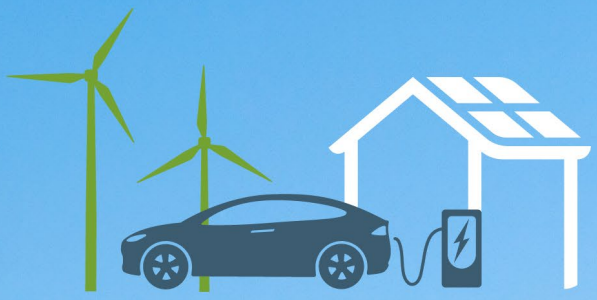
2030 Zero Carbon Plan



Progress Report | April 2023

2022 accomplishments & 2023 priorities

SMUD®

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Introduction

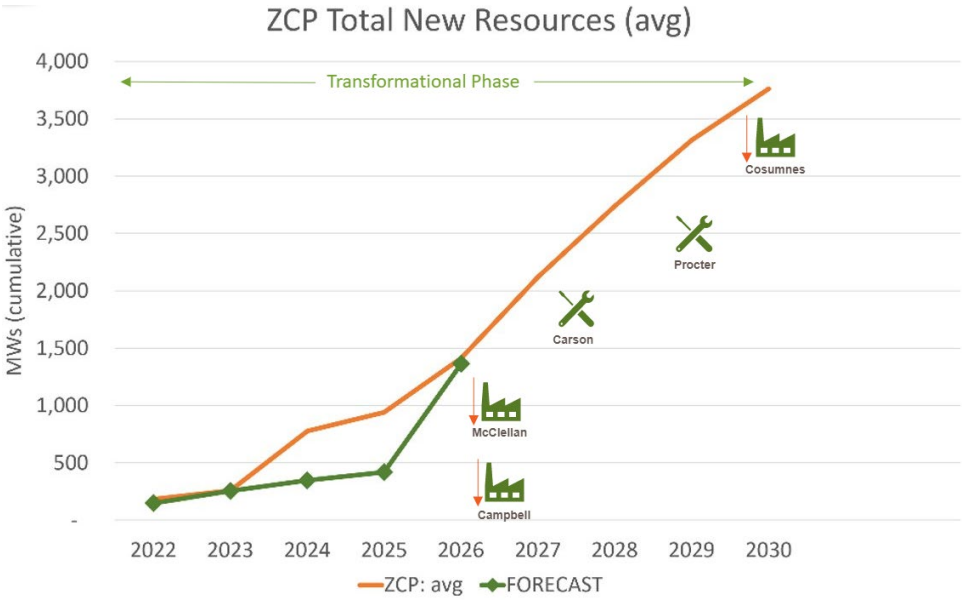
It's been 2 years since the 2030 Zero Carbon Plan (ZCP) was approved by the Board in April 2021. 2022 was a challenging year with the 3rd consecutive year of extreme drought conditions, the hottest September heat storm on record, supply chain constraints and inflation at a 40-year high, affecting many areas of our operations such as commodities, labor, supplies and materials. However, despite these events, we are pleased to report we have completed or made significant progress toward both our 2022 goals and 2030 Zero Carbon goals. Our Zero Carbon Plan, whose pillars can be seen in the graphic below, is an ambitious plan with flexibility to work within the guardrails of affordability and reliability.

This report reviews our high-level 2022 accomplishments and the upcoming priorities for 2023. It will be presented to the Energy Resources and Customer Services committee on Wednesday, April 19, 2023. The presentation deck that accompanies this report is available at: https://www.smud.org/-/media/Documents/Corporate/About-Us/Board-Meetings-and-Agendas/2023/Apr/2023-4-19_Exhibit_to_Agenda_Item_1.ashx.

2030 ZCP Filed with the California Energy Commission

SMUD developed the 2030 ZCP using an Integrated Resource Plan (IRP) process, including a comprehensive and inclusive approach to public and industry stakeholder engagement. The final step in this process was to file the ZCP with the California Energy Commission (CEC),

which was completed in September 2022. The administrative regulatory filing met our obligation under SB350 (2015), which requires SMUD and other utilities to file a Board-adopted IRP at least every 5 years. The filing 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, which our 2030 ZCP will supplant.



SMUD is now in the transitional phase towards 2030. The graph above shows the average new renewable resources, represented by the orange line, including storage & distributed energy resources, as identified in the ZCP. The green line with diamonds represents the actual MW's and current forecasted MWs of work in progress, combining all of the resources, including storage and distributed energy resources. Expected growth in customer programs is excluded from the forecast for the time being, as it's a little too early to forecast the trajectory of customer adoption.

We are forecasting to meet the plan in 2026, but will have a steep curve in the latter years with challenges due to the economy, supply chain, and demand for renewable projects in our region. We are preparing now, by continuing to work on the utility scale renewable projects that are forecasted to come on-line in early 2026. This will put us in a position to replace McClellan and Campbell. With reliability a priority, we will evaluate the performance of these new resources and the resource needs of the state as we develop the replacement plans. We're also developing an important project pipeline, as it takes, on average, 5 years to develop a project from site identification, planning, environmental studies, permitting, engineering, procurement and construction.

We continue to execute the strategies and priorities laid out in the ZCP, looking for development opportunities, issuing solicitations, evaluations of LDES technologies and pursing grants and partnerships for pilot projects utilizing emerging technologies.

SMUD's Greenhouse Gas Emissions

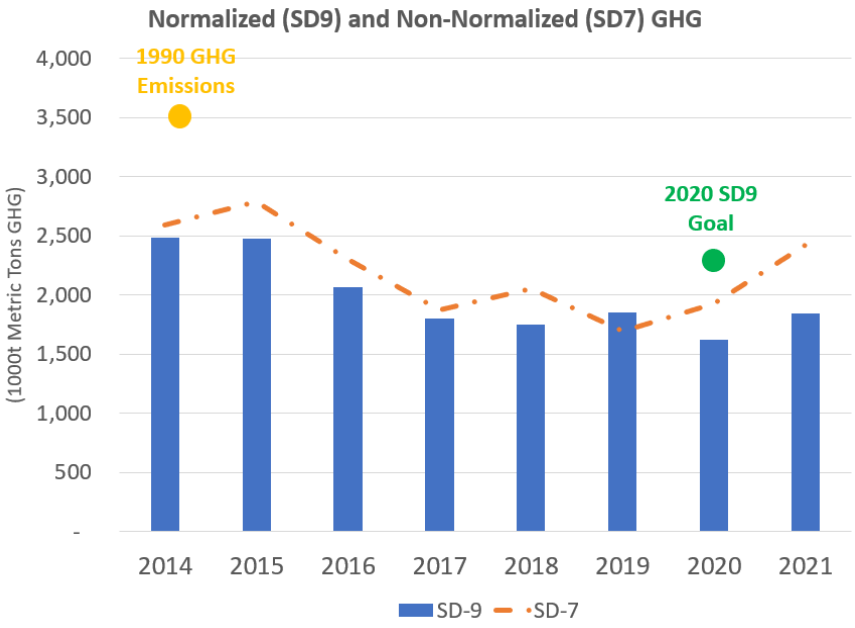
SMUD's Strategic Direction 9 Resource Planning (SD9) contains our goals for reducing Greenhouse Gas (GHG) emissions in our energy supply, in addition to other resource planning directives[1].

As described in our latest SD9 Board Monitoring report[2], GHG emissions reported in SD9 are adjusted or "normalized" for factors out of our control. The "normalization" factors consider variations in hydro and intermittent resources as well as customer load. Normalization allows us to say, "If everything came out as expected, what would our emissions have been?" SD9 also adjusts for Renewable Portfolio Standards (RPS) compliance and use of surplus renewable energy credits.

Alternatively, Strategic Direction 7 Environmental Leadership (SD7), 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 2014-2021. The differences between the 2 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 trended downwards over this period. We have also made substantial reductions relative to our 1990 GHG emissions of 3.5 million metric tons and were well below our 2020 SD9 goal of 2.318 million metric tons. Our 2021 emissions were up year-over-year due to a historic drought that affected much of the Western United States, resulting in an ~60% reduction in SMUD's hydro generation resources and significantly reducing our ability to purchase carbon-free power from the Northwest. With hydro generation being such a large part of our portfolio, we expect swings in GHG emissions year-to-year with hydro conditions. However, with all the new clean resources we plan to add, we expect our emissions to continue trending downward over time.

[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 most recent SD9 Board Monitoring report: https://www.smud.org/-/media/Documents/Corporate/About-Us/Board-Meetings-and-Agendas/2022/Oct/ERCS-Info-Packet---Oct-19-2022.ashx



**2022 SD9 and SD7 emissions will be finalized and reported in the SMUD Policy Committee meeting in September 2023.*

Over the last 12 years, we have added 1,000 MW of new carbon-free renewable energy to our energy supply. The table below summarizes the renewable resource additions that we've added to our energy supply, by resource type, that support the downward trend on emissions, and the approximate annual GHG emissions reductions impact these clean resources have.

Renewable Resource Additions 2010-2023

Resource Type	MW	Equivalent Annual GHG Emissions Reductions (MT)	Equivalent Light Duty Vehicles Removed from Road
Wind	378	512,014	110,586
Solar	442	290,865	62,822
Geothermal	151	441,908	95,445
Biogas/Biomass	19	47,541	10,268
Hydro	10	5,699	1,231
Total	**1,000**	**1,298,026**	**280,351**

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

Between 2021-2023, we added almost 370 MW of new renewable resources and from 2024 onwards have over 1500 MW of proven clean technology resources in various stages of planning and development, with much more to develop as detailed in our 2030 Zero Carbon Plan. 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, we expect our renewable percentage to exceed California's 2030 60% Renewable Portfolio Standard by up to ~30%.

We expect our GHG footprint to continue to trend down in a significant manner on our way to zero carbon in 2030, but we have much more work to do. As detailed in our ZCP, we are focused on 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 Utility Scale section details our clean energy developments focused on reducing our energy supply GHG emissions on our way to 2030 Zero Carbon.

Utility Scale

New Technology

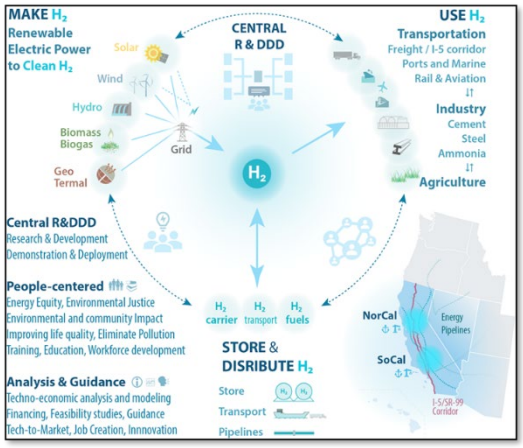
Grid Scale Technologies Research

Significant progress has been made on the research plan presented to the Board 2 years ago. We've researched every area identified in the plan, including Carbon Capture, Long Duration Energy Storage and Alternative Clean Fuels (Hydrogen). These resources hold the potential to completely decarbonize our energy supply. We have gathered and analyzed information, made decisions and pivots and identified areas for deeper focus.

Alternative Clean Fuels (Hydrogen)

Hydrogen is a crucial new technology option that supports our 2030 ZCP. It will allow us to expand our dispatchable renewable energy resources for the last 10% of our portfolio. The Department of Energy's (DOE) focus on hydrogen at the national level and California's statewide commitment through the ARCHES Hub opens doors to innovation, job training and development opportunities in the green energy sectors and—more importantly—in our region and service territory. The DOE regional Clean Hydrogen Hubs (H2Hubs) program has committed $7 billion to establish between 8-10 regional hubs. SMUD staff worked with ARCHES on developing and submitting two concepts to the DOE for consideration as part of the April 7 application process.

SMUD's concepts have been selected as alternatives in the application. SMUD staff will continue to work on bolstering the concept papers with additional engineering and technical assessments to ensure the projects are "shovel-ready" for future funding consideration through ARCHES or other funding opportunities.



- **Concept 1**:
  Electrolytic Hydrogen Production to support Power, Transportation, and Industrial Applications possibly at Consumes Power Plant or Procter & Gamble Power Plant
- **Concept 2**:
  Thermochemical Conversion of Biomass to Hydrogen to support Power, Transportation, and Industrial Applications

SMUD staff will continue to work on bolstering the concept papers with additional engineering and technical assessments to ensure the projects are "shovel-ready" for future funding consideration through ARCHES or other funding opportunities.

Long Duration Energy Storage (LDES)

We are very excited about a couple of projects in the long-duration energy space. Our ZCP includes a significant commitment to energy storage, and lithium-ion batteries alone are not likely to meet our entire need.

In 2021, 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 and 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 6 technologies for further examination and pursuit, which are included in the table on the following page.

Technology	Developers/Vendors
Pumped Hydropower Storage (PHS)	• American Hydro Corporation (Currently owned by Wärtsilä) • Andritz AG • GE Renewable Energy • Quidnet Energy
Latent Air Energy Storage (LAES)	• Highview Power Storage • MAN Energy Solutions SE
Antimony-Based	• Ambri
Advanced Compressed Air Energy Storage (CAES)	• Hydrostor
Flow Battery	• Sumitomo Electric Industries Ltd. • UniEnergy Technologies • Redflow Limited • ESS • Invinity • Primus Power
Zinc-Based	• Eos • ZAF Energy • ZincFive • Zinc8 • NantEnergy

Learning from and building off our efforts with Black & Veatch, we continued to pursue long duration energy storage (LDES) in 2022 through Non-Disclosure Agreements and the issuance of a Request for Information (RFI) to the six recommended technologies, in hopes that we could enter into more specific discussions with each vendor and potentially choose a pilot project for implementation. Of those we contacted, 8 responded to the RFI with 16 different projects/products, as shown below.

Technology	RFI responses received
Liquid Gas Energy Storage (LGES) (CO_2)	Energy Dome
Metal-Based, Battery cell	Ambri, EnerVenue, NextEra
Compressed Air Energy Storage (CAES)	Energy Internet Corp., Hydrostor Inc.
Flow	NextEra, Sumitomo
Thermal, pumped heat	Malta

A team of SMUD subject matter experts, working alongside with Black & Veatch, performed an assessment of these technologies and recommended a shortlist of 4 technologies for a potential pilot: Battery Cell: Nickel-Hydrogen, Zinc Bromide, Li-Ion (customized duration) and Flow Battery (Vanadium Redox).

The next step is to issue a Request for Proposal (RFP) or Request for Qualification (RFQ) to select a technology to pilot in addition to the LDES pilot with ESS Inc., currently underway, which is explained in more detail in the next section.

Agreement with ESS, Inc.

In the Fall of 2022, the Board of Directors authorized SMUD to enter a multi-year strategic collaboration with ESS, Inc. aiming to speed up the adoption of long-duration energy storage in our service area. The partnership with ESS Inc., a leading manufacturer of long-duration iron flow batteries for utility-scale energy storage applications, could allow us to deploy up to 200 MW of long duration energy storage to our grid and accelerate our decarbonization efforts.

The agreement calls for ESS to deliver a mix of its Energy Warehouse™ and Energy Center™ long-duration energy storage (LDES) solutions for integration with our grid. Phase 1 targets demonstrating up to 4 MW/24 MWh. The Phase 1 scope consists of a 0.5 MW demonstration of 6 Energy Warehouses (each rated at 75kW/400kWh) at Hedge, a 2 MW Energy Center demonstration at Hedge, and a 1.5 MW Energy Center demonstration at a site to be determined.

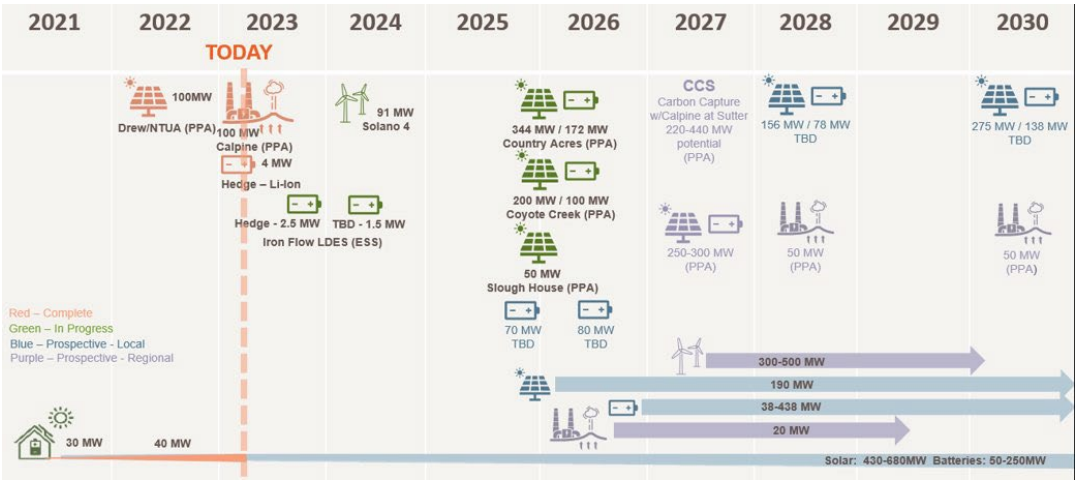
We are well into the engineering design phase, and civil construction will begin at Hedge in April 2023. The 6 Energy Warehouses (75 kW/400 kWh) are expected to be installed and commissioned by year-end 2023.

Carbon Capture – Post-Combustion

We continue to explore projects in this area, including a potential Power Purchase Agreement (PPA) for Carbon Capture at Calpine's Sutter Energy Center, which would convert an existing natural gas plant to include carbon capture and storage (CCS). The project has potential to generate up to 220-440 MW and sequester up to 1.5 million metric tons GHG per year. Estimated online date is 2027.

Proven Clean Technologies

Renewable Projects Update



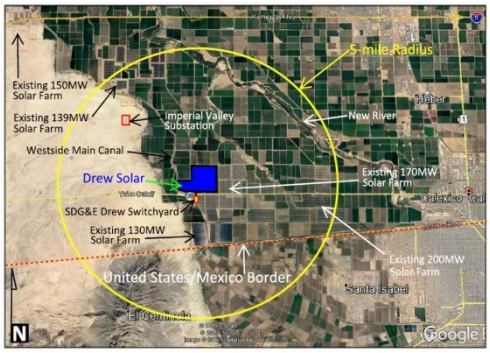
The graphic shown above is a roadmap representation of the Total Renewables Average MW graph on page 5. The roadmap visually demonstrates the accomplishments we have achieved since the Board approval of the ZCP plan in April 2021.

The renewable resources represented in the graphic include solar, battery energy storage systems, geothermal and wind. Because the plan is flexible, and not all potential projects become a reality, there are ranges for the different types of renewable assets to reach our goal and ensure reliability.

The projects that are on-line today, such as Drew (PPA), Calpine (PPA), and Hedge are indicated in red. Projects in progress such as Solano 4 (PPA), Country Acres (PPA), Coyote Creek (PPA), and Slough House (PPA) are indicated in green. The projects online and in progress will be described later this in section. Local and regional potential projects and those projects still needed to meet the ZCP are indicated in blue and purple, respectively.

Drew Solar

The Drew Solar Project, completed in 2022, is a 30-year Power Purchase Agreement (PPA) for 100 MW Solar. Located in Imperial County and connected to CAISO, it has an expected output of 282,000 MWh/year.



Hedge

Commercial operation of the Hedge Lithium Ion Battery Energy Storage System (BESS) began in January 2023. The system will provide 4 MW of electricity and 8 MW-hours of storage that can be tapped when other energy resources are strained—enough to power 800 homes for 2 hours with clean, renewable energy.

Calpine

January 2023 marked the beginning of the 10-year Power Purchase Agreement (PPA) of energy from Calpine's operations at The Geysers, which adds 100 MWs of geothermal energy to SMUD's portfolio—enough to power about 100,000 homes for a year. Located north of San Francisco, The Geysers is the single largest geothermal electric operation in the world.

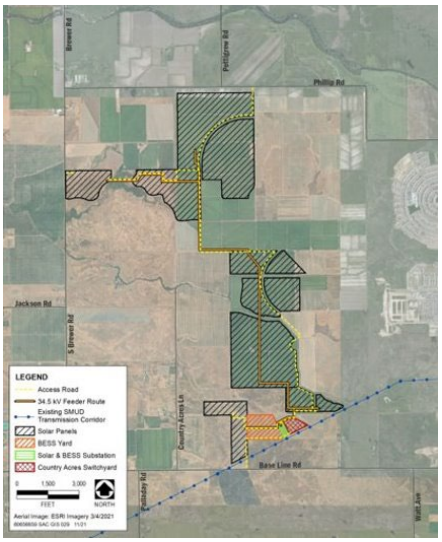
Solano 4

The Engineering, Procurement, and Construction contract for Solano 4 was awarded to Vestas in 2022. The project scope includes decommissioning Solano 1 by removing 23 wind turbines (0.66 MW each or 15 MW total). Turbine removal is underway and expected to be completed in May 2023.

The project scope also includes the installation of 19 wind turbines (9 in Solano 4 East and 10 in Solano 4 West). Each

turbine can produce 4.5 MWs for a project total of 85.5 MW. Construction on the new turbines started in April 2023, with expected completion in May 2024. Once the Solano 4 project is complete, SMUD Solano Assets (Solano 2, 3 & 4) will have a total installed capacity of 300 MW.

Country Acres



Our 2022 efforts on the Country Acres project were focused on preparing the Environmental Impact Report (EIR), evaluating proposals, selecting the developer and signing a Letter of Intent to negotiate terms for the Solar + Battery PPA. Passage of the Inflation Reduction Act made new tax credits available to SMUD for the first time, lowering the project cost opportunities for this project.

In 2023, we will focus on permitting and contracting efforts. The Final EIR is targeted to be released and presented to the SMUD Board, the Placer Planning Commission, and the Placer Board of Supervisors in Quarter(Q)2 of 2023. Finalization of the PPA, Large Generator Interconnection Agreement, Development Agreement and Lease are also targeted to be complete in Q2 and construction is targeted to begin in the second half of 2023.

The Country Acres project is located in unincorporated western Placer County, just west of Roseville and north of Baseline Rd, adjacent to SMUD's existing Transmission Corridor. The project will build up to 344 MW of solar and 172 MW of 4hr battery energy storage on 725 acres and is forecasted to be complete early 2026. The project will connect to SMUD's existing 230 kV transmission.

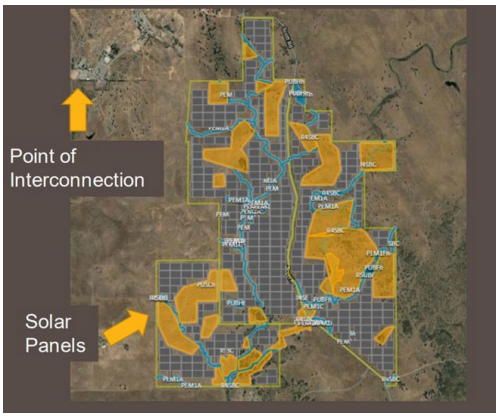
An important component of the project was inclusion of SMUD's Principles for Development, which include obligations for the developer to meet SMUD's key objectives, including minimizing impacts to sensitive biological, cultural and tribal resources; inclusion of agricultural practices such as sheep grazing, and pollinator habitat; minimizing ground disturbance; incorporation of sustainable life cycle management for construction and operation materials and wastes; engagement with local workforce and addressing workforce disparity gaps for historically underserved communities; and sourcing materials from companies with a human rights policy and statement of supply chain ethics commitment as part of the development, construction and operation of the project.

Construction is expected to contribute more than $41 million in direct and indirect value to the Placer County economy--supporting more than 360 jobs in Placer County during the

construction phase. Once operational, it is expected to contribute $3.7 million to the Placer economy annually and support an additional ~40 local jobs annually.

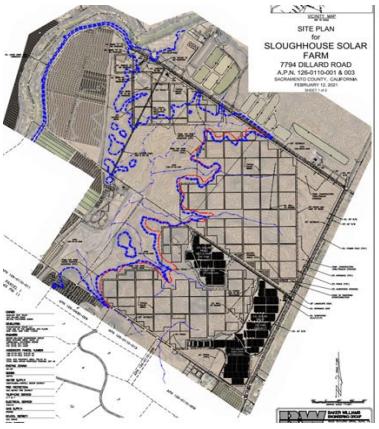
Coyote Creek

SMUD is in contract with DE Shaw for the procurement of energy for the Coyote Creek project. As the developer, DE Shaw is currently in the environmental review process. The scope of the Coyote Creek project includes 200 MW Solar coupled with 100 MW x 4hr BESS. The project is located on the Barton Ranch in unincorporated Sacramento County and connects to SMUD's 230 kV Transmission line. It is forecast to be completed early 2026.



Sloughhouse

SMUD is in contract with the developer, DE Shaw, for the procurement of energy for the Sloughhouse project. The scope of the project is a 50 MW solar installation, interconnected to SMUD's 69kV system, and located at Dillard Road in the Cosumnes community. Design, environmental review and permitting are in progress. The project is forecasted to be completed early 2026.



Project Development Pipeline

SMUD staff continues to pursue other renewable and storage projects, with online dates in the 2025-27 timeframe, both locally and regionally. Finding local resources has been challenging, as the 2022 solicitation resulted in zero local resources. However, we will continue to look for options.

From a planning standpoint, we have performed significant analysis and outreach, numerous studies and a competitive solicitation. However, there is still much work to do 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; interconnection studies; and several different delivery options of non-local renewables and what that 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.

By the end of 2026, our new renewable resources in the next 3 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.

Customer Programs & Initiatives

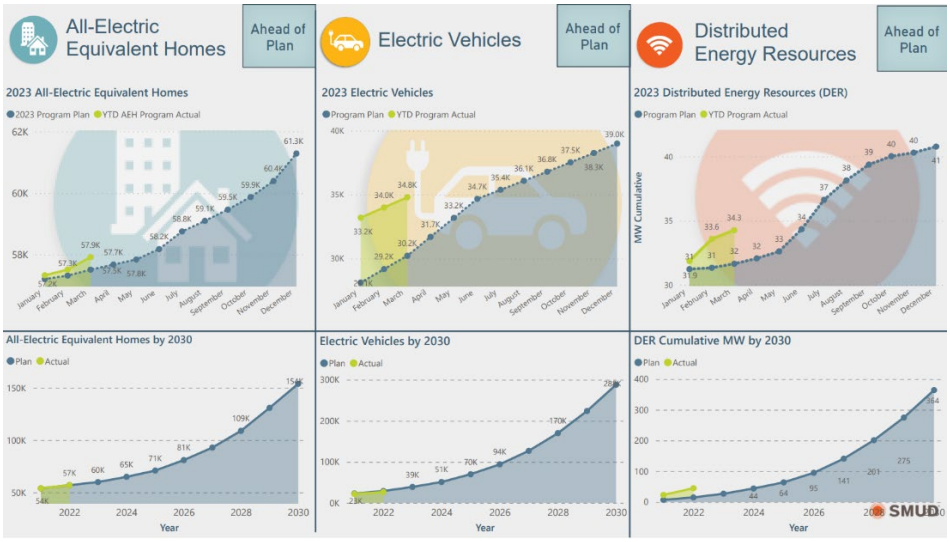
Program Portfolios

The Customer Programs and Initiatives and related components of the ZCP are grouped into portfolios with generally common objectives, goals, or metrics. These include:

Building Electrification & Energy Efficiency: This portfolio of programs encourages customers to reduce local carbon emissions in homes and businesses through beneficial electrification by converting end use equipment and appliances from gas to efficient electric systems, as well as reduction of overall energy use. Carbon reductions from the programs and initiatives in this portfolio are converted to equivalent all electric homes in the ZCP.

Transportation Electrification: This group of programs and initiatives is focused on supporting the growth and adoption of electric vehicles and related charging infrastructure systems in homes and businesses, as well as the development of mechanisms to ensure the mitigation of grid impacts through rates or charging management initiatives. The primary metric currently utilized for this portfolio in the ZCP is the number of equivalent light duty electric vehicles in our service territory.

Distributed Energy Resources (DERs): The focus of this portfolio is the implementation of customer programs, technologies, and systems that provide resources and load flexibility options that can replace traditional thermal generation assets needed to manage loads by reducing loads during periods of high demand or shifting and storing excess energy for use when needed. The primary metric for this portfolio is available MW of DERs.



The charts above represent the goals for each of these portfolios as currently represented in the 2030 ZCP. The bottom three charts provide the annual targets through 2030, while the top three provide the planned monthly targets for 2023.

As the charts indicate, we are making steady progress towards our goals and are ahead of plan both annually and year-to-date. However, we do have some steep curves in the latter years that we need to prepare for.

Our Zero Carbon goal is a bold one. To reach it, SMUD must engage our customers to come alongside us in the journey. Our progress reflects the organization's focus in aligning with our customers—from resource planning to program development to marketing, outreach and community engagement work and everything in between. This alignment and focus includes delivering on our goals in a way that brings all communities along.

We've set a bold goal for 2023 of getting 100,000 customers to Join the Charge by the end of this year, and we're well on our way. Our new "Clean Power Savings" campaign launched this month, with a strong focus on rebates. Customers can save money and save the planet. This is a fully integrated, multi-channel campaign, which means it's supported by target marketing for our various customer segments and is carried through to our outreach and events—from ride and drives at the State Fair, to our outreach in schools to our Community Impact Plan work through neighborhood walks and other outreach activities. Our Board members do a great job of spreading the word and getting our customers and others engaged.

Current and Projected Key Metrics & Milestones by Portfolio

The information in the following sections provides data for some of the key metrics and goals associated with the programs and initiatives in each of the portfolios described above.

Building Electrification and Energy Efficiency

We are on track to meet the "Cumulative Equivalent All-Electric Homes[3]" targets. In 2022, we completed building electrification installations equivalent to approximately 3600 all-electric homes, bringing the total in our service territory to around 57,000. For 2023, we expect to complete projects that will add approximately another 4,300, which will meet or exceed our current planned trajectory.

	2022 Final	2023 March Actual	2023 Goal
Heat Pump HVAC Conversions	2,109	510	2,180
Heat Pump Water Heater Conversions	897	191	1,000
Induction Cooktop Conversions	256	84	300
All Electric New Homes & Multifamily Units Constructed	1,299	158	750
Multifamily Units Retrofitted	954	0	500
Commercial Retrofit Projects	311	44	500
All Electric Equivalent Homes (Cumulative)	57,000	57,925	61,287

Initiatives in progress this year include the restructuring and relaunch of our **Home Electricity Reports** program with a more direct focus on supporting the ZCP goals for carbon reduction. We expect the relaunch of this program in June of this year.

Another program initiative in the implementation stages is the addition of a **turnkey Heat Pump Water Heater (HPWH) purchase and installation process** on the SMUD Energy Store. Customers will be able to directly purchase units on the SMUD Energy Store, provide basic information on their water heater location and electrical characteristics and receive installation

[3] "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. We use 3,300 kWh as an equivalent home, as an existing single-family home is estimated to add 3,300 kWh of electricity post complete electrification. As such, 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.

quotes from contractors to install the units in their homes. We expect this option to be available to customers in late Q2 or early Q3 of this year.

Significant additions to the **Building Energy Efficiency and Electrification portfolio** were included in the 2023 program plans to **expand the availability and reach of these programs to underserved, low- and moderate-income customers** through the Community Impact Plan (CIP). Staff are working on the implementation of these initiatives including the development of a financing program (Carbon free loans). More detailed information and description of the CIP is provided in the following section.

While we do expect to remain on track this year, we must scale up our program goals significantly over the next few years and do so in a cost-effective manner. Some of the tailwinds that we expect to help in this regard are the **Technology and Equipment for Clean Heating (TECH)** California statewide incentive program, as well as the **Energy Security and Climate Change provisions of the 2022 Inflation Reduction Act (IRA**). Staff will continue to closely monitor these programs to determine how best to update and adapt our programs in this area to increase the adoption of electrification and energy efficiency measures across all customer segments. We expect the TECH incentive program to be implemented in Q2 of this year, while the IRA program details are not likely to be available until late this year or in early 2024. Additional tailwinds for building electrification include increased focus on adoption of clean technologies in local and statewide building codes and standards.

Community Impact Plan

The Community Impact Plan (CIP) is a set of significant initiatives that provide a roadmap of how we ensure no community is left behind in the ZCP and is a key component in our ability to bring customers along on our journey.

The plan underscores SMUD's commitment to making meaningful investments in under-resourced communities to ensure their participation in a clean energy future. The CIP is comprised of three core areas: affordability, equitable access, and community engagement. The CIP was initially launched in 2022 and has been significantly expanded for 2023 with targeted investments, outreach, and engagement in our under-resourced communities.

Accomplishments for 2022 include the first neighborhood electrification project in the Gardenland community, with the installation of more than 150 electrification and energy

efficiency measures in residential homes. The effort in this neighborhood continues in 2023 and will be expanded to include neighborhood electrification efforts in the North Highlands, Elk Grove, and Meadowview communities.

Development of a Carbon Free loan program is currently underway, targeted to support the ability of traditionally under-resourced or low and median-income customers to undertake beneficial electrification upgrades in a more cost-effective manner. Staff is exploring financing mechanisms and partners to support this program, which was expected to launch in Q2 of this year. However, recent uncertainties in the economic and banking sectors have caused delays in implementing this program.

In addition to our residential work, we expanded our relationships with Property Business Improvement Districts and community-based organizations to ensure commercial customers have access to affordable, equitable clean energy programs. Through a partnership between SMUD, Gardenland Northgate Neighborhood Association and the Sacramento Hispanic Chamber of Commerce, the Northgate Business Electrification project secured $1.5M in American Rescue Plan Act funds to be spent in the next two years to assist in small and mid-size commercial electrification efforts.

SMUD also invested in regional workforce programs with the goal of developing equitable job training pathways for under-resourced community members to position them for clean energy jobs.

Additional investments in 2023 include expansion and support for workforce development training programs to facilitate internships and on-the-job training, Shine awards, funding for community ambassadors for targeted outreach and education in under-resourced communities, additional funding for electrification efforts for small and mid-size commercial customers in targeted business areas, as well as commercial kitchen electrification retrofit projects.

Transportation Electrification

By the end of 2022, there were approximately 32,396 light duty EVs in operation in the SMUD territory, according to data from the Electric Power Research Institute (EPRI). This year we are expecting that number to increase by 20% to 39,000. The targets in the ZCP have this number growing to approximately 288,000 light duty electric vehicles (EVs) in operation[4] by 2030, which is more than a 7-fold increase from where we expect to end this year.

[4] Note: “in operation”- means new vehicles, used vehicles and vehicles that were sold- and is the EPRI term for the true number of EVs in our service territory.

	2022 Actual	2023 March Actual	2023 Goal
Residential EV Chargers Installed	577	300	500
Commercial EV Chargers	349	42	355
Residential EV Rate Participants (Cumulative)	17,229	19,027	22,620
E-Fuel Solutions Projects	-	0	4
Managed Charging Pilot Participants (Cumulative)	297	330	1000
# of Light Duty EV's in Service Territory (Cumulative)	32,396	34,796	39,000

Transportation electrification is seeing significant local and national attention. As a major element of the Inflation Reduction Act, it is expected to receive significant support through grants. These elements, combined with increasing interest from customers and proliferation of vehicles and options, will certainly help to drive demand and market penetration of electric vehicles and electric transportation options over the coming years.

The challenge we face is to ensure that the electric infrastructure and charging options available to customers do not become barriers to adoption. To that end, our focus this year and looking ahead will be to increase our efforts to educate and inform customers about vehicles and charging options, while also expanding our managed charging pilots this year and next. We will garner the learnings and outcomes from these pilots to develop a full-scale program that seeks to maximize customer utility and benefit while minimizing grid and infrastructure impacts.

In 2023, we will have a significant focus on communications, marketing and outreach work in the EV space with a campaign planned for mid-year. The work includes:

- Developing a campaign to encourage customers to ‘call SMUD first’—early in the lease/purchase decision process.
- Providing charging information and emphasizing the benefits of off-peak charging and right-sizing charging solutions, which in many cases result in customers becoming aware that they may not even need a level 2 charger at home.
- Featuring EV incentives prominently in our new spring 2023 Clean Power Savings campaign.
- Getting insights into where we expect chargers to be installed to identify and minimize any potential grid impacts, building on SMUD’s “trusted advisor” work with our customers. Based on Clean Fuel Rewards data, two-thirds of SMUD customers surveyed researched EVs via their utility – this is higher than Southern California Edison (SCE); Pacific, Gas & Electric (PG&E); Los Angeles Department of Water and Power (LADWP); and San Diego Gas & Electric (SDG&E) customers.

In 2022, we launched our **eFuel Advisor program** which provides data, analysis, information, and recommendations to fleet owners on the Total Cost of Ownership and pathways to electrifying internal combustion engine (ICE) vehicles, including charging options. This year, we launched our **eFuel Solutions** component of the program which provides turnkey design, construction and installation of EV chargers for customers that choose to electrify their fleets with on-bill repayment of the costs over time. We are currently working with a handful of customers and expect to complete 4 commercial fleet electrification projects this year.

Our current managed charging pilot includes participation of eligible residential vehicles from Ford, GM, and BMW with enrollment via the **Open Vehicle Grid Integration Platform** (OVGIP), utilizing vehicle telematics as the means to communicate with and optimize charging parameters. We also recently concluded a contract with Optiwatt as a second charge management solution or model, which will allow us to add Tesla vehicles to the pilot with a goal of increasing participation to around 2000 vehicles through 2024.

In the residential space, we are working on expanding our contractor network and contractor education for EV charger installations and will be updating our **Charge@Home** program parameters and requirements in Q2 2023 to reflect these changes. In addition, we are working to implement a home charger turnkey installation process through our SMUD Energy Store. Customers will be able to select and purchase a qualifying charger and provide information to receive a quote and contractor offer to install the charger in the same transaction. This initiative is slated for launch in late Q2 of 2023.

Another initiative underway is the **ChargeReady** or **Reliable, Equitable, and Accessible Charging for multi-family Housing (REACH)** grant project. SMUD received a grant from the California Energy Commission in 2022 for the project. The main goal of the project is to develop a technical and business model to inform future deployments of this type in the industry. Project partners include Mutual Housing and the Sacramento Metropolitan Air Quality Management District (SMAQMD). REACH will utilize SMUD's eFuel program for design, construction and installation of more than 100 Level 2 charging handles in up to 10 multi-family sites in underserved communities across our service territory. The project team is currently evaluating the sites, with construction estimated to start mid-year and a goal to be completed by mid-2025. Part of the project scope includes a *Community Engagement Plan* to survey residents' knowledge and interest in EVs, as well as provide education and outreach. The total project budget is approximately $3.7M with SMUD is contributing about $1.5M in match share.

Our Research and Development team also continues to work on cutting edge projects to advance the state of Vehicle to Grid (V2G) technology and standards. The next section provides information on some of these projects.

Vehicle to Grid (V2G) Research & Pilots

Vehicle to Grid technology and standards are still in early stages of development and will require further research and testing before they can be considered economical and reliable sources of storage and backup and/or economically feasible options for resiliency and backup for customers.

One of our longest running projects in this area has been our collaboration with the Twin Rivers Unified School District (TRUSD) on an electric school bus V2G demonstration project. Currently, 24 DC Fast Chargers with V2G capability have been installed at their bus depot. The DC Fast Chargers are configured to support Automated Load Management (or locally controlled bill optimized charging).

Later in the project the units will support managed charging (or V1G) which can support demand peak shaving and load shifting and Vehicle-to-Grid (V2G). Changes in the aggregator utilized for the project (FordPro), resulted in delays in commissioning of the units for V1G and V2G due to integration issues between the buses, charging stations and the aggregator.

Integration and interconnection plans have been completed and approved and will be provided to TRUSD later in April 2023 for review and signature. Once FordPro completes their integration with SMUD, the charging units can be configured for V2G capability and units will be commissioned for export which we expect later in Q3 2023.

SMUD is also seeking to expand our V2G electric school bus pilots with other school districts to further test this capability and explore additional use cases. Elk Grove Unified School District and A to Z bus sales have expressed interest in participating and are planning to acquire DC Fast Charging units and buses that support V2G. In addition, San Juan Unified School District has also expressed interest and are likely to acquire V2G capable DC Fast Chargers but may not have V2G capable buses until 2024. Other school districts have applied for grants that will hopefully result in more V2G capable buses and school districts being able to participate in our pilots.

Our team is also working on several projects to explore V2G capabilities for Light Duty EVs and fleets. These include:

- A joint project with Tokyo Electric Power Company (TEPCO) and Nissan at SMUD. Initial testing of an installation was completed at the SMUD campus with a Nissan Leaf utilizing

a Fermata FE-15 bidirectional charger, that can charge/discharge up to 15 kW and is designed for commercial customers/fleets. Further testing of this system is planned with an updated FE-20 Fermata charging unit soon. Staff is currently evaluating initial data to examine ways to improve discharge power and setpoint tracking.

- SMUD submitted federal grant applications partnered with GM, Nissan and Ford to explore V2G options for fleet applications with customers:
  - An application with GM was submitted to the DOE Vehicle Technologies Office requesting about $1M in federal funds with SMUD contributing about $620K in cost share. This project would utilize SMUD's own EVs (Bolt and Silverado) for managed charging (V1G) and certain vehicles (Silverado) for bidirectional charging V2G (in-house testing). Scope includes partnering with third-party fleet operators for larger scale testing in a later phase. Grant awards notice for this is expected in Q2 2023. SMUD may also proceed with a scaled down version of the project if no grant money is awarded.
  - We also submitted a grant application with Nissan and Ford for the Department of Transportation's Advanced Transportation Technology and Innovation (ATTAIN) solicitation for a budget of about $9M with about $1.8M in SMUD match. We are also planning for a smaller project if grant funding is not awarded.

Load Flexibility

In 2022, we added approximately 5 MWs of new load to this portfolio. In 2023, we anticipate adding another 11 MWs through the expansion and launch of additional elements in our **Virtual Power Plant** (VPP) programs, as well as incremental addition from remaining programs. By 2030, our net additional load flexibility resource is projected to jump to more than 360 MWs, which is a significant 9-fold increase from where we are today. Most of this increase is planned to come from our VPP programs to manage customer-sited AC load, battery storage and EV charging. This value is the ZCP Base Case MW Capacity and is the baseline level of DER adoption sized to fill the resource gap needed to reach our ZCP goal.

	2022 Actual	2023 March Actual	2023 Goal
My Energy Optimizer Smart Thermostats (Cumulative)	12,503	16,119	16,000
My Energy Optimizer Starter Batteries (Cumulative)	144	218	306
My Energy Optimizer Partner+ Batteries	-	0	400
Peak Conserve (NextGen ACLM) enrollments	-	0	2,000
PowerDirect Commercial Customers (Cumulative)	36	42	82
Total MW (Cumulative)	30	34	41

Within the **My Energy Optimizer** (MEO) suite of offerings, 2022 saw a very successful launch and growth in our smart thermostat Partner program. We exceeded the goal of 10,000 enrollments for the 2-year pilot before the end of the first year and have already exceeded our revised goal for this year within the first 3 months.

The smart thermostat offering provides a $25 enrollment incentive and $25 annual bonus to customers who agree to have their qualifying smart thermostat control their air conditioner usage during periods of high demand. The SMUD Energy Store included a popular offering that coupled enrollment with purchase of a qualifying smart thermostat. The program also includes a **Critical Peak Pricing** (CPP) secondary offer. Critical Peak Pricing offers a discount of $0.02 per kWh during non-event periods from June 1 to September 30. During CPP peak events, an additional charge of $0.5 per kWh is added to the applicable time period's price. Since the end of last summer, CPP enrollment has increased over 10-fold. SMUD will expand CPP recruitment to even more program participants this summer. We will continue to enroll customers as demand and budget allows, as we plan to implement the demand response events this summer and test additional use cases to optimize program performance and customer experience ahead of full-scale deployment in 2024.

The **PowerDirect** automated demand response commercial offering provides up to $125/kW of automated energy reduction and may qualify for incentives that will offset up to 100% of the PowerDirect technology and equipment cost. This technology automatically scales back energy use for the selected equipment by the customer when demand for electricity is at its peak. This year, SMUD will be expanding options for small to medium business customers to increase customer enrollment.

This year we will also launch 2 additional residential load flexibility programs as we continue to build out our Virtual Power Plant. These are:

- **My Energy Optimizer Partner+:** This customer offering provides $250 kWh rebate up to $2,500 for year-round control of a resident's battery system. The battery will continue to be available for customer use and back-up power needs in the event of an outage. Customers in the Partner+ level will receive ongoing performance payments in addition to the enrollment incentive. For this incentive level, customers must own and have installed a Tesla Powerwall (expansion to other manufacturers are in development). Partner+ has launched a small pilot group this month with a full customer launch planned in early summer. The offering also includes a workforce development and an equity component.

- **Peak Conserve:** This residential customer offering provides a $50 sign-up bonus and up to a $25 annual bonus for customers who agree to the installation of a two-way communicating "cycling" device on their home's central air conditioner to allow for cycling of their air conditioning compressor during periods of summer high demand. The devices utilize SMUD's mesh meter network to communicate with the controller, negating the need for additional communication systems or for the customer to have WiFi to participate. Launch of this program is planned for May 2023 with a goal of installing 2000 devices this year and 4000 additional devices in 2024.

Green Pricing

The primary goal of this portfolio of programs is to give customers the ability to opt in and select a level of renewable and/or carbon-free electricity that meets their individual or corporate objectives. Customers that enroll and participate in the **Voluntary Renewable Electricity Program** (VREP) options pay for their own portion of this renewable power above and beyond what SMUD provides through our retail rates.

All SMUD customers benefit from this arrangement through the Retail Sales Exclusions associated with qualifying sales and results in a direct reduction in carbon emissions from our power supply mix.

	2022 Actual	2023 March Actual	2023 Goal
Residential Greenergy customers	65,257	66,296	69,000
Commercial Greenergy customers	1,621	1,582	1,600
Neighborhood SolarShares homes (Cumulative)	489	489	796
Commercial SolarShares Customers / Accounts	30 / 436	30 / 437	30 / 436
Total Qualifying GWh Sales	762	160	770
# of trees planted	9,525	2,302	10,000

Over the past three years, staff have undertaken a redesign of the residential and commercial **Greenergy** programs to align more closely with the ZCP and provide additional options and choices that meet customer needs and expectations. New residential Greenergy options went live in 2022 and a new commercial **Greenergy California Renewable** product offering went live in January of this year as the primary product offering for commercial customers. Planning and design of a commercial renewable shares offering is also underway with a projected launch later in 2024. However, given current market conditions with higher than anticipated prices for Renewable Energy Credits and tight supplies, limited or no growth of the Greenergy programs this year is anticipated.

Our **Neighborhood SolarShares** program is awaiting reapproval from the California Energy Commission as a community solar option for compliance with the updated building energy efficiency standards and is currently on standby with a waiting list of applications. Approval is anticipated within the next few weeks.

Our **[Large] Commercial SolarShares** program is fully subscribed and closed to new enrollments but continues to maintain and support our existing customer contracts and accounts.

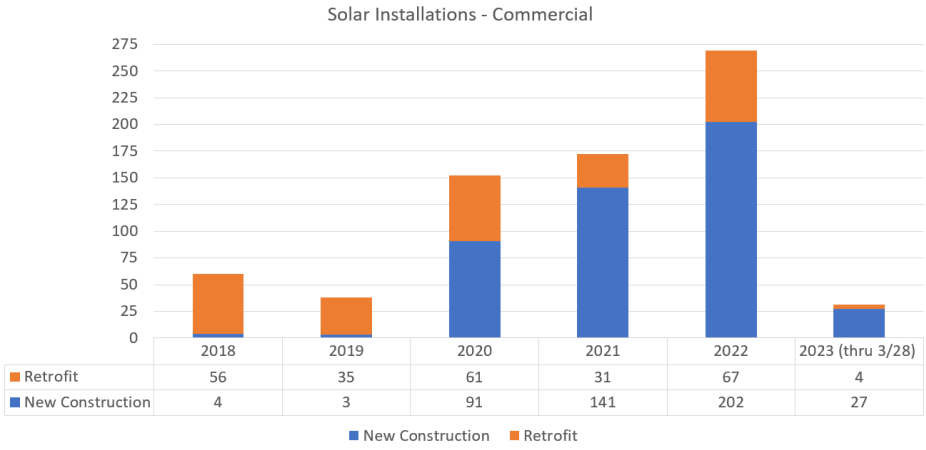
We also just renewed our contract and agreement with the Sacramento Tree Foundation to continue offering shade trees to customers over the next three years. This long-standing partnership which has continued for more than a quarter of a century has planted approximately 600,000 shade trees in our community and is one of our most beloved programs. Our new contract includes a focus on tree plantings in under-canopied areas as well as increasing community engagement and community plantings.

To complement our Neighborhood SolarShares program, staff is currently planning the development and implementation of an **Existing Home SolarShares** program to offer a low cost, easy to use, community solar option that does not require roof space, home ownership, or solar access, which will be targeted to low- and median-income customers. Launch of this program is expected by the end of 2023.

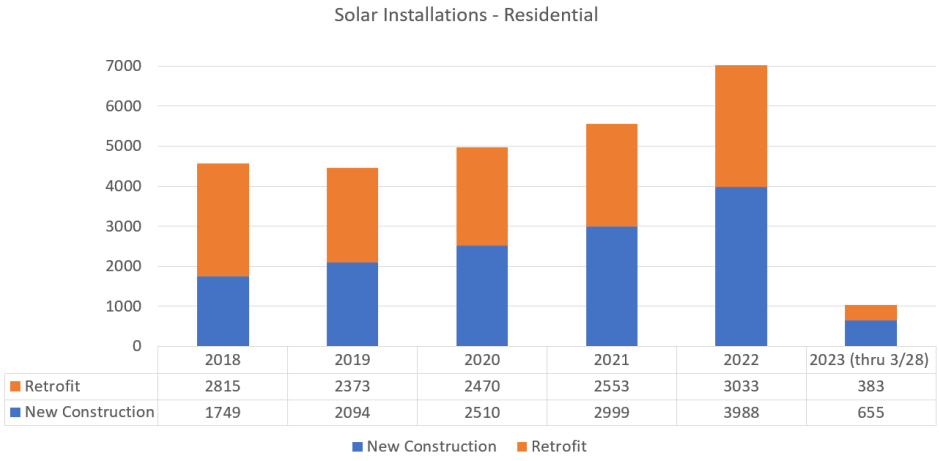
Planning efforts are also currently underway for the design of a community solar program for schools and non-profits. Staff is collaborating with a number of school districts to examine various business models and implementation options to develop agreements with at least one school district for this program, which we expect to be implemented in 2024.

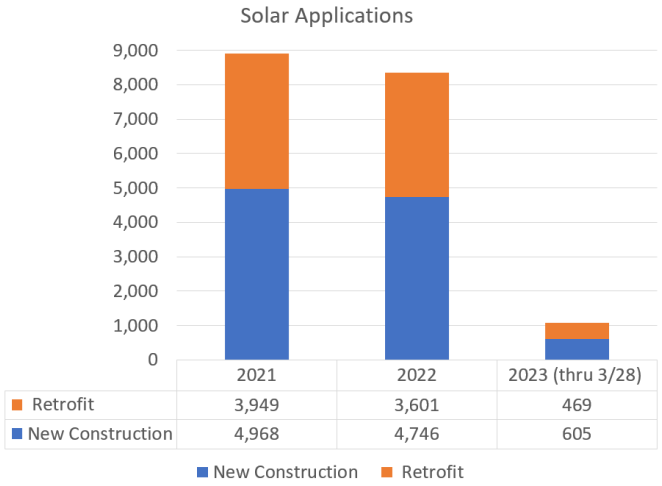
Behind the Meter Solar

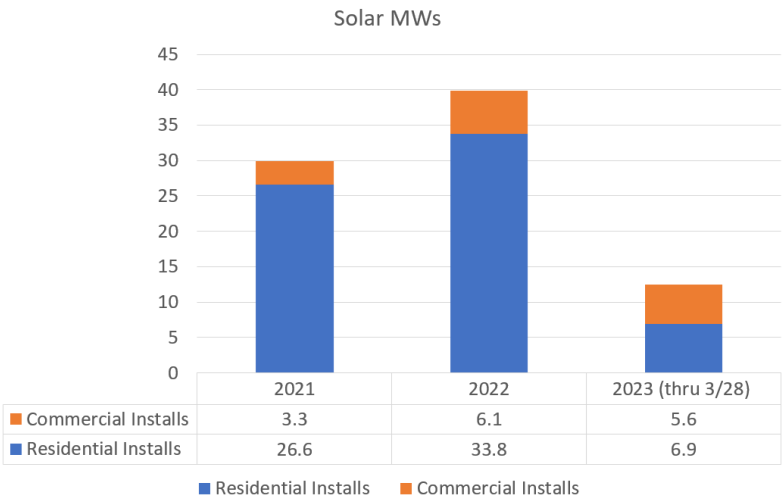
These tables visualize the progress we've made with **Behind the Meter Solar** applications, installations and MWs. In 2022, we added 39.9 MWs of solar (33.8 MWs Residential + 6.1 MWs Commercial). The number of solar installations have grown each year since 2019. The tables also show the breakdown between new construction and retrofit for both commercial and residential and the growth each year.



	2018	2019	2020	2021	2022	2023 (thru 3/28)
Retrofit	56	35	61	31	67	4
New Construction	4	3	91	141	202	27


Solar Installations - Residential
7000
6000
5000
4000
3000
2000
1000
0
2018 2019 2020 2021 2022 2023 (thru 3/28)
Retrofit 2815 2373 2470 2553 3033 383
New Construction 1749 2094 2510 2999 3988 655
New Construction
Retrofit


Solar Applications
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
2021 2022 2023 (thru 3/28)
Retrofit 3,949 3,601 469
New Construction 4,968 4,746 605
New Construction
Retrofit


Solar MWs
45
40
35
30
25
20
15
10
5
0
2021 2022 2023 (thru 3/28)
Commercial Installs 3.3 6.1 5.6
Residential Installs 26.6 33.8 6.9
Residential Installs
Commercial Installs

On March 1, 2022, SMUD launched **Virtual Solar**, which provides an opportunity for customers living in qualified, low-income multifamily properties to benefit from solar energy. Since its launch, solar contractors, energy consultants and affordable housing developers have expressed interest in the program. Inquiries since the launch represent approximately 2 MW of solar production benefiting an estimated 780 customer accounts. On December 2, 2022, SMUD received the first Virtual Solar application for a 50-unit, 57.65 kW installation.

In November of 2022, SMUD launched **Virtual Solar SEED Benefits** to provide additional incentives for Virtual Solar. Qualified Virtual Solar property owners who use a SEED-qualified solar or electrical contractor to complete the installation can receive a Solar SEED incentive that pays property owners $0.60 per watt of installed solar, up to $500,000 upon project completion.

Partnerships & Grants

Grants and Partnerships are key to SMUD attaining our goal of Zero Carbon. In 2022, SMUD implemented our grant strategy and focused on grant capture and partnership efforts.

As part of the strategy, we developed 13 Clean Energy Concept Papers in the topic areas shown in the graphic above. These concepts encompass a broad range of implementable strategies across technologies. The intent is to socialize these concepts with prospective collaborators, partners and funders in the public and private sector to educate and inspire them to partner and help SMUD achieve the 2030 ZCP.

In 2022, we successfully obtained grants that not only benefited SMUD, but also brought additional funds for our community through partnerships and support to community members in grant applications. SMUD helped secure $56M in funding of which $9M benefited SMUD customers, $9M to SMUD and $38M to SMUD partners helping to accelerate emerging technologies. In June 2023, SMUD will provide a more detailed update to the Board on Grant and Partnership activities.