

2030 Zero Carbon Plan



Progress Report | March 2022

2021 accomplishments & 2022 priorities



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Introduction

It's been almost a year since the 2030 Zero Carbon Plan (ZCP) was approved by the Board in April 2021. SMUD staff hit the ground running and accomplished a lot over the last year. We are pleased to report we're on track and have either completed or made significant progress on all the priority items identified in our 12-month action plan presented a year ago, including the following:

- Performed **detailed reliability studies**.
- Performed **grid scale technology research** on carbon capture, long duration energy storage (including Upper American River Project (UARP) pumped storage) and alternative fuels.
- Secured and solicited several **solar and storage renewable projects** targeted for mid-decade completion.
- **Expanded existing and piloted new customer programs** to electrify and decarbonize Sacramento.
- Implemented a comprehensive **communications, marketing, outreach and education plan**.
- Formed a team and developed a framework for a **community impact strategy** to ensure under-resourced community participation.
- Identified opportunities and processes for **financial savings**, including establishing a robust **grant and partnership strategy** to fund our pathways to accomplish the ZCP.



This report will review the 2021 accomplishments and the upcoming priorities for 2022.

2030 ZCP to be Filed with the California Energy Commission

SMUD developed the 2030 ZCP using a comprehensive Integrated Resource Plan (IRP) process, including a comprehensive and inclusive approach to public and industry stakeholder engagement. The final step in this process is to file the ZCP with the California Energy Commission (CEC), which we intend to do this year. This administrative regulatory filing meets our obligation under SB350 (2015), which requires SMUD and other utilities to file a Board adopted IRP at least every 5 years and places our ZCP IRP on the regulatory stage for the CEC to use in various planning and study efforts and allows visibility to the industry. SMUD last filed an IRP with the CEC in April 2019 meeting the initial IRP filing requirement, of which our 2030 ZCP will supplant. Staff will bring SMUD's IRP package for Board adoption in a few months as required by statute, prior to submitting the regulatory filing with the CEC.

Downward Trends on Greenhouse Gas Emissions in our Energy Supply

SMUD's Strategic Direction 9 (SD9) - Resource Planning, contains our goals for reducing Greenhouse Gas (GHG) emissions in our energy supply in addition to other resource planning directives¹. For example, SMUD's 2020 SD9 GHG goal was to reduce our emissions to 2.318 million metric tons (MMt), equivalent to a 34% reduction relative to our 1990 level emissions of 3.5 MMt. As shown in our SD9 Board Monitoring report for 2020², we exceeded this GHG reduction goal by reducing our GHG emissions 54% below 1990 emissions, or 1.624 MMt.

As described in our annual SD9 Board Monitoring report, GHG emissions reported in SD9 are adjusted or "normalized" for factors out of our control. This includes variations in hydro and intermittent resources as well as customer load that can increase or decrease our emissions. Normalization allows us to say, "If everything came out as expected, what would our emissions have been?" SD9 also adjusts for Renewables Portfolio Standards (RPS) compliance and use or banking of surplus renewable energy credits.

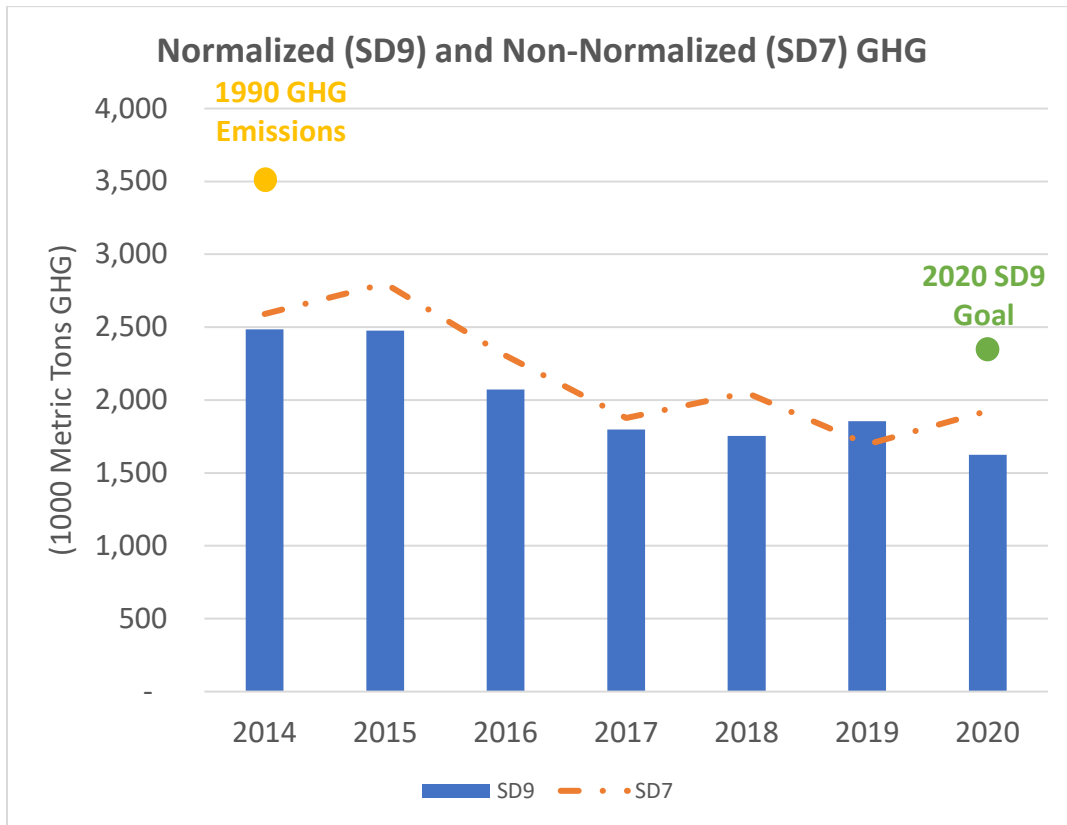
Alternatively, Strategic Direction 7 (SD7) - Environmental Leadership, reports our non-normalized GHG emissions in our energy supply. Under SD7, we report our actual energy supply GHG emissions to serve our customer's load, without considering variability in things like hydro or wind generation, or variations in load, things we do adjust for in SD9.

The graph below reports our emissions under SD9 and SD7 between 2014 and 2020. The differences between the two are the normalization and adjustment factors as described in the SD9 Board Monitoring reports. As illustrated in the graph below, our normalized (SD9) and non-normalized (SD7) emissions have been trending downwards over this period. Further, as

¹ SMUD's current Strategic Direction 9 language: <https://www.smud.org/-/media/Documents/Corporate/About-Us/Directives/Strategic-Direction/SD-9.ashx>

² SMUD's latest SD9 Board Monitoring Report: <https://www.smud.org/-/media/Documents/Corporate/About-Us/Board-Meetings-and-Agendas/2021/Sept/Updated---Final-SD-9---Resource-Planning-Board-Monitoring-Report.ashx>

illustrated, we have also made substantial reductions relative to our 1990 GHG emissions of 3.5 million metric tons.



**2021 SD9 and SD7 emissions will be finalized and reported in the SMUD Policy Committee meeting in September 2022.*

Over the last decade, SMUD has taken two very distinct actions supporting the achievement of our 2020 SD9 GHG reduction goal.

First, over the last decade, we added over 600 MW of new carbon free renewable energy to our portfolio. The table below summarizes the renewable resource additions, by resource type, that we've added to our resource portfolio over the past decade. It shows the downward trend on emissions and the approximate annual GHG emissions reduction impact from these clean resources.

Renewable Resource Additions 2010-2020

Resource Type	MW	Equivalent Annual GHG Emissions Reductions (metric tons)	Equivalent Light Duty Vehicles Removed from Road
Wind	378	512,014	110,586
Solar	182	163,216	35,252
Geothermal	51	134,432	29,035
Biogas/Biomass	19	47,541	10,268
Hydro	3	3,424	740
Total	633	860,626	185,880

**Approximate GHG reductions based on SMUD's thermal fleet average carbon intensity factor of 0.39 MTGHG/MWh.*

Second, in recent years our energy traders have made a concerted effort to identify and purchase low carbon or carbon free short-term market purchases from neighboring utilities. This has also contributed to the decline in our energy supply GHG emissions. While our energy trading team is committed to continuing the practice of identifying and procuring these low and carbon free purchases, market conditions will dictate the availability going forward.

In 2021, we added almost 200 MWs of new renewable resources and from 2022 onwards, have over 900 MW of zero emission resources in various stages of planning and development, with much more to be developed as part of our ZCP. Further, a significant number of our planned carbon-free resources are being developed locally, in support of our natural gas transition plan. With all these new carbon-free resources planned and with much more to develop as detailed in our ZCP, we expect our renewable percentage to exceed California's 2030 60% Renewables Portfolio Standard by nearly 30%. As a result, we expect our GHG footprint to continue to trend down in a significant manner as we make our journey to zero carbon in 2030.

Our emissions are trending downward, but we have much more work to do. As detailed in our ZCP, we are focused on completely eliminating GHG emissions by transitioning away from our natural gas plants, expanding proven clean technology, and exploring new and emerging technology and business models to achieve our very aggressive goals.

The following Natural Gas Generation Repurposing and Proven Clean Technologies sections detail our continuing efforts to reduce our GHG emissions in our energy supply on our way to 2030 Zero Carbon.

Natural Gas Generation Repurposing

Reliability Studies

From April through September 2021, a detailed reliability study analysis was performed and focused on two main areas:

- 1) **Thermal generator retirement** studies that evaluated McClellan and Campbell Power Plant retirements.
- 2) **Transmission planning system adequacy** studies that evaluated the ZCP, our load serving capability, and compliance with the North American Electric Reliability Corporation (NERC) Reliability Standards

Thermal Generator Retirement

A few key findings were identified in the reliability studies for the specific retirements of McClellan and Campbell Power Plants.

Retirement of McClellan would require between 70 and 110 MWs of dispatchable generation, such as battery storage, in the Northern Area of the SMUD service territory by 2024. The solution to this is adding a Northern Area Project in our service territory which is currently in the SMUD's new generation interconnection project queue with approximately 300 MW of solar combined with 150 MW of storage. This project would need to be prioritized to be online prior to the McClellan retirement planned in end of the 2024.

For the Campbell retirement, one of the necessary additions is already in process, which is the Sacramento Valley Energy Center (SVEC) that has a commercial operation date of 2024. In addition, the Campbell retirement would require an additional project (Northern Area Project) with 300 MW of solar combined with 150 MW of storage in the SMUD service territory by 2024, like McClellan.

Transmission Planning System Adequacy

For the transmission system adequacy study with all lines in service, SMUD's transmission system is adequate to implement the ZCP with the required special protection systems as an interim mitigation to meet NERC Reliability Standards.

For the 1500 MWs of local utility solar identified in the ZCP, transmission system upgrades are required such as special protection systems (also known as Remedial Action Schemes) or alternatives. RAS mitigation is considered an interim solution with less time to install and less financial commitment. For a long-term mitigation, SMUD's transmission upgrades are under evaluation to reduce and/or eliminate special protection systems to interconnect up to 1500 MW of local utility solar to improve SMUD transmission system reliability.

Two new RAS are needed to interconnect two new solar combine battery energy storage power plants -- the Sacramento Valley Energy Center (SVEC) and a Northern Area Project -- by 2025 in order to retire McClellan and Campbell thermal generation power plants. Each new facility will require a new RAS to be interconnected to the SMUD transmission system.

Post 2025 and when more new clean resources are added to the transmission system, additional RAS or alternatives will be needed and will be assessed on a project-by-project basis to ensure we meet reliability standards. The load serving capability is adequate to meet our forecasted load by 2030 and the transmission system complies with the regulatory reliability standards under SMUD's current ZCP.

Late 2020s reliability needs supporting thermal plant transition will be reassessed annually as we move forward. Many uncertainties exist such as new technology and business model development, market participation, load and distributed energy resource growth, hydro, and droughts, etc. Reaching 2030 Zero Carbon and beyond reliably could require additional resources and transmission buildout in addition to the original plan to support 100% replacement of our natural gas resources and unspecified market purchases as well as new grid scale technologies and business models.

Grid Scale Technologies Research

Significant progress has been made on the research plan presented to the Board a year ago. We hit every research area identified including Carbon Capture (both post combustion and pre-combustion), Long Duration Energy Storage, UARP Pumped Storage and Alternative Clean Fuels. These resources hold the potential to completely decarbonize our energy supply. We have gathered and analyzed this information, made decisions and pivots, and identified areas for deeper focus.

Carbon Capture – Post-Combustion

On September 7, 2021, the SMUD Board heard from a panel of representatives from the Electric Power Research Institute (EPRI), Stanford, and the Clean Air Task Force. They discussed various aspects of Carbon Capture and Sequestration. The topics covered included an update on current technical research and development activities from EPRI, an examination of potential sequestration sites in the Central Valley and across SMUD's territory, a look at the economics of Carbon Capture and Storage, and the potential to apply this technology to SMUD's ZCP.

Carbon Capture – Pre-Combustion-Net Power Allam-Fetvedt Cycle:

The Net Power Allam-Fetvedt cycle was the hot topic going into last year's examination phase. The Allam-Fetvedt technology is a proprietary process for efficiently generating electricity from natural gas while capturing all carbon dioxide (CO₂) emissions. Shortly after discovery through an employee suggestion, we asked NET Power to examine a potential pilot project in the 25MW

range. SMUD staff, EPRI, and a third-party independent consultant of experts (the bond engineers that know our power plants) did a deep dive into the NET Power offering, including the review of engineering and financial documentation provided by NET Power, participation in EPRI's in-depth study, including a physical site visit to LaPorte, TX and access to real time testing being performed under EPRI's guidance.

Through these efforts in relatively short order, we determined that while promising, the Allam-Fetvedt Cycle is at a proof-of-concept stage and does not have a commercially proven technology. The La Porte test facility had not operated for any extended time period to prove availability, operations & maintenance or economic claims at this time. Through our investigation, we discovered NetPower's relationship with their turbine manufacturer had ended. Net Power's need to identify a new turbine manufacturer significantly impacts the timeline for the project to become commercially viable. When tied with sequestration, the Allam-Fetvedt technology promises to be one of the least expensive and most efficient dispatchable zero carbon energy solutions. And combined with a zero-carbon fuel, the process can provide a negative carbon result. Everyone we talked to and all the information we reviewed demonstrated that the technology is the real deal. However, the expectations we had of a commercially ready product came up short. NET Power's Allam-Fetvedt plant won't be ready for commercial development until they identify a new turbine manufacturing partner, have a new test turbine constructed and complete their process testing at the LaPorte site, which is likely still a few years away. We'll keep our pulse on their developments. The Allam-Fetvedt is not the only carbon capture technology, and we are exploring other projects in this area.

Long Duration Energy Storage (LDES)

Our ZCP includes a significant commitment to energy storage, and lithium-ion batteries alone are not likely to meet our entire need. SMUD engaged with Black & Veatch, an industry leader in the LDES field, to perform an industry scan and help us narrow our focus for future development to those technologies that have the most potential for successful growth. Black & Veatch looked at many different types of LDES technologies. They assessed options from every category of storage medium, conducting further analysis on many technologies that had potential applications to SMUD's ZCP. The analysis included both quantitative and qualitative analysis of technical readiness level, manufacturing readiness level, geographic restrictions, operational (return) efficiency and economics (capital and levelized energy costs).

In the end, Black & Veatch recommended six technologies for further examination and pursuit. Pumped hydro is well established and may be available in a non-FERC (Federal Energy Regulatory Commission) jurisdictional application outside of SMUD territory. Liquid Air Energy Storage shows great promise as an infill application with low initial capital costs with the ability to easily expand energy storage duration. Antimony based battery systems are still in the early commercialization stages, but show immense upside for cost control, safety and ability to operate without significant capacity loss. Advanced Compressed Air Energy Storage is geography specific, but there is a project in California that may be of interest. SMUD has done much research into flow batteries and as that technology continues to advance, it may find a niche in our portfolio. Finally, zinc-based battery systems might be a suitable alternative to Lithium as they continue to develop.


Technology	Developers/Vendors
Pumped Hydropower Storage (PHS)	<ul style="list-style-type: none"> American Hydro Corporation (Currently owned by Wärtsilä) Andritz AG GE Renewable Energy Quidnet Energy
Latent Air Energy Storage (LAES)	<ul style="list-style-type: none"> Highview Power Storage MAN Energy Solutions SE
Antimony-Based	<ul style="list-style-type: none"> Ambri
Advanced Compressed Air Energy Storage (CAES)	<ul style="list-style-type: none"> Hydrostor
Flow Battery	<ul style="list-style-type: none"> Sumitomo Electric Industries Ltd. UniEnergy Technologies Redflow Limited ESS Invinity Primus Power
Zinc-Based	<ul style="list-style-type: none"> Eos ZAF Energy ZincFive Zinc8 NantEnergy

Learning and building off our efforts with Black & Veatch, we plan to continue pursuing LDES in 2022 through Non-Disclosure Agreements and the issuance of a Request for Information to the six recommended technologies with the hope that we can enter more specific discussions with each vendor and potentially choose a pilot project for implementation.

UARP Pumped Storage

One of the concepts we hoped to get clarity on in 2021 was potentially using existing SMUD reservoirs in a pump back arrangement to store and ultimately increase the amount of energy the Upper American River Project (UARP) can generate each year. In 2020, Mesa Associates, Inc. (Mesa) had looked at all UARP reservoirs and came back with a recommendation to look at two specific locations where pump back hydro might be feasible. In 2021, we tasked Mesa to continue with this work and develop final site recommendations for conversion of the Jones Fork and Union Valley Powerhouses, provide Class 5 engineering cost estimates for each site, and develop 10% design submittals including major options for implementation.

Mesa’s study of the Union Valley and Jones Fork powerhouses showed that the water depth below each generator outlet was insufficient to support a return pumping system. In order to make the pump back system work, new piping would have to be installed to allow proper water depth for the return pumps. With this piping and pump system in place, Mesa found significant energy can be stored at each location. The new penstock piping requirements add significant cost to the project, but it still returned a calculated levelized cost of storage that was in line with other long duration energy storage options at current pricing.



Union Valley Powerhouse	Jones Fork Powerhouse
45MW capacity	11.5MW capacity
New Penstock required (1,450 ft.)	New Penstock required (1,220 ft. or 5,000 ft.)
272 MWh/day potential energy storage	139MWh/day potential energy storage

With these results in hand, we will hand Mesa’s work off to an in-house team charged with turning this information into an official SMUD project proposal for evaluation through our Enterprise Prioritization process and comparison to other energy purchase or development options.

Alternative Clean Fuels

Finally, we narrowed our focus on alternative fuels that we can design our thermal plant retooling efforts around. The gas turbines at Procter and Carson can burn many different types of fuel, but not all reconfiguration efforts are equal, so knowing what to prepare for will make the redesign efforts go much smoother. To that end, we engaged with AECOM, a leader in this space to help guide us through an analysis of the alternate fuels market.

After reviewing many fuel types including Naphtha, bio and renewable diesel, various synthetic gasses and ammonia variants, AECOM recommended that we concentrate our efforts on Renewable Natural Gas with blended hydrogen. All other options are either cost or infrastructure prohibitive – there’s either just not enough of it, it has emissions concerns, or we won’t be able to compete with the transportation industry for product. AECOM’s research showed a sharply declining cost curve for hydrogen leading to potential cost competitiveness by 2030. Combining our current contracts for RNG blended with hydrogen provide for a low carbon dispatchable option using existing projects that may help us meet our 2030 goal.

Rather than build fuel projects directly, AECOM recommended that we use a virtual approach and procure fuel through contracts, leveraging our pipeline and storage capabilities to shape our fuel supply. Our alternative clean fuels pathway will be to continue to monitor these emerging fuels while being prepared to take actions toward cost effective opportunities that are identified.

2022 Priorities

Our next steps for 2022 will be to:

- Finalize retirement and conditional availability plan for McClellan and Campbell.
- Determine the Carson Simple Cycle Conversion Plan, including performing a Battery Hybrid application
- Perform targeted and in-depth research on LDES (including pump back hydro) from the studies short list and determine a potential pilot.
- Monitor developments in alternative fuels.
- Finalize Concentrated Solar Power plus Thermal Energy Storage technology study.

Proven Clean Technologies

Renewable Project Update

2021 was a busy year. From a planning standpoint, we performed a lot of analysis, studies, outreach, as well as a competitive solicitation. The results were the development of a number of projects, including the Drew Solar Power Purchase Agreement (PPA) for 100 MW with a commercial operation date (COD) of 2022, as well as completing the PPA for the Sacramento Valley Energy Center Solar and Storage Project (SVEC), about 200 MW of solar and 100 MW of battery with a COD of 2024. Additionally, the Sloughhouse Project is a smaller project for 50 MW with a COD of 2023.

Lastly, we are partially through the evaluation of a number of offers for the Northern Area Project, which is in our north service territory. As determined from the reliability studies, the Northern Area Project is necessary to retire McClellan and both the Northern Area Project and SVEC are necessary to retire Campbell. In 2021, we released a Request for Qualification (RFQ). Offers came in at the end of February 2022 and final awards are expected sometime in May. For 2022, in addition to managing the RFQ for the Northern Area Project, we will be launching a second competitive solicitation for additional proven clean technologies.

As we move into the mid-decade, there is a bulk of the ZCP resources identified for the 2025 to 2028-29 timeframe. Much of the negotiation and analysis will be kicked off in 2023 to be able to achieve those goals. There's a fair amount of work to be done between now and the middle to end of the decade. Specifically, more analysis needs to be done around firming up our resource plan, siting of local utility solar and storage and all the interconnection studies, and several different delivery options of non-local renewables and what it means from a transmission study analysis and market rules. We will also be studying low hydro impacts in conjunction with the reliability studies and determine what that might mean from an energy supply standpoint between now and the end of the decade to meet the ZCP.

Our new renewables by 2025 will reduce carbon by nearly 1 million metric ton (MT) (almost 50% of current carbon footprint) and allow us to retire both McClellan and Campbell Power Plants. We are going to double our RPS resources (based on energy) and meet about 25% of our total energy sales with new renewables coming online in the next 3-4 years, 11% above the

2024 44% RPS requirement and well ahead of schedule to achieving the State's 2030 60% RPS requirement (our ZCP is shooting for ~90% renewable by 2030).

The new resources in the next 4 years will provide enough energy to power 300,000 homes, an estimated carbon reduction of about 1,100,000 metric tons per year, the equivalent of removing about 230,000 gasoline cars from the road.

The new resources include the following in the calculations above:

- Geothermal (100 MW Geothermal)
- Drew - NTUA (100 MW Solar)
- Solano 4 (91 MW Wind)
- SVEC (200 MW Solar + 100 MW Battery)
- Sloughhouse (50 MW Solar)
- Northern Area Project (344 MW Solar + 170 MW Battery)

New Technology & Business Models



Building Electrification & Energy Efficiency

Encourages customers to decarbonize their homes and workplaces, including reducing electricity usage and/or converting from gas to efficient electric appliances and equipment.



Transportation Electrification

Special rates and incentives that make it more affordable to buy and power electric vehicles for homes or businesses and support infrastructure development and managed charging.



Load Flexibility

Creates opportunities for customers to reduce load during times when the grid is under stress or increase load when there is excess renewable power.



Thermal Transition

Research into alternative fuels and storage technologies as clean, reliable generation solutions to enable the retirement or retooling of our thermal plants and support our transition to a carbon free generation resource mix.

The technologies and business models in this section encompass a wide variety of programs and projects that in aggregate comprise an important set of resources and activities associated with delivering on the goals of the ZCP. For the purposes of this report, these have been grouped into 4 “portfolios” comprised of programs and projects with generally common objectives and goals.

Each of the portfolios is described in more detail to follow, but some additional context is provided here:

- The programs and projects in each portfolio are based on their primary goals and objectives, however, there are plenty of cross-cutting programs that include multiple technologies and services from multiple portfolios. One example of this is our Complete Energy Solutions program for commercial customers. While that program focuses on electrification and energy efficiency, it also includes electric vehicle charging and load flexibility components that are presented to customers based on

their needs and wants. The point here is that we can meet our customers' needs in multiple ways and try to meet them where they are in their decision-making process and in the channels and methods that they prefer.

- Many programs and services encompass a variety of options, delivery methods, marketing messages, and approaches based on customer segmentation and preferences. Some clear examples of this are programs and services provided for low income or disadvantaged communities and our partner agencies. Some of these are implemented and delivered by our partners in the Customer Experience Delivery and Sustainable Communities organizations and will be described in more detail later.
- The portfolios encompass a total of about 30 customer programs and roughly equal number of research and development projects and studies planned or in flight for 2022. Some of the key programs and projects associated with each are listed in the following sections categorized by residential or commercial programs and research and development pilots or projects.

Building Energy Efficiency and Electrification

Residential Programs	Commercial Programs	Research & Development
<ul style="list-style-type: none"> • Advanced Home Solutions ➔ <ul style="list-style-type: none"> • Contractor driven program for sealing, insulation, heating & cooling, and water heating incentives. • Home Electricity Reports ★ <ul style="list-style-type: none"> • Personalized electricity use reports with a focus on carbon. • Home Appliance Rebates <ul style="list-style-type: none"> • Retailer incentives for efficient products and appliances • Customer incentives for induction cooktops. • Zero Carbon Weatherization ➔ <ul style="list-style-type: none"> • Direct install retrofits for EAPR customers. 	<ul style="list-style-type: none"> • Integrated Design Solutions ➔ <ul style="list-style-type: none"> • Builder incentives for commercial new construction. • Smart Homes ➔ <ul style="list-style-type: none"> • Builder incentives for residential new construction. • Complete Energy Solutions ➔ <ul style="list-style-type: none"> • Turnkey program for comm. retrofits. • Custom Retrofit ➔ <ul style="list-style-type: none"> • Incentives for large and/or specialized projects. • Express Energy Solutions ➔ <ul style="list-style-type: none"> • Menu based incentives for individual measures and retrofits. • Multifamily Retrofit ➔ <ul style="list-style-type: none"> • Apartment owner incentives for energy efficiency and electrification. 	<ul style="list-style-type: none"> • Technology Assessments ★ <ul style="list-style-type: none"> • 120V Heat Pump Water Heater Trial • St. Francis Manor Central HPWH • Commercial Kitchen Electrification • Grid Infrastructure needs in support of electrification • Industry Association Support <ul style="list-style-type: none"> • Advanced Water Heating Initiative • Electric Power Research Institute • Emerging Technologies Coordinating Council (EETC) • Consortium for Energy Efficiency-Emerging Technologies Collaborative • Codes and Standards <ul style="list-style-type: none"> • Policy development for state building and appliance regulations.

★ = new program ➔ = expand program

Strategic Alignment: SD-9 & SD-10



The Building Electrification and Energy Efficiency portfolio represents one of the more mature and long-standing portfolios, although over the past two years and in response to the zero-carbon plan, has been redesigned with a much heavier focus on beneficial building electrification. While our focus on energy efficiency remains steady and relatively flat over time, development and implementation of the building electrification programs and projects are planned to see a significant increase year over year to meet the goals of the ZCP.

Many of the programs in this portfolio are being expanded relative to prior years with an increasing focus and goals on electrification. Just to speak to a handful of programs and projects:

- The **Advanced Homes Solutions** program is our flagship residential contractor-driven program in this portfolio, which provides rebates and incentives across multiple

measures and technologies to encourage homeowners to improve the energy efficiency of their homes and convert heating and water heating equipment from gas to electric. In 2021 ~1400 HVAC gas to electric conversions took place through this program and for 2022 our goal is to increase this to ~2000.

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- On the commercial side of our programs, the **Integrated Design Solutions** and **Smart Homes** programs are key areas of focus to encourage and accelerate the development and construction of all electric or electric ready commercial and residential developments in our service territory by working with and providing incentives to developers and builders. In 2021 the Smart Homes program saw ~280 single family (SF) new homes and ~300 new multi-family (MF) units completed. In 2022 our goal is to more than double these numbers to ~700 SF all electric homes and ~600 all electric MF units.

In 2021, this portfolio achieved a total of ~100 GWh of savings from energy efficiency and this will remain relatively similar in 2022 with an expected savings of ~110 GWh. For building electrification, we ended 2021 with ~18 equivalent GWh from the building electrification elements of the portfolio. For 2022, our projected targets are to achieve ~27 equivalent GWh representing a 50% increase from these measures.

Equivalent GWh in this case is calculated as the amount of gas savings from electrification measures in Therms, converted to GWh, less the increased electrical load.

Some of our key Research & Development efforts for 2022 are focused on exploring technologies that are needed to facilitate the transition to electric water heating in residential and commercial buildings as well as supporting electrification of commercial kitchen applications. Key projects include:

- **120V Heat Pump Water Heater (HPWH)** trial – This project is part of larger national effort to evaluate and test this emerging technology option for heat pump water heaters and investigate the customer experience and viability as a low-amp option to facilitate gas to electric retrofit installations with fewer/cheaper electrical infrastructure upgrades
- **Commercial Kitchen Electrification** – We plan to monitor pre/post electrification retrofit at a commercial kitchen and develop a case study to document experience, performance, costs and challenges. This study will be a contributing element to a broader plan to cost-effectively address this segment, which has some significant technical and economic barriers to decarbonization.
- **Grid Infrastructure** – This study and analysis will assess building infrastructure needs to support full electrification of buildings, transportation, and addition of battery storage, beginning with our residential single-family segment.
- **Statewide Code & Standard (C&S)** support – This includes active participation in Title 24 Building Standards transition to encouraging all-electric opportunities construction, as well as support for Title 20 Appliance Standards and Federal Standards Advocacy.

Transportation Electrification

Residential Programs	Commercial Programs	Research & Development
<ul style="list-style-type: none"> • Charge @ Home ★ • Home charger install rebates. • Drive Electric Outreach Events ⏻ • EV Support Program <ul style="list-style-type: none"> • Online and telephone support for residential customers for all EV and EVSE related questions. • Dealer Engagement <ul style="list-style-type: none"> • Sales staff education + incentives. • Clean Fuel Reward <ul style="list-style-type: none"> • Statewide install rebate at point of sale. ⏻ • Clean Cars for All <ul style="list-style-type: none"> • EVSE installs for low-income customers. • Renewable Energy for EVs • EV Off-Peak Discount Rate 	<ul style="list-style-type: none"> • SMUD eFuelSM ★ • Advisory and installation services for commercial charging systems • Commercial EV Program ➡ • Vehicle and charger incentives for fleet, workplace, multifamily, schools. • LCFS Credit Sharing ➡ • Share proceeds from credit sales with eligible Commercial customers. • Commercial EV Pilot Rate ★ • Rate that address demand charge barriers for EV charging • CALeVIP <ul style="list-style-type: none"> • State incentive program for charger installations in commercial buildings 	<ul style="list-style-type: none"> • Electric school bus Vehicle-to-Grid ★ • Utility initiated discharge from battery to grid. • Residential/Light duty Managed Charging pilot ★ • eMobility Hubs in DACs ➡ • CEC Reach grant applications for EVSE installations in underserved or DAC multifamily dwellings ★ • Charging technology assessments • Equity and accessibility research • Modeling & Certifications of Low Carbon Intensity (LCFS) Electricity Pathways and Electric Renewable Identification Number (eRIN)

★ = new program ➡ = expand program ⏻ = reboot program



The Transportation Electrification portfolio of programs and projects will see a significant growth in scope and the addition of some key new programs and projects this year. Some background and general observations to provide context on this portfolio:

- Funding from the sale of Low Carbon Fuel Standard (LCFS) credits accrued to SMUD pays for the majority of the programs in this portfolio. LCFS funds are required to be utilized for the promotion of electric transportation options and solutions for customers.
- LCFS rules also mandate that a certain percentage of the funds be dedicated towards promotion of electric transportation in disadvantaged and/or low-income communities and customers. The percentage for 2022 is 30% of residential base credits remaining after funds allocated to the California Clean Fuel Rewards program is first calculated. This percentage and climbs to 40% in 2023 and tops out at 50% in 2024.
- We are collaborating with the Customer and Grid Strategy teams on updating and developing a comprehensive Electric Vehicle (EV) strategy and plan which will be presented to the Board in April and will include additional detail and information on our plans going forward.
- In general, our first couple of years of the efforts in this portfolio have been focused on customer education and getting cars in driveways. Starting this year, a significant added focus of this portfolio is to get chargers in home garages and businesses.
- In 2021 ~400 EV chargers were installed through our programs and in 2022 we expect to more than triple that with a variety of residential and commercial installations across different customer segments and applications.
- We also estimate an increase of ~23% in the number of EVs in our service territory as more models become available and some of the supply chain constraints ease. In terms of numbers, that estimate would see an increase from ~23,500 to ~29,000 total vehicles. Sales of EVs in CA have now risen to 12% of all new vehicles sold annually.



Program Highlights:

- **Residential Charge @ Home:** An initial launch of this new residential program took place in January, which provides incentives for residential customers to purchase level 2 chargers and install them in their homes. This program will be expanded and paired with our Advanced Home Solutions program and contractor network over the next few months with a goal of 800 installations this year.
- **SMUD eFuel:**
 - *Advisor* component launched this year to deliver a no-cost, customized analysis of fleet and businesses' electric transportation future. The program is focused on businesses with fleet vehicles and employee parking as well as multifamily dwellings.
 - *Solutions* is an installation service that removes key barriers of vehicle electrification by offering SMUD's technical expertise, project management experience and bulk pricing. Businesses that choose to move forward with EV charging solutions will receive a no- or low-cost installation in exchange for a monthly fee on a SMUD bill. This portion of the program is targeted for launch in Q2 of this year and is currently in the Request for Proposal (RFP) stage.
- **Twin Rivers Unified School District Commercial Managed Charging (V1G and V2G) and expansion of V2G:** The Twin Rivers Unified School District (TRUSD) has 16 electric school buses in their possession equipped with technology that enables discharge of the bus battery through a compatible charger to their facility loads or grid. The bus electrification was supported by state grants awarded to the TRUSD. TRUSD, SMUD, and other partners were recently awarded the CEC BESTFIT grant to demonstrate intelligent charging functions such as Automated Load Management (ALM), Managed EV Charging (V1G), and Vehicle to Grid discharge (V2G). ALM helps customers reduce their electricity bill by charging more off-peak cost time periods, reducing demand charges, and possibly avoiding local distribution upgrades. V1G provides demand response and load shifting services to the utility. V2G can allow EVs to behave in a similar way as a utility controllable stationary battery storage system. In 2022 the V2G charger installation will be completed. V2G testing will also begin and extend into the following year. A follow-on project is proposed to extend this electric school bus V2G demonstration to potentially 2-3 other interested school districts.
- **Light Duty Residential Managed Charging:** This pilot will focus on residential EV charging to soften the grid impact of nighttime charging on the grid and favor consumption of lower cost cleaner daytime energy (solar overgeneration). Vehicle telematics compatible with GM, Ford, and BMW vehicles will be used to time charging. Use of telematics does not require replacement of existing customer chargers with a smart charger which greatly simplifies customer enrollment. 1,000 customers will be targeted for this pilot over the next two years and both Level 1 (120V) and Level 2 (240V) charging will be allowed. The intent of softening grid impacts is to avoid overloading service transformers and their upgrades, reducing the

cost of transportation electrification. Consuming lower cost cleaner daytime energy will optimize the economics for significant decarbonization of SMUD’s energy supply planned in the ZCP.

Load Flexibility

Residential Programs	Commercial Programs	Research & Development
<ul style="list-style-type: none"> • My Energy Optimizer (formerly Virtual Power Plant) ★ <ul style="list-style-type: none"> • Partner: Aggregates loads from participating smart thermostats and battery storage units (and potentially EV’s) for load shed events. Includes integration with CPP rate. • Partner+: Aggregates loads from direct control of participating customer-sited battery energy storage systems. • Behavioral Demand Response (BDR) <ul style="list-style-type: none"> • Pilot program to test customer response to load shed events • Next Gen ACLM – Planning <ul style="list-style-type: none"> • Two-way cycling devices for AC load management/control 	<ul style="list-style-type: none"> • PowerDirect® ➔ <ul style="list-style-type: none"> • Load reduction through pre-programmed and automated control of selected equipment. • StorageShares <ul style="list-style-type: none"> • A virtual alternative to on-site battery storage for customers that provides bill savings while also providing grid benefits to SMUD 	<ul style="list-style-type: none"> • Smart inverter testing <ul style="list-style-type: none"> • Test feasibility of smart inverters to provide grid services. • PRECISE software development deployment to allow customized PV smart inverter settings for interconnection • Smart Energy Optimizer (SEO) <ul style="list-style-type: none"> • Pilot project with a small number of customers that allows SMUD to dispatch 51% of battery capacity • PowerMinder <ul style="list-style-type: none"> • Pilot project with residential customers to test load shifting with Wi-Fi connected heat pump water heaters

★ = new program ➔ = expand program



Perhaps the portfolio that is anticipated to see the most significant change and focus is our Load Flexibility suite of programs and projects. The ZCP includes a heavy emphasis on planning and implementing programs that take us much further than we have in the past in promoting, expanding and tapping into Distributed Energy Resources and sharing the values of these with our customers. While we do have some long-standing and mature “Load Management” programs (for example our ACLM/Peak Corps program has been in continuous operation since the late 1970’s), these have typically been utilized primarily for emergency load curtailment or for very limited economic dispatch events.

Starting this year, we will be implementing some significant pilot programs to begin to build out and test the scope and reliability of our “Virtual Power Plant” initiatives, which we’ve named “**My Energy Optimizer**” after receiving input from customers.

Over the next few years, the results from these pilot programs will be a critical factor in determining the balance and need for additional resources necessary to support the retirement or retooling of our thermal plants. If we are successful in making electrification attractive to our customers, having access to shared use of controllable loads will reduce the need for additional generation and provide grid support that will reduce the need for distribution system upgrades.

My Energy Optimizer (Virtual Power Plant):

- SMUD will launch two new offerings in 2022. The Partner level will accommodate thermostats, batteries with a Critical Peak Pricing (CPP) rate, and eventually EVs. The Partner+ level will be battery only.



- Virtual Power Plants (VPPs) are aggregated, controlled distributed resources (such as storage, solar, EV charging and demand response or load flexibility) to meet utility demands and replace some of the services typically provided by traditional generation sources. VPPs are a way of sharing resources and value with our customers to achieve a carbon free portfolio. Because this approach to load management will serve a critical role in our thermal transition plan, we need to launch and test them quickly to allow time to course correct before we scale widely as adoption of EVs and storage take off.
- 2022 will be a ramp up year with the goal of enrolling approximately 10,000 customers by the summer of 2023.
- Uplight was selected for the Partner level (formerly known as the Multi-DER VPP) and they are currently in launch preparation mode.
- The program will serve as the gateway for customers to enroll on the new CPP rate and allow enrolled devices to be automatically adjusted during CPP events, which provides SMUD with reliable load flexibility and the customers automated participation to reduce the impact of events, as well as financial incentives for enrollment and continued participation. Load flexibility and scaling programs like the Multi-DER VPP is crucial to meeting SMUD 2030 ZCP.
- My Energy Optimizer is residential only. Eligible devices are smart thermostats and storage.
- The second My Energy Optimizer level is Partner+ (formerly the Storage Virtual Power Plant). The solicitation has been released and the program is planned for launch in summer 2022.
- The program may also include commercial customers depending on the type of implementer chosen through our solicitation process.
- My Energy Optimizer will focus on battery energy storage and smart thermostats at the onset, but these programs are built to accommodate multiple distributed energy resources in the future such as EVs, EV chargers, AC switches, and more.

Behavioral Demand Response (BDR)

In 2021, we ran a successful BDR pilot with approximately 50,000 customers to determine customer response and load shed potential over the course of multiple events during the summer. In this pilot, customers are notified ahead of time of the need to reduce loads voluntarily and are then provided information on how they did relative to a cohort of similar customers. The pilot results showed promising results that we hope to build on in the future. In 2022, however, we plan to take hiatus with for BDR as we plan and launch our other VPP programs and look to examine how best to resume and scale the BDR pilot in future years.

Next Generation ACLM:

- This effort is currently prioritized for planning in 2022 with a proposed launch in 2023.
- It would install two-way controllable switches on ACs, replacing the long-standing PeakCorps or ACLM emergency load offering by offering greater grid benefit and customer experience.

PowerDirect

- PowerDirect is our auto-demand response program for C&I customers. We will be seeking to update this program with a new implementer in 2022 and are planning to incorporate additional options to help meet our 2030 goal.
- We're at 15.2 MWs for 2022 and the program is planned to be ramped up to 30 MWs by 2030 representing an average additional 2 to 2.5 MW of controllable load over the next 6 to 8 years.

StorageShares

Through StorageShares, customers enjoy the benefits of demand charge reduction through bill savings without the burden of battery storage installation, maintenance, and ownership. Customers purchase "shares" of utility scale battery systems operated by SMUD, installed at a beneficial location on the grid, and receive monthly bill credits over a 10-year contract term. Upfront funds received from participants help to offset costs of SMUD's utility-scale battery at the Hedge substation which provides the 4,400 shares for the program. The number of shares a customer is eligible for is limited to the potential benefit a physical behind-the-meter battery system could provide and is suited to help managed load shapes with high peaks (such as EV charging) but not for customers seeking back-up power

The Load Flexibility portfolio also represents an example of the intersection and crossover of program implementation with Research & Development. While the My Energy Optimizer programs represent large scale pilot programs that include a significant research element, several other more focused **Research & Development** projects are also included within this effort.

Smart Inverter Testing:

The PRECISE tool (PREconfiguring and Controlling Inverter Setpoints) co-developed by SMUD and the National Renewable Energy Labs (NREL) is going live this month as part of the interconnection process. PRECISE enables interconnection of more behind the meter (BTM) PV on the SMUD system while mitigating grid power quality issues and increased customer savings by leveraging advanced inverter settings. PRECISE enables PV smart inverter integration with the SMUD system and enhances the system's hosting capacity. PRECISE will help distribution engineers to seamlessly interconnect and integrate high penetrations of PV generation on today's grid in a safe, cost-effective, secure, and reliable way.

This year we are also launching a smart inverter project to test direct-connected and aggregator-connected smart inverters for their monitoring and grid support capabilities. We will also assess business models and relationships with third-party equipment and service providers. The project is intended to provide a test environment for DERMS development and testing.

Smart Energy Optimizer (SEO):

The Smart Energy Optimizer pilot that allows SMUD to dispatch at least 51% of battery capacity for residential customers with SolarEdge batteries will continue in 2022. The lessons learned from this pilot informed the development of My Energy Optimizer

Partner and Partner Plus programs, intended to replace SEO. These SEO customers will be given an opportunity to transition to My Energy Optimizer portfolio (Storage VPP) when that program goes live.

PowerMinder:

The PowerMinder pilot allows SMUD to manage and shift water heating energy use to different times of the day that can take advantage of lower rates or reduce loads on the grid. This pilot currently includes GE and Rheem controllable heat pump water heaters that include an automatic mixing valve. Early results from this pilot have shown the need for improving the technology and reliability of the control systems for these water heaters in order to increase the value and anticipated load potential contribution to the ZCP. The pilot will continue field testing as technology and communication system improvements are implemented in 2022.

Thermal Transition & Grid Services

Our research efforts for the ZCP fall within two pillars: Customer Solutions and Thermal Transition Solutions. This two-pillar structure was the basis for reorganizing our R&D team as part of the realignment process last year.

The Customer Solutions pillar includes the Building and Transportation Electrification and Energy Efficiency research projects while the Thermal Transition Solutions pillar includes the Utility-Scale Storage, Generation, and Carbon Capture and Sequestration. Load Flexibility is jointly addressed by both pillars because it seeks to displace the grid services associated with the Thermal Transition Solutions pillar but depends on customer uptake of emerging technologies that electrify transportation and other end uses associated with the Customer Solutions pillar.

Some of the Research and Development projects in flight include:

Hedge Utility-Scale Storage Project:

The Hedge utility-scale project is a 4 MW /8 MWh battery. It is SMUD's first utility-scale battery controlled by grid operations. Interconnected at 12 kV, this resource will be scheduled and operated by Distribution Operations via the Advanced Distribution Management System. A variety of distribution and bulk grid use cases will be tested as a learning opportunity for Power Generation and Distribution Planning and Operations.

SMUD solar port microgrid:

The solar port microgrid adds additional resiliency to the 175 kW high speed DC fast charger at the SMUD solar port that is already coupled to a car port solar PV array and 120 kWh stationary battery built from second life Nissan Leaf batteries. The battery at this site was previously used to cushion the DC fast charger's infrequent but intense demands on the electrical grid. The microgrid upgrades to this site will enable testing of islanding and the ability for charging to continue to be active if the grid power is down.

Carbon Sequestration Research:

We completed a carbon capture assessment at Cosumnes Power Plant (CPP) last year. This year we will perform a techno economic and geologic study at the Solano wind site for the potential for storage of CO₂ and Hydrogen Power to Gas.

To support Power Gen's evaluation of commercial readiness of the Allam-Fetvedt Cycle to capture carbon emissions, R&D facilitated participation in an EPRI project performing an economic analysis of the cycle, with final report expected around May 2022.

SMUD is partnering with EPRI and the Xerces society (focused on pollinator conservation) to help answer some key questions around whether the use of native plants and pollinators at local solar farms helps reduce operational costs concerning erosion and vegetation management and quantify soil carbon measurements to understand the relative impact and implications regarding SMUD's ZCP.

Research Studies and Assessments:

We have about two years to make decisions about thermal replacement solutions, given the long lead time to construct alternative grid-scale solutions and this is an important part of our overall research portfolio. Last year we completed a Long Duration Energy Storage (LDES) market and technology characterization as well as an assessment of alternative fuels. The next step will be to issue an RFI and look at possible pilots to evaluate technologies that have the potential of delivering LDES at a scale (for example energy storage of 100 MW for 10 hours). Further research on alternative fuels will take a deeper dive on shortlisted technologies such as Renewable Natural Gas and Renewable Hydrogen. The latter is specifically focused on research on hydrogen blending in collaboration with the National Renewable Energy Laboratory (NREL) and US Department of Energy.

Current and Projected Distributed Energy Resource Targets

The information below provides our current assessment of where we stand relative to the goals associated with our Distributed Energy Resource (DER) programs that correlate with some of the different portfolios described in this section and listed in the ZCP. These are described in terms of the metrics and units currently associated with each of the DER components:

Building Electrification

We are on track to meet the "Cumulative Equivalent All-Electric Homes" targets. In 2021 we completed building electrification installations resulting in more than 1,800 equivalent all-electric homes. For 2022, we will add another 3,600 which will meet or exceed our current planned trajectory.

For reference, an "Equivalent All Electric Home" does not require an individual home to be all electric. This metric considers the impact of electrifying individual devices and the aggregated impact at the community level. This metric is the combination of commercial and residential applications. Using 3,300 kWh as an equivalent home (an existing single-

family home is estimated to add 3,300 kWh of electricity post complete electrification). Note that a commercial building could be many existing equivalent homes and a new single-family home could be a fraction of an existing single family equivalent home.

Transportation Electrification

In 2021, there were 23,576 light duty EVs in operation in SMUD territory according to data from the Electric Power Research Institute (EPRI). This year we are expecting that number to increase to 29,000, which is a 23% increase. By the year 2030, we expect this number to jump to 288,000 light duty EV's in operation, which is more than a 1,000% increase from where we are today.

- Note: "in operation"- means new vehicles, used vehicles and vehicles that were sold- and is the EPRI term for the true number of EV's in our service territory.

Load Flexibility

In 2021, we added 5 MWs of new load from this portfolio. In 2022, we anticipate adding another 7 MWs primarily through the launch of our Virtual Power Plant (VPP) programs as well as incremental addition from remaining programs in this portfolio. By 2030, our net additional load flexibility resource is projected to jump to more than 360 MW's, which is a significant increase from where we are today. Most of this increase is planned to come from our VPP programs to manage customer-sited AC load, EV charging, water heating and storage. This value is the **Zero Carbon Plan Base Case MW Capacity** and is based on the baseline level of DER adoption sized to fill the resource gap needed to reach our ZCP goal.

Maximizing Community Benefits

Communications, Marketing and Outreach

2021 Goals and Priorities

Our job in 2021 was clear – to develop and implement a comprehensive communications, marketing, outreach and education plan. We had two goals: To create awareness of our zero-carbon goal and awareness of two key data points – that we live in one of the dirtiest air basins in the country and that Sacramento's childhood asthma rates are unacceptably high. This messaging helped solidify in people's minds why our zero carbon goal matters.

Secondary messaging was to reassure customers that we wouldn't waver in our commitment to providing safe, reliable and affordable power.

Phase 1 of our efforts started months before the ZCP was even in place. We've previously shared with the Board our outreach to customers in



virtual forums and listening sessions to road test our goal, messaging around the why and level set understanding and support. This data would help us inform our strategy for broad marketing, communications and outreach. We were sure to explain the broad benefits our vision and goal would provide to our customers and community. Key messages included:

- We live in one of the most polluted cities in the country and local asthma rates in children are higher than the national average.
- We are experiencing rising temperatures, which have a negative impact on our environment and the economy, creating a climate crisis that needs to be addressed. Under-resourced and low-income communities are impacted even more.
- While we're on a trajectory of improvement, we recognized that there's still more to be done and there's no time to waste. SMUD is in a unique position to help move the whole region along and be the example for others to follow.



Leading up to the formal launch of the ZCP and our overarching umbrella campaign, we actively listened to our community, collected their feedback and input and used that to inform our messaging and campaign. We directly connected with 1,500 customers, stakeholders and community leaders to get their input before the ZCP or campaign were launched. This included discussion panels at board meetings with industry experts, moderated stakeholder listening sessions, dozens of far-reaching as well as targeted virtual community meetings and even more outreach presentations at various community events, infusing our zero carbon education message into every opportunity that we could.

2021 Accomplishments

Immediately following the Board's approval of the ZCP in April 2021, we launched one of the biggest and most comprehensive campaigns in SMUD's history. Our umbrella "Clean PowerCity Campaign" was multi-language and multi-channel, and we introduced a lot of new things we'd never tried before. It stretched across traditional marketing channels and extended into our broader PR, outreach, education, social media and news media efforts. Everyone played an important part in sharing the message. We designed and implemented 2 iterations of the campaign last year to engage all of our customers and community, one in the spring and one in the fall. The umbrella campaign included TV, radio, community, regional and national print publications, outdoor and digital advertising, videos, sponsorships and other community



7k+ Clean Power My City t-shirts world-wide



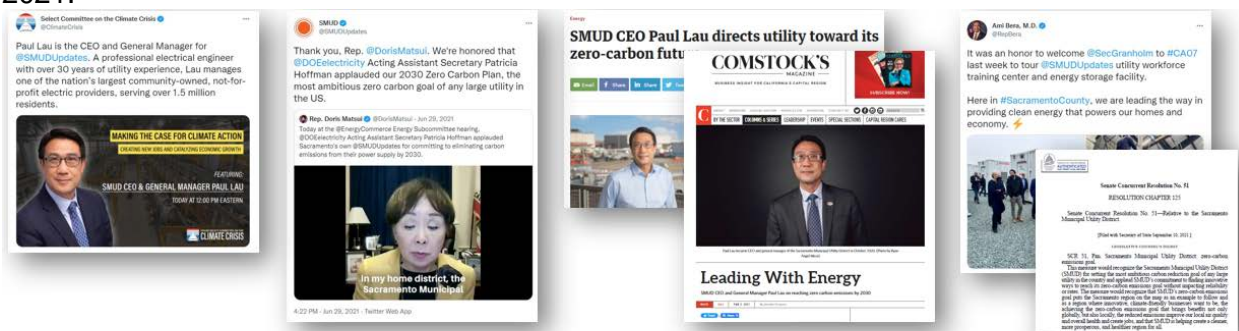
TikTok Challenge

\$6,500+ awarded in scholarships

5k+ Clean PowerCity champions joined the charge



events and partnerships. They supported our goal to make sure our customers and others were aware of our goal and why it's important. We used all the traditional tools in our tool belt, and tried some things too, particularly to connect with the younger generations and engage their passion for the environment. We launched our first ever TikTok challenge, which we believe is a first for a utility. In just 2 weeks, we received more than 22,500 engagements/likes/shares and 965 followers. We reimagined all of our green program marketing to align with our Clean PowerCity campaign, things like our EV and go electric campaigns. We encouraged our customers to Join the Charge, resulting in 5,000+ Clean Power City Champions by the end of 2021. Through email outreach, digital communications, social media, listening sessions, easy-to-use QR codes, community outreach and events, speaking opportunities, virtual forums and more – our ZCP and Clean PowerCity Campaign was infused into virtually everything we did in 2021.



52% Clean Energy Vision Awareness

90% Support Clean Energy Vision
Once customers are aware

#1 J.D. Power Syndicated Sustainability Study
2022 YTD for residential & commercial customers

When we step back and take stock of 2021, it's clear the message about our ZCP and industry leading goal was heard far and wide. From Paul Lau's invitation to testify in Congress about the far-reaching benefits of the ZCP, to accolades from Congresswoman Matsui, DOE Secretary Jennifer Granholm and more, our message reached far beyond the Sacramento Region. And we know this is critical to forging partnerships, securing funding and the like.

Locally, publications like Comstock's Magazine and the Sacramento Business Journal, showcased our innovative and inclusive approach to a clean energy future in feature articles.

And there was even a Senate resolution commending our ZCP and ambitious zero carbon goal. By the end of 2021, the momentum was growing in the form of visibility and support from our customers and community. By December, awareness of our Clean Energy Vision was 52%, a significant achievement in less than a year.

And of customers who are aware of our Clean Energy Vision, 90% support it.

In J.D. Power's 2022 mid-point Sustainability Study—which is an in-depth residential and business survey examining customer attitudes towards climate change, customer awareness of their utilities plans and levels of customer engagement and advocacy. SMUD ranked #1 out of 35 brands study throughout the nation.

2022 Priorities

As we saw in 2021, no single communication, marketing, education or outreach channel alone can achieve our goals. We're working on the creative for the second phase of our campaign. We set the foundation on why SMUD is doing this in 2021.

Now in 2022, we're transitioning our marketing, communications and outreach to focus on the things SMUD is doing to achieve our zero carbon goal and the things our customers can do to help us get there. We'll start by sharing what we're doing to reach our goals as an organization, for example how we're electrifying our fleet, installing more local solar and utility-scale battery storage and promoting the many other projects and programs. We know the Zeus trucks will hit our Fleet this year, and we're excited to showcase these exciting new developments.

We'll build upon the strong foundation created in 2021 and continue to tell the story of our 2030 Clean Energy Vision, why it's important, more specifically, what our customers and community can do to come along on this journey with us toward a clean energy future.

The next phase of our Clean PowerCity campaign is in development, and we'll deliver 2 more multi-lingual, multi-channel marketing campaigns this year, along with digital communications, targeted social media, continued research and ongoing listening sessions, virtual forums and digital focus groups. That continued outreach to hear directly from our customers will be important to ensuring our mass and segmented messaging resonates.

By the end of 2022, it's our goal to have more than 50,000 Clean PowerCity Champions signed up to Join the charge and support us on our journey toward a clean energy future.

As we continue to navigate out of the pandemic, we're looking to really leverage our community partners to maximize reach and participation.

We have a new partnership for the California International Marathon (CIM), and, of course, Museum of Science and Curiosity (MOSAC) and the Kings, in addition to many smaller partnerships will help us reach a range of audiences. Arts partnerships MOSAC and others will help us boost engagement in Clean PowerCity, with a focus on youth and families. Youth outreach includes partnerships with schools, clubs and nonprofits like Future Farmers of America and Safetyville. This will help us to expand our reach and engagement with younger generations. We'll continue to proactively showcase our goal and the work we're doing to reach our goal of zero here locally and beyond.

We're so appreciative that the Board has taken such an interest in helping us tell the story and encourage our customers to Join the Charge. You saw on a previous slide that there were more than 100 speaking engagements about Zero Carbon between the Board and Paul last year, and we're moving full steam ahead again this year.

SMUD employees have been trained as Clean Power Champions who'll take advantage of speaking opportunities where they can share more about our ZCP with our customers and

community. We'll also be developing an employee ambassador/advocacy program for social media. It will give our employees the tools to share out SMUD contact to their networks. We know people trust their friends, family and connections, so this is a great way for us to amplify our message and reach even more people. We will do this with our trained clean power city champions employees who will take advantage of speaking opportunities and employee ambassador program for social media.

Customers have been asking what they can do to help. With part 1 of our campaign successful in getting the word out about the goal and why it matters, we're excited to help our customers really join the charge. We are excited to bring all the programs in development to our customers. We know it's critical to meet our customers where they're at. Some of the things planned for 2022 include:

- Zero carbon volunteer projects in Board Ward areas.
- Community drives similar to the successful 2021 e-Waste drive.
- All-new neighborhood groups and Homeowner Associations efforts with partnership agreements and community events to support the Clean Energy Vision and get feedback on SMUD programs and initiatives.
- Focused, young adult/youth outreach and presentations including in-classroom, clubs and social media thought leadership/influencers to encourage the youth voice in amplifying Clean PowerCity Champions.

Just like 2021, we have some new things planned for 2022:

- A Clean PowerCity microsite – a one-stop shop for customers to learn more and Join the Charge.
- Transformer wraps and fleet vehicles with a Clean PowerCity message.
- Interactive digital tools to help customers learn about clean energy solutions.
- Road to Zero Carbon video series featuring SMUD employees.
- A new series of short-animated tips videos for customers of all incomes and types to implement for a cleaner environment.

This is a long-term and all-hands-on-deck effort. Our broad marketing, communications and efforts are integrated with our much more targeted efforts to reach specific segments. Getting the word out about what we're doing and where we're headed is going to take a collaborate effort to maximize our reach and impact.

Community Impact

We're proud to celebrate over 75 years of giving back to the community we serve by supporting efforts to improve the quality of life in our region. Two of the most prominent ways we do that is through:

Customer Experience Delivery:

- Provide a subsidized rate to households with <200% federal poverty level.

- Provide free energy efficiency and electrification education and solutions to qualifying households.
- Partner with a safety net of organizations to get the word out and increase our offerings.

Sustainable Communities:

- This community-focused program aligns with SMUD's core purpose and vision to enhance the quality of life for all our customers through innovative energy solutions. The program helps bring environmental equity and economic vitality to all communities in our service area, with special attention given to historically underserved neighborhoods.

2021 Accomplishments

In 2021 we continued to focus on reducing the bill burden of our customers most in need by:

- Providing 178 households with an energy bundle along with energy education.
- Electrifying four multi-family affordable housing complex with ~460 units.
- Completing 17 home rehabilitations including a combination of energy efficiency, weatherization and solar with our community partners.
- Collaborating with the Sacramento Metropolitan Air Quality Management District to provide 162 used electric vehicles through the Clean Cars 4 All Program.

Our Sustainable Communities program continued to support community partnerships, with an enhanced focus on 2030 goals an alignment by:

- Funding a record 36 Shine Award projects in support of advancing social well-being, healthy environments, economic prosperity, mobility and clean energy with a focus on under resourced communities.
- Educating 16,000 residential, commercial and K-12 students about how the 2030 plan benefits our community and on technologies and SMUD programs that put them in control of their energy costs.
- Hosting over 50 commercial education workshops target zero carbon and energy efficient strategies.
- Creating 1,000 equitable and inclusive workforce training and employment opportunities in partnership with local CBOs to meet the 2030 Clean Energy job needs and enable diverse communities to participate in the clean energy economy.
- Funding the development of a e-mobility hub to serve our customers in under-resourced communities, while helping site two hub opportunities leveraging the data gathered from our Sustainable Communities Resources Priorities Map, our Customer Experience Delivery and IT teams.



- Launching of two community electrification education pilots in Oak Park and Curtis Park.
- Maintaining a community partnership network of over 135 neighborhood local organizations to ensure two-way communication about how to ensure the 2030 plan is inclusive.

We met with several external organizations in 2021 and moderated stakeholder listening sessions with specific groups to see gather feedback in response to our ZCP. During these listening sessions we heard some consistent themes as shown below:



Based on this feedback, we identified a clear need to develop a comprehensive Community Impact Plan that will guide SMUD 's commitment to making a meaningful and impactful investment in under-resourced communities, while ensuring their participation in a clean energy future. This plan will leverage the strong relationships SMUD has built with its commercial, residential, and community-based customers and partners as a means of tailoring programs, messaging, and partnerships to meet the customers" where they are" as it relates to need for and execution of our 2030 Carbon Zero Plan. Having neighborhood-based ambassadors will help ensure that all communities are included in the zero-carbon economy.

We formed a multi-disciplinary team to develop the Community Impact plan in late 2021 and expect to have the plan finalized before the end of 2022.

2022 Priorities

The term "under-resourced" refers to a diverse group of customers with their own unique set of challenges and barriers to being an active participant in SMUD's ZCP. As residential customers, they include households with low/median income, minority communities and renters who face a variety of challenges around participating in a clean energy future – lack of income, high energy burdens, inadequate housing, cultural/language barriers. Additionally, under-

resourced communities are often more impacted by the negative environmental impacts associated with climate change, and further burdened by lack of substantial infrastructure, education and career training opportunities, and institutional presence needed to fully engage in the clean energy space.

Based on the community feedback received, it's clear that our recommendations need to align on along the issues that matter most to them: affordability, equitable access, and community engagement/education.

Traditionally, the benefits of and access to clean energy sources have not been equally shared. Higher income residential homeowners and businesses who own their properties with access to financing represent the majority of participants in energy efficiency and electrification programs.

The cost of investing in electrification technology represents an immense obstacle for under-resourced communities. Low-income households use more than twice the proportion of their total income on food, energy and household needs as high-income households. In short, if one can't afford to keep their lights on, they likely can't afford housing, let alone upgrades to their housing.

Furthermore, the poor structural condition of their property, limited access to financing, and the challenges posed by rental housing create additional barriers for under-resourced communities to participate in the benefits of a clean energy economy.

Compounding matters, under-resourced communities also lack equitable access to many other essential community components necessary to ensure a high quality of life, such as access to transportation, livable wage employment and training opportunities, economic development, education opportunities, digital access and a healthy environment.

With inflation increasing at its highest rate in over 30 years, and Sacramento now one of the least affordable housing markets in the nation, an even higher proportion of their income will go towards necessities further exacerbating the wealth gap that currently exists.

To address equitable access SMUD intends to:

- Invest in Sacramento's low-income housing stock with clean energy technology.
- Reduce cultural and language barriers to clean energy technology adoption.
- Build capacity of community-based organizations who can help magnify our reach and deliver services.
- Increase access to economically mobile careers and ensure that regional workforce development solutions are available to all our communities.
- Community Engagement/Education.

Given the community feedback and insights that were heard in the listening sessions, some customers do not understand what it means to be zero carbon, why it should matter to them

(personally) and how they can participate that specifies what actions can they do now (and in the future), given their unique income, housing and/or cultural challenges.

SMUD intends to address each of these areas through a combination of:

- Expanding current programs and services.
- Modifying/developing programs for customer segments that don't currently have programs tailored for them (including workforce development efforts).
- Investing in the support services (education, outreach, language translation services) that may be needed to be successful.

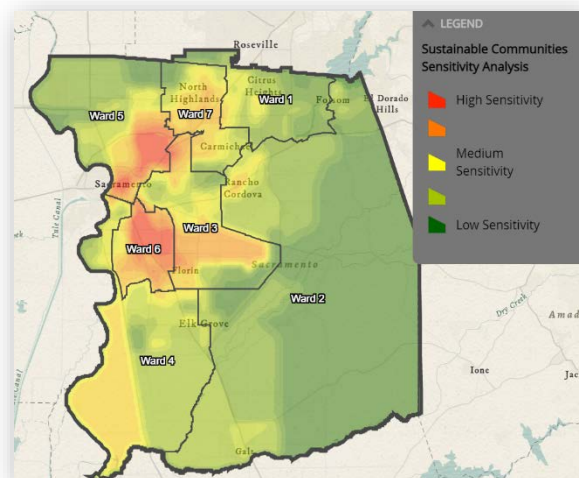
We are already starting to implement changes in how we operate our current programs based on the feedback from key stakeholders. For example, we've mapped every residential and commercial customer that are in the disadvantaged areas (as identified here)

For the 300 or so electrification projects we complete each year, we're in the process of narrowing down one community or neighborhood to electrify homes. Once we have selected a neighborhood, we will plan do the following:

- Electrify 200 to 300 homes in a concentrated area
- Identify neighborhoods most in need based on geography, age of home, energy burden, % of EAPR customers, etc.
- Engage the community to create support and recruit homeowners and property owners.
- Plan retrofits in clusters based on age and layout of home (for economies of scale).
- Assign contractors to perform direct installation of equipment.
- Educate the community on the many benefits, operation and long-term maintenance needs, and monitor energy use.

This community microtargeting based on need is extending to our community partnerships and sponsorships and program delivery. Through identifying grassroots local community champions through CBOs and neighborhood stakeholders, we will expand the capacity of existing aligned 2030 programs to meet the education and implementation needs of the 2030 plan. These partnerships will help us address the following priority initiatives:

- Equityfocused Autonomous Vehicle Racing Program- K-12 Title 1 school focused engineering program that provides both jobs for the instructors and green jobs training.
- Power Partners Program- Community electrification education pilot focused on peer to peer engagement and education.



- MBARK Partnership- Collaboration of local chambers focused on equitable adoption of clean technology in historically underserved communities.

As a result, many of our Community Sponsorships and Sustainable Community Partners for 2022 have specific goals and outcomes tied to 2030 Plan education and implementation. Finally, we are establishing a comprehensive language translation strategy to ensure that our existing and new programs and partnerships can be accessed by all of our customers.

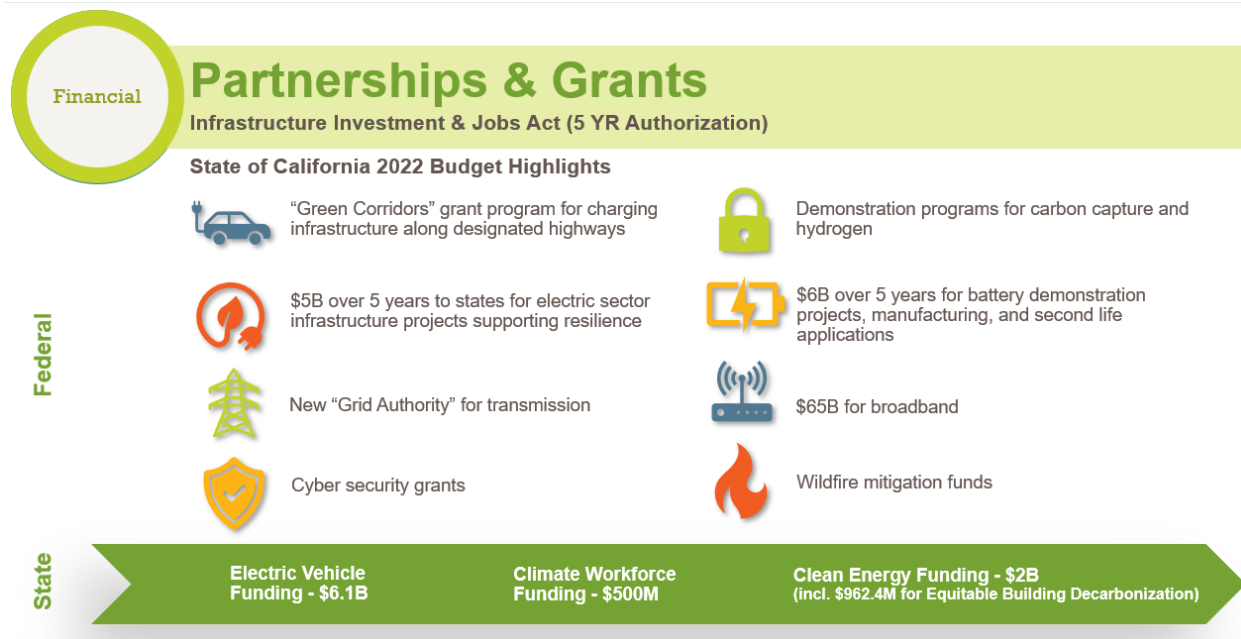
Financial

Financial Highlights

Soon after having the ZCP adopted by the Board, the first-rate cycle was completed and resulted in Board approved rate increases for 2022 and 2023 at or below Consumer Price Index (CPI), 1.5% in 2022 and 2% in 2023. Next year as we gather the information for the 2024 and 2025 rate case, the necessary rate increase levels will need to be considered, as inflation has risen sharply and affected many areas of our operations such as commodities, labor, supplies, and materials. In 2021, \$35 million was deferred as seed money to kick off projects that will help reach plan goals and help with rate pressure. Additionally in 2021, we capitalized on opportunities not directly aimed at the plan, but will help create some headroom, including a bond refunding that will save us \$3 million per year through 2028 and contributing additional pension funding to lower those ongoing costs into the future. The Finance team will continue to identify and execute on similar savings opportunities over the next few years, but also look at other ways such as renewable prepaids that can lower contracted PPA prices and other cost cutting measures all targeted at lowering the need for future rate increases.

The **Enterprise Prioritization** function was initiated last year through our reorganization and now as a formalized group looking at how we prioritize spending decisions across SMUD, which will be critical in meeting the goals of the plan and also seek to balance resource constraints and risks to the enterprise within the decision-making process. **Operational Excellence (OpEx)** program team and framework was also established. The OpEx team will be looking for sustainable operational savings and efficiencies that are needed while expanding organizational agility across SMUD. The identification, execution, and tracking of OpEx initiatives is now underway. The team will be working collaboratively with all Business Units along with Strategy, Prioritization, Innovation, Business Planning, and Enterprise Performance to maximize results and find ways to provide savings and work more efficiently. **Grants Capture and Strategy** was also formulated over this last year. It's an important part of helping us attain the financial wherewithal to accomplish our goal of zero carbon and stay within rate increases capped at or below CPI.

Partnerships & Grants



Pre-Capture Focus

In 2021, Government Affairs focused on grants “pre-capture,” which refers to strategic relationship building, influence, and shaping of funding opportunities. We made significant strides at the Federal level. Highlights include meetings with the Biden Transition Team, FERC Commissioners, Pat Hoffman at DOE, Kelly Speakes-Backman at Department of Energy (DOE), the White House, DOE staff, Environmental Protection Agency (EPA) staff, and our delegation. The Federal Affairs team coordinated Paul Lau’s testimony at the House Select Committee on the Climate Crisis, and at a FERC technical conference on the western interconnection, as well as Rachel Huang’s testimony at a FERC technical conference on electrification. These efforts helped to introduce our 2030 ZCP to federal audiences. Recent recurring meetings with Rose Stephens-Booker, West Coast Regional Specialist for DOE’s Office of Intergovernmental and External Affairs led to a SMUD visit from Energy Secretary Jennifer Granholm and provided SMUD with intelligence on DOE’s priorities for energy-related grants. For instance, SMUD was strongly encouraged during recent meetings with DOE staff to provide formal comments responding to the agency’s Requests for Information in program areas where SMUD eventually intends to apply for grant funding. Through pre-capture, SMUD aims to participate in development of grants ahead of their official release so that we are well-positioned to propose projects that match the agency’s funding intent.

Grant Capture Outlook

Given our pre-capture efforts, we contracted with Momentum to help SMUD identify and screen grants while they concurrently support our regional partners with whom SMUD may be

collaborating on upcoming funding opportunities. SMUD screened 63 grant opportunities last year, 27 since Momentum came on board. In 2021, SMUD was awarded 4 grants, some of which were applied for in 2020, and those projects are underway – CEC Blueprints for M/HD ZEV Infrastructure; BESTFIT Innovative charging Solutions (twin rivers V2G); EV Ready Communities Blueprint (City of Sac); Hyblend Project (Hydrogen Blending Research). TWe also were awarded American Public Power Association’s Demonstration of Energy & Efficiency Developments (APPA DEED) – Zero Energy Champions, which will help our youth in understanding their role in moving to a zero-carbon environment and for them to learn about zero carbon careers.

Partnership Development

We are working to lay the foundation and build the framework for a regional collaboration structure. For example, SMUD, Air Quality Management District (AQMD), Sacramento Area Council of Governments (SACOG) and Regional Transit (RT), the 4 Agency group, agreed on regional funding priorities for zero emission vehicle deployment. Additionally, SMUD has been engaged Sacramento County and the City of Sacramento on our federal and state grants strategy to build alignment with their government affairs efforts. We’ve also developed a 3-party building electrification Memorandum of Understanding (MOU) with the City and the County that demonstrates the mutual goal of regional collaboration. The MOU is designed such that any other City in Sacramento County can easily join so that we can show a broad regional coalition. Finally, we are following up with staff from the smaller cities in our service area (after our successful meetings with Paul Lau and our Board with Mayors and City Managers) to educate them about the ZCP, our priorities and to learn their priorities. These and similar relationships will likely form the source of partnerships SMUD will need to be competitive for grants.