibility in mind. New Inflation Reduction Act rules are being interpreted by the U.S. Treasury. It appears that the 30% Investment Tax Credit will largely be in place in the coming years, but there is still a lack of clarity on how this will affect market pricing, and thus program uptake absent or with scaled back incentives. NEM 3.0 is in the works in California, but not yet finalized. The SGIP funds for storage are also in flux, with a lack of clarity on whether these will be renewed or not.

EcoMotion assumes 5 MW of household storage at a cost of $1,250,000; 250 kW of storage for low income customers at a cost of $1,000,000, and 5 MW of commercial storage at a cost of $1,250,000.

5.Encourage Distributed Energy Resources 2.5 MW This estimated potential analysis assumes five large customers that might want to invest in either fuel cells or microturbines or other distributed energy resources on their premises. Assuming an average size of 500 kW, these resources have the potential to cut peak demand in Glendale by 2.5 MW.

This recommendation bears no direct costs to GWP. The utility encourages consumers to invest in ~$5 million in capital costs by allowing and streamlining interconnection, waiving permit fees and standby charges. Overall, EcoMotion recommends that in these instances GWP establishes a ton of effective partnerships. GWP might consider providing engineering studies to interested customers and convening discussion groups with interested and experienced customers.

Note, of course, that there are lost revenues associated with this strategy. Fuel cells, for example, are baseload resources. Thus they offset baseload capacity. While they lower the peak, they do not target the peak. In the future, and when green hydrogen is available at a reasonable cost, GWP may elect to own and operate fuel cells on customers premises.

#6 Meet the Solar Mandate with Storage - 63 MW

NEM Solar + Storage Here is a plan to solar-ize households, nearly doubling the age-old NEM program in Glendale in terms of participation in the next five years. The result: an assumed capacity of 15 MW of solar, paired with 15 MW/60 MWh of storage. It is assumed that 250 low income customers will participate (subsidized with a $1/watt subsidy), as well as 100 businesses will participate with 50 kW average solar sized systems, for another 5 MW of solar capacity and 5MW/20MWh of energy storage.

EcoMotion assumes that 100% of the cost of solar will be paid by Glendale consumers, to the tune of $26.25 million for the residential program, $2.5 million for the low income program, and $15 million for the commercial program. EcoMotion assumes that GWP will pay 100% of the cost of distributed and dispatchable storage at a cost of $35 million, $6.25 million, and $10 million respectively.

VPP + Storage EcoMotion recommends a virtual power plant that has 15 MW of solar and 15 MW/60MWh of storage. GWP Program Cost: $7.5 million. EcoMotion assumes 1,750 homes, 250 low income homes, and 100 businesses, with average capacity contributions of 5 kW, 5 kW, and 50 kW respectively. Assume $4 per watt solar and $4,000/kW storage for residential; $3/watt and $2,000/kW for storage. GWP pays an incentive for solar of $1/watt for low income participants.

FIT Solar + Storage The Feed-In Tariff element of the solar program calls for 3 MW of solar + storage capacity. Of this, 2,500 kW will come from commercial sector customers; 500 kW will come from residential customers. The capital costs of the equipment are borne by the participating customers. Assumed that residential systems will cost $3/watt for solar and

$4,000/kW for storage. For businesses, solar is assumed to be $3/watt for solar and $2,000 kW for storage.

Community Solar + Storage For Community Solar, it is assumed that there will be 3,500 residential participants, 500 low income participants, and 200 businesses. They will each purchase 2.5 kW, 2.5 kW, and 50 kW respectively resulting in 8.75 MW, 1.25 MW, and 10 MW of overall capacity. Similarly, customers will each be responsible for 2.5 kW, 2.5 kW, and 50 kW of storage. The cost to GWP is on the order of $42.25 million; $37.25 million for consumers. This follows the design convention of customers paying for solar and GWP paying for dispatchable storage capacity.

Utility-Owned Local Solar Utility-Owned Local Solar + Storage Capacity ten megawatts is assumed at a GWP program cost of $40 million, $4/watt, for solar, and $20 million, $2,000/kW, for 10 MW/40 MWh of storage. Total program cost of $60 million for GWP.

The Five-Point solar plan presented hits the community hard. NEM solar installations nearly double in the next five years. Between NEM homes, VPP homes, FIT homes, and Community Solar homes… the plan hits 8,000 homes out of the 76,757 homes currently served by GWP, fully 10.4% of Glendale homes. In addition, 600 businesses are slated for participation with rich incentives.

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The following tables presents EcoMotion's estimated capacity potential for the seven recommendations. Every effort has been made to base values on industry findings and to be conservative with participation, costs, and savings.

Potential Peak Capacity from Recommendations #1 - 5

		Participants	Savings per Customer (kWh)	Savings per Customer (kW)	Total Customer Savings (kWh)	Total Capacity Savings (kW)
#1 Fresh Start: Create a Movement					-	
	Homes	38,379	400	0.1	15,351,400	3,838
	Businesses	7,907	4,000	0.5	31,628,000	3,954
#2 Adjust Pricing						
	Homes	76,757		0.1		7,676
	Businesses	15,814		0.5		7,907
#3 Double Energy Efficiency					-	-
	Homes	7,676	1,200	0.4	9,210,840	3,070
	Low Income	2,000	600	0.2	1,200,000	400
	Businesses	200	20,000	4	4,000,000	800
#4 Ramp Up Distributed Energy Storage						
	Homes	1,000		5		5,000
	Low Income	50		5		250
	Businesses	100		50		5,000
						-
#5 Encourage Distributed Energy Resources		5	4,380,000	500	21,900,000	2,500
Capacity Subtotal (kW)						40,394

Potential Peak Capacity from Recommendation#6

		Participants	Solar / Participant kW	Storage / Participant kW	Total Solar kW	Total Storage kW
NEM Solar + Storage						
	Homes	1,750	5	5	8,750	8,750
	Low Income	250	5	5	1,250	1,250
	Businesses	100	50	50	5,000	5,000
VPP Solar + Storage						
	Homes	1,750	5	5	8,750	8,750
	Low Income	250	5	5	1,250	1,250
	Businesses	50	50	50	2,500	5,000
FIT Solar + Storage						
	Homes	10	10	10	100	500
	Businesses	25	100	100	2,500	2,500
Community Solar + Storage						
	Homes	3,500	2.5	2.5	8,750	8,750
	Low Income	500	2.5	2.5	1,250	1,250
	Busineses	200	50	50	10,000	10,000
Utility-Owned Local Solar		1	10,000	10,000	10,000	10,000
Capacity Subtotal (kW)						63,000

Potential Peak Capacity from Recommendation#7

	Potential Timeline		Stored Energy / Vehicle kWh	VGI Capacity / Vehicle / kW	Total VGI Energy kWh	Total VGI Capacity kW
Pilot program	2023					
	Fleet vehicles	20	80	60	1,600	1,000
Phase I Program	2025					
	Fleet vehicles	100	80	60	8,000	6,000
	Autos	250	35	10	8,750	2,500
	Phase 1 Capacity					**8,500**
Phase 2 Program	2027					
	Fleet vehicles	250	80	60	20,000	15,000
	Autos	750	35	10	26,250	7,500
	Phase 2 Capacity					**22,500**

Potential Capacity Totals

Scenarios	Total
Recommendations # 1 - 6 with VGI Pilot program	104,394
Recommendations # 1 - 6 with Phase 1 VGI program	111,894
Recommendations # 1 - 6 with Phase 2 VGI program	125,894

The second set of tables presents anticipated costs to participants and to GWP. The costs presented are rough order estimates of the upfront costs for the capacity presented. Of note is the cost share between participants and utility.

There are other costs to consider: Administrative costs are not presented. Nor are the operating costs involved. For instance, GWP will be responsible for buying solar power from the FIT

program. Lost revenues associated with the Energy Efficiency programs are not included. In that case, EcoMotion anticipates that increased EV adoption and building electrification will outpace any lost revenues associated with energy efficiency.

Overall, implementing the seven recommendations over the next five years will be on the order of $437 million, with $158 million paid by GWP customers. As such, GWP's net cost is ~$279 million for ~104 MW of peak capacity.

Estimated Costs of Recommendations #1 - 5

		Participants	Total Savings (kWh)	Total Savings (kW)	Total Cost of Solar	Total Cost of Storage	Cost to Customers	Cost to GWP
#1 Fresh Start: Create a Movement								
	Homes	38,379	15,351,400	3,838			$0	$1,000,000
	Businesses	7,907	31,628,000	3,954			$0	$100,000
#2 Adjust Pricing								
	Homes	76,757		7,676		$0	$0	$0
	Businesses	15,814		7,907		$0	$0	$0
#3 Double Energy Efficiency								
	Homes	19,189	9,210,840	3,070		$46,054,200	$0	$46,054,200
	Low Income	2,000	1,200,000	400		$960,000	$0	$960,000
	Businesses	200	4,000,000	800		$2,000,000	$2,000,000	$2,000,000
#4 Ramp Up Distributed Energy Storage								
	Homes	1,000		5,000		$20,000,000	$10,000,000	$10,000,000
	Low Income	50		250		$1,000,000	$0	$1,000,000
	Businesses	100		5,000		$10,000,000	$5,000,000	$5,000,000
				-				
#5 Encourage Distributed Energy Resources								
		10		2,500		$0	$5,000,000	$0
	Recommendations 1 - 5 Cost Subtotal					$80,014,200	$22,000,000	$66,114,200

Estimated Cost of Recommendation#6

		Participants	Total Solar kW	Total Storage kW	Total Cost of Solar	Total Cost of Storage	Cost to Customers	Cost to GWP
NEM Solar + Storage								
	Homes	1,750	8,750	8,750	$26,250,000	$35,000,000	$26,250,000	$35,000,000
	Low Income	250	1,250	1,250	$3,750,000	$5,000,000	$2,500,000	$6,250,000
	Businesses	200	5,000	5,000	$15,000,000	$10,000,000	$15,000,000	$10,000,000
VPP Solar + Storage								
	Homes	1,750	8,750	8,750	$35,000,000	$35,000,000	$35,000,000	$35,000,000
	Low Income	250	1,250	1,250	$5,000,000	$5,000,000	$2,500,000	$7,500,000
	Businesses	100	2,500	5,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000
FIT Solar + Storage								
	Homes	50	100	500	$300,000	$2,000,000	$300,000	$2,000,000
	Businesses	100	2,500	2,500	$7,500,000	$5,000,000	$7,500,000	$5,000,000
Community Solar + Storage								
	Homes	3,450	8,625	8,625	$17,250,000	$17,250,000	$17,250,000	$17,250,000
	Low Income	500	1,250	1,250	$2,500,000	$2,500,000	$0	$5,000,000
	Businesses	200	10,000	10,000	$20,000,000	$20,000,000	$20,000,000	$20,000,000
Utility-Owned Local Solar		1	10,000	10,000	$40,000,000	$20,000,000	$0	$60,000,000
		8,000						
Solar cost subtotal							$136,300,000	$213,000,000

Estimated Cost of Recommendation#7

		Participants	Total VGI Energy kWh	Total VGI Capacity kW	Total Cost to Customer	Total Cost to GWP
Pilot program						
	Fleet vehicles	20	1,500	1,000		$400,000
Tempered program						
	Fleet vehicles	100	7,500	5,000		$10,000,000
	Autos	250	8,750	1,750		$3,500,000
			-	-		
Aggressive program			-	-		
	Fleet vehicles	250	18,750	12,500		$25,000,000
	Autos	1,250	43,750	8,750		$17,500,000

Grand Total Estimated Prices			
Scenarios	Total Cost to Customer	Total Cost to GWP	Total
1: Recommendations 1 - 6 with Pilot VGI	$158,300,000	$279,514,200	$437,814,200
2: Recommendations 1 - 6 with Tempered VGI	$158,300,000	$292,614,200	$450,914,200
3: Recommendations 1 - 6 with Aggressive VGI	$158,300,000	$321,614,200	$479,914,200

Final Comments

Resources for Success

Sufficient Resources An important consideration for GWP is the staff that will be required to manage the significant boost in outreach and programmatic activity presented herein. There will be a number of new staff required, as well as certain staff quality requirements. EcoMotion has been told about how difficult it is to hire additional staff in the City of Glendale. This challenge will have to be overcome to expect a groundswell of any kind.

To engage the recommendations presented herein and to cut the City's peak demand by a third… is going to take resources. The capacity that can be built with the seven recommendations will require staff and/or consultants that have the skills and motivation to accomplish an aggressive work plan. Marketing funds will be required. Expertise – to fulfill assessment and coaching duties – will also be required. Staffing requirements ripple beyond GWP. The Building Department will need more plan checkers and inspectors. There will be web works, social media, and conventional media to fully use.

Monitor and Make Programmatic Changes

To achieve desired results over the next five years, and beyond, GWP will have to diligently monitor program status, including participation rates, costs, and savings. This will reveal both successful programs and those that are underperforming.

Monitoring and tracking takes several dimensions: Budget tracking is key. So is carbon tracking. EcoMotion also recommends tracking social equity indicators. It is important to track how GWP is doing in cutting peak demand, in cutting carbon, and in doing so in ways that are equitable for all residents and businesses.

Build Strong Partnerships

The utility of the future – a healthy Glendale Water and Power – will look a lot different than the traditional utility model. This survey of best practices provides glimpses into future business models on the customer's side of the meter. The report highlights means for GWP to best serve Glendale's residents and businesses.

Instead of centralized power plants, transmission lines, and distribution lines all operating in a single direction, successful utilities of the future will rely on thousands of points of light, thousands of connected DERs. Utilities will rely on consumers for a change… they will be interdependent. The wires run in both directions.

Instead of relying on power plants, GWP will also build relationships. GWP has significant tools on hand with Energy Efficiency, Load Management, and Distributed Energy Resource. These tools can help to reinvigorate GWP and to increase the quality of life in Glendale, while the City is taking responsible climate action. GWP has the capacity to effect a carbon-free and energy-resilient future for the City of Glendale.