



SMUD Board Panel 2: DERs and the Edge of the Grid

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Leverage Distribute Energy Resources (DER) to Increase Grid Reliability



Customers are adopting DERs at a fast rate

U.S. energy storage annual deployments will reach 7.3 GW annually in 2025

Sharp scale-ups are being driven by utility procurements and the accelerating residential market

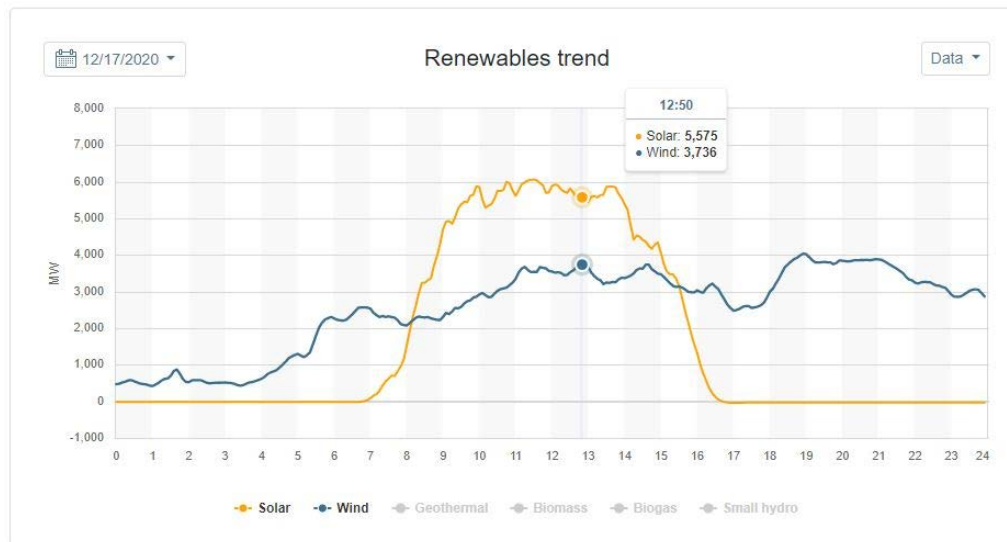
U.S. energy storage annual deployment forecast, 2012-2025E (MW)



- The U.S. energy storage market is set to grow from 523 MW in 2019 to 7.3 GW in 2025, more than 14x growth in annual deployments.
- Accelerated growth will occur in 2020 and 2021, driven by the first large-scale utility procurements coming online, with the market set to nearly triple in 2020 and more than double again in 2021.
- Supply constraints and delays in the FTM market have moved some initial 2020 projects to 2021 or later, but since these delays the scale of planned large-scale system planned has surged. Vertically integrated utilities nationwide are investing heavily, and wholesale market participation will open up new areas for growth.
- The Residential market is also poised for remarkable growth, tripling from 2019 to 2020 due primarily to favourable policies and resiliency concerns in California.

Source: Wood Mackenzie - U.S. Energy Storage Monitor

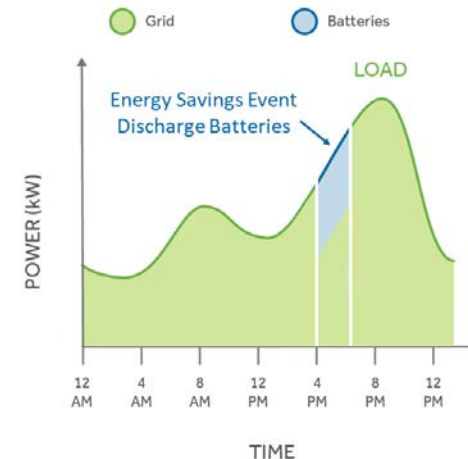
Solar & wind generation are intermittent and non-dispatchable



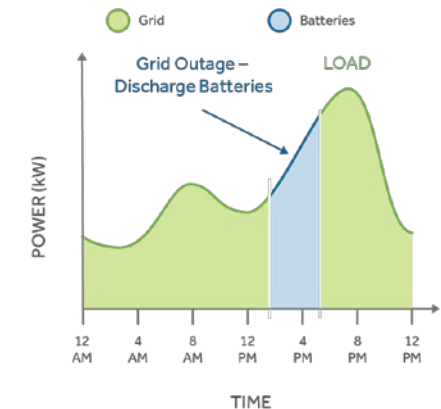
Source: California ISO - Today's Outlook

Control DERs to enable faster shift to zero-carbon supply

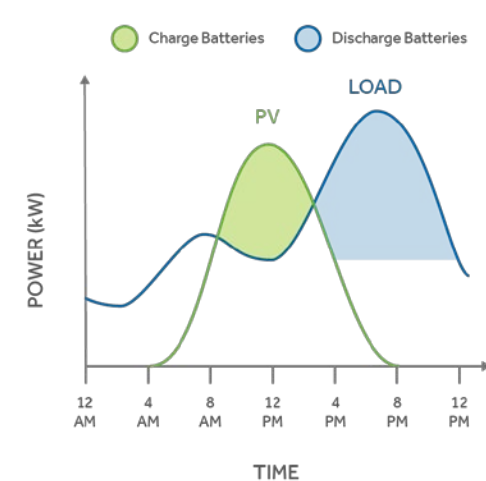
Demand Response



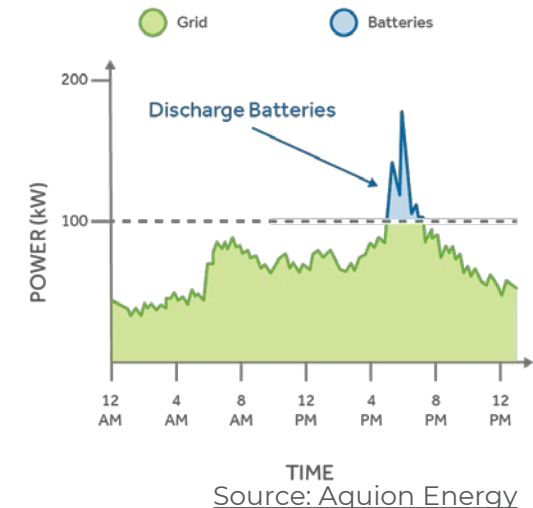
Backup Power



Solar-Self Consumption



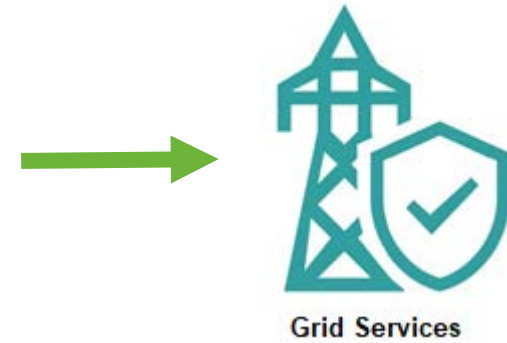
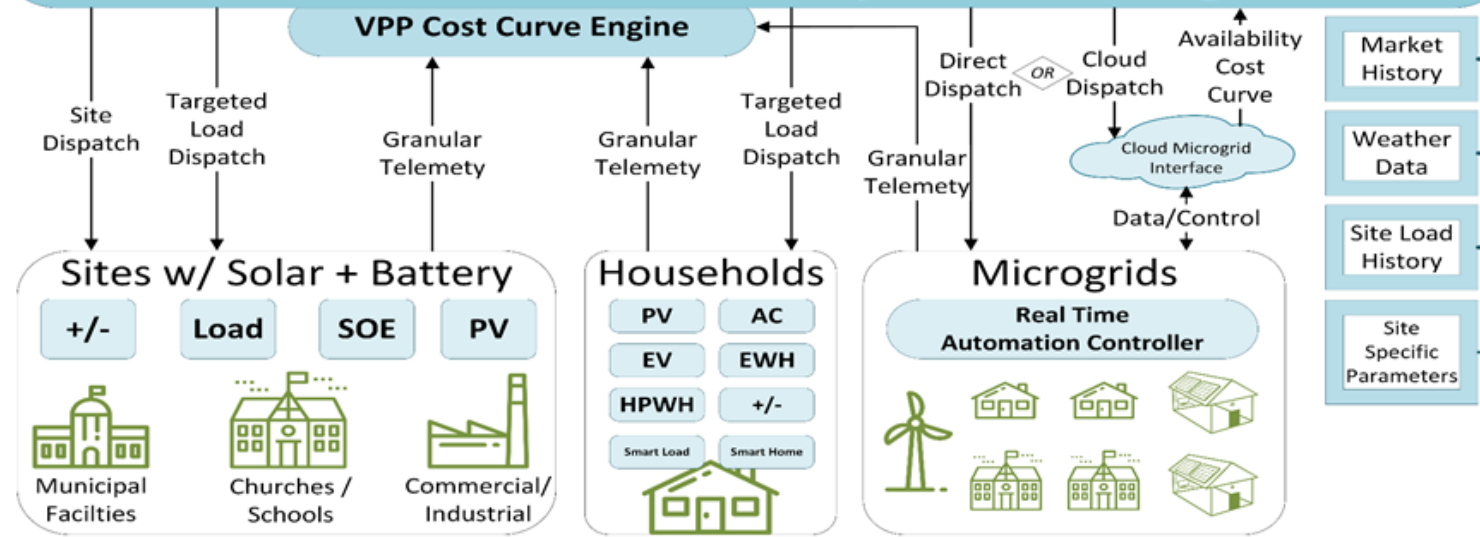
Demand Charge Management



Harness a Virtual Power Plant (VPP) to Meet 2030 Zero Carbon Goals



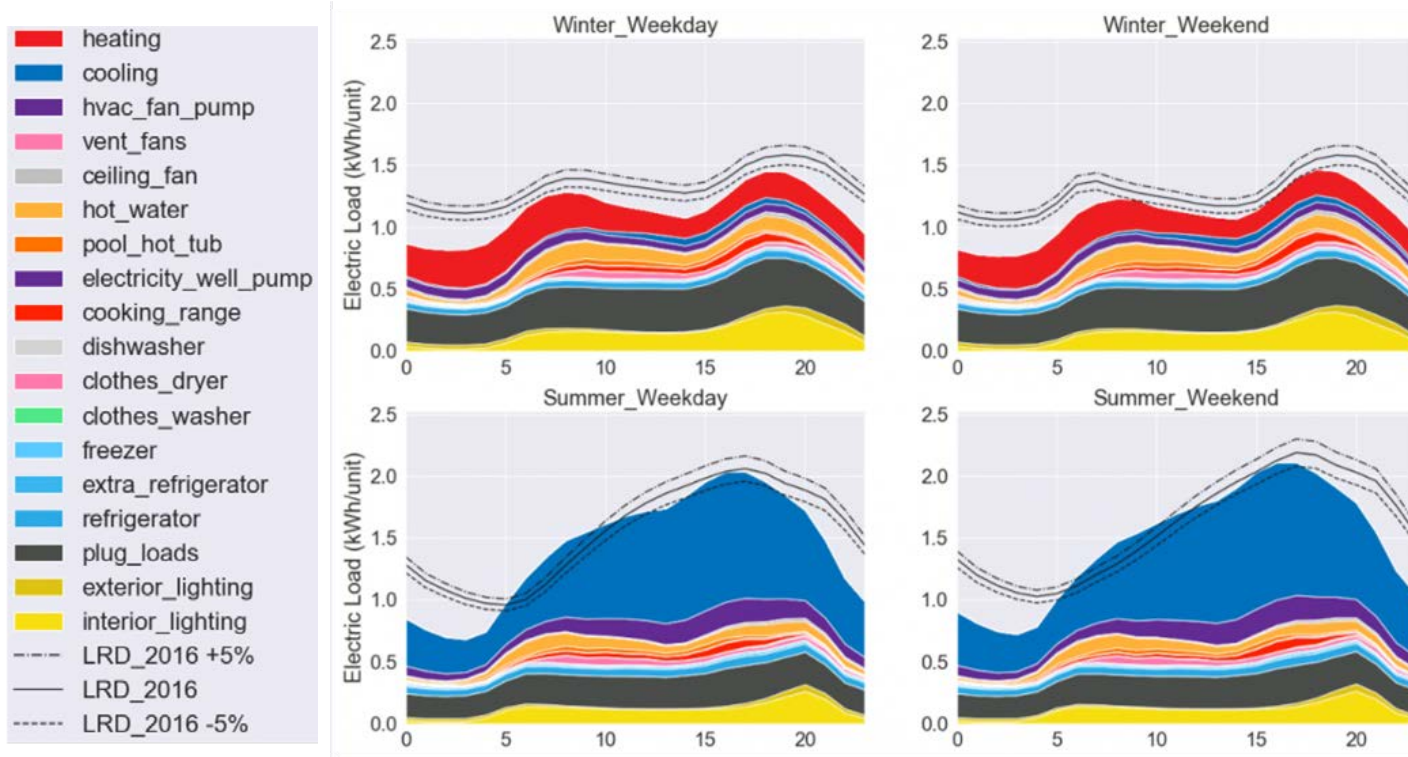
VPP Economic Dispatch Engine



Diverse Portfolio of Technologies Working Together is Key

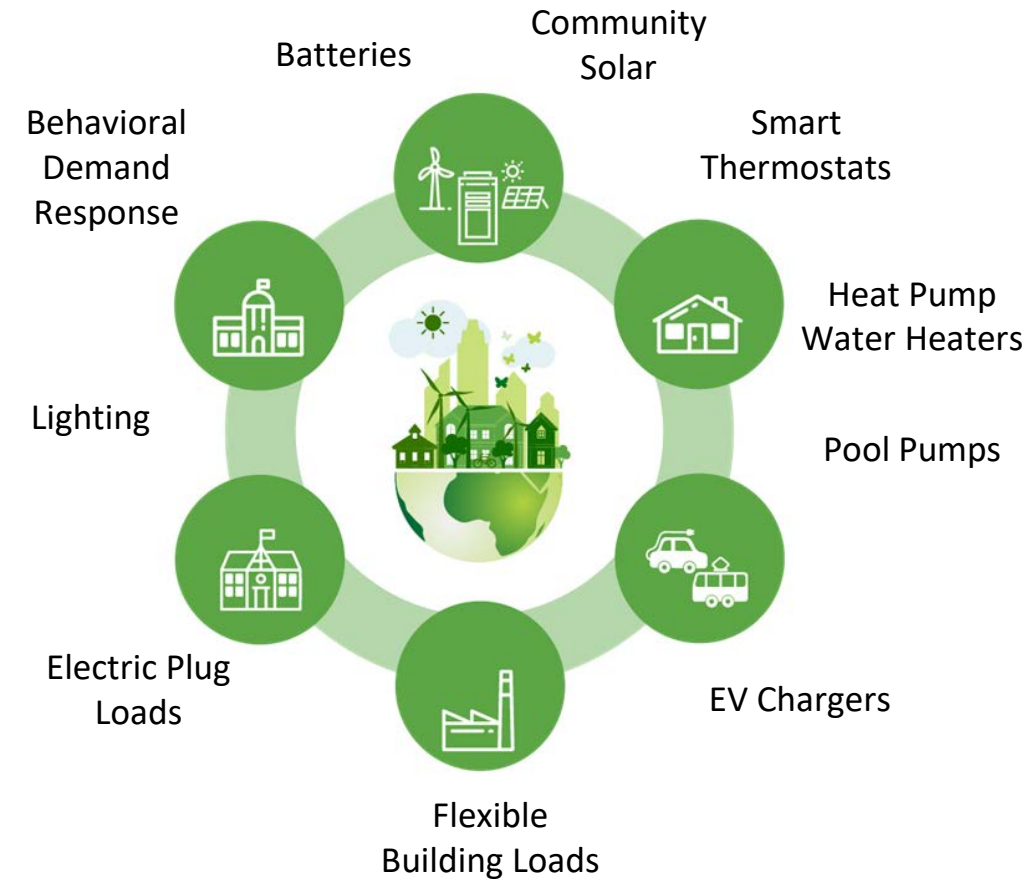


Customer loads are made up many components & vary throughout the year



Source: Office of Energy Efficiency & Renewable Energy - End-Use Load Profiles

Combine the unique characteristics of multiple technologies across customer segments to increase flexibility & control



Provide Value to Utility, Customers & Community



Utility

Meet Sustainability Goals

Grid Services & Resilience

Energy Savings

Reduced Supply Costs

Increased Brand Awareness

Customers

Bill Savings

Program Enrollment & Participation
Incentives

Technology Rebates

Community

Reduced Emissions

Cleaner Air

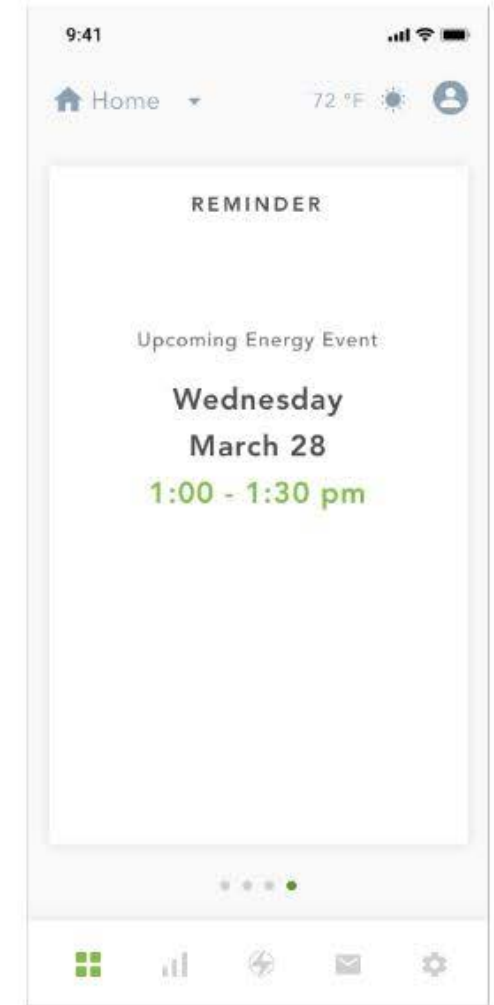
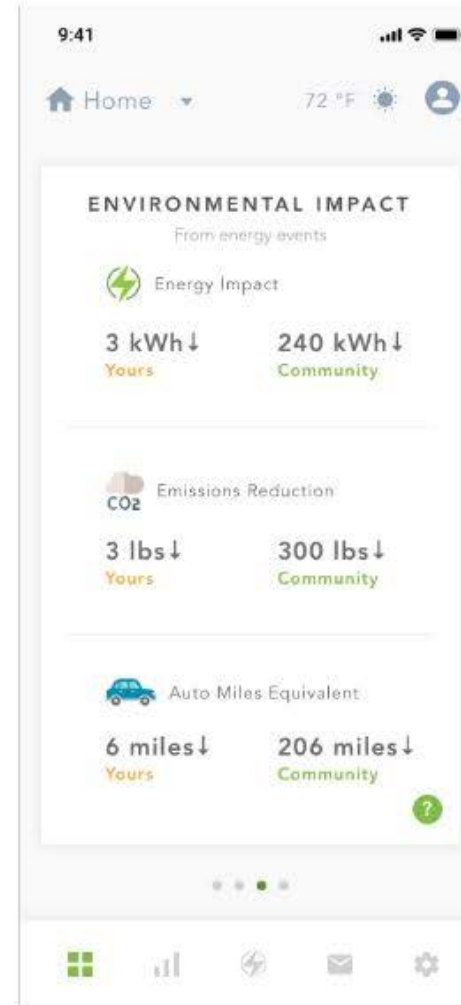
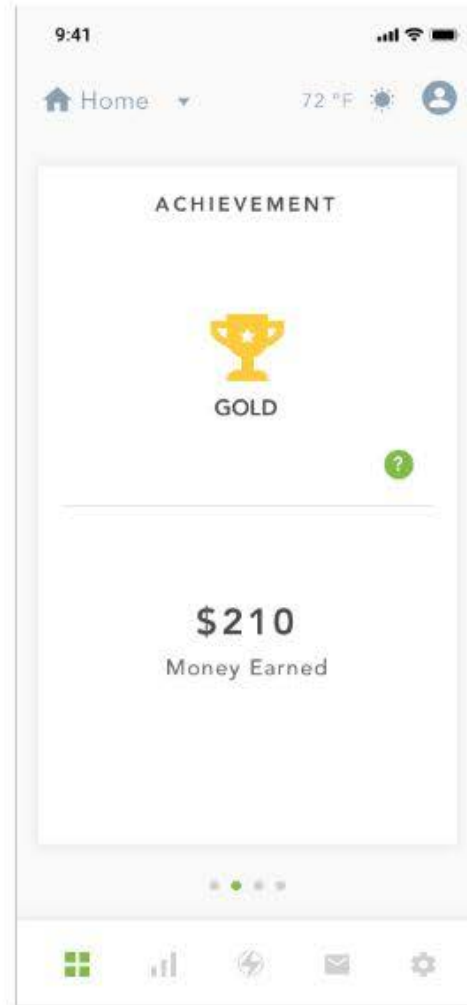
Education

Sense of Community

Shared Renewable Resources



Communicate Value & Impact to Customers to Increase Engagement

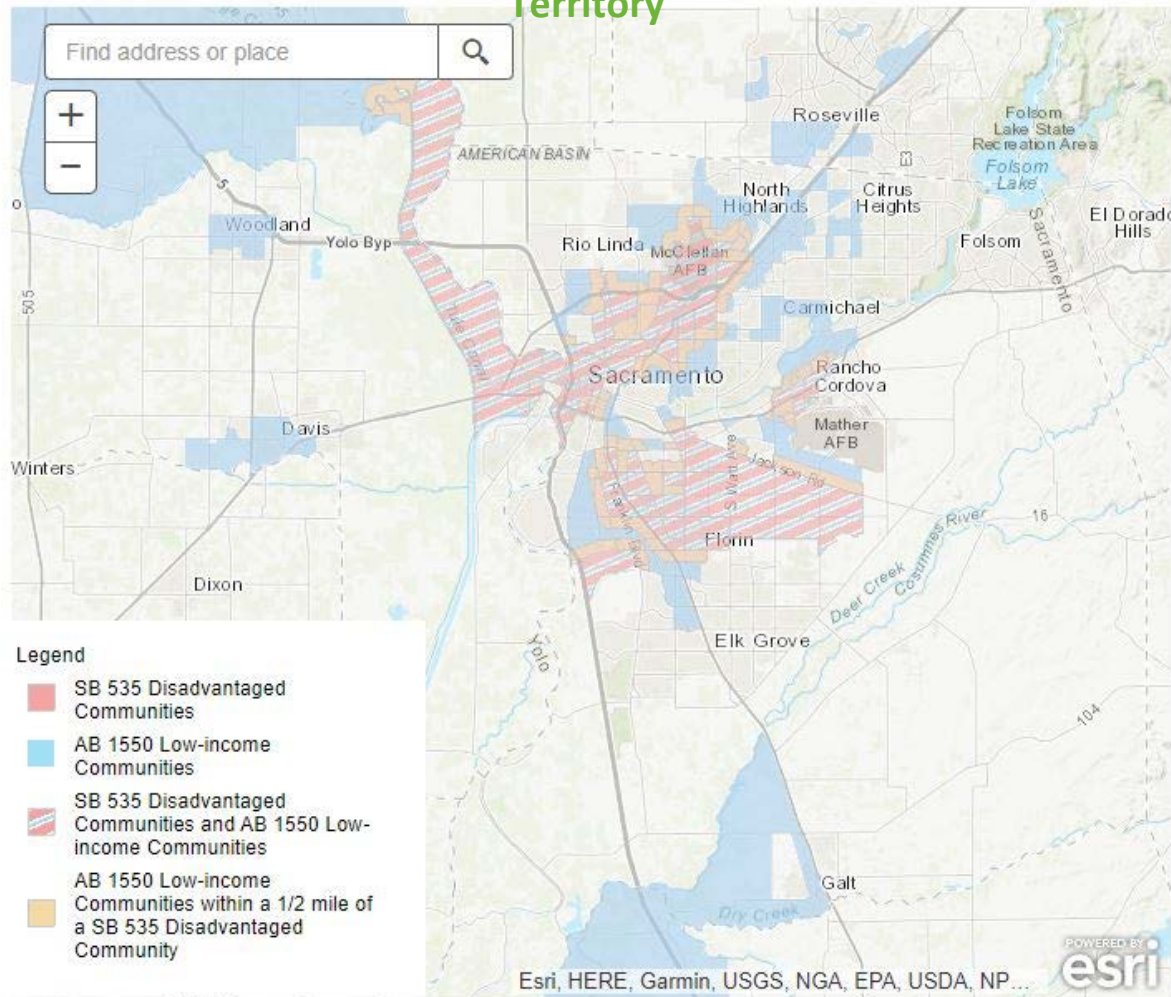


Olivine engages community participants through their mobile and web apps

Provide Equity Clean Energy Access to Everyone



Disadvantaged & Low-Income Communities in SMUD's Territory



CA Office of Environmental Health Hazard Assessment - SB 535 Disadvantaged Communities Map

Strategies to Engaged Members of Disadvantaged and Low-Income Communities



Behavioral Demand Response Options



Technology Rebates



Additional Program Incentives



Targeted Outreach

Implementation of Olivine Communities in DACs



Fresno Energy Program (PG&E's DAC Pilot)



Clean Power Alliance (CPA) Power Response Program



Richmond Advanced Energy Community (upcoming)

Community Vision for SMUD



Clean Energy



Grid Services



Reduce Cost



Lower Energy Load



Community Engagement + Education



Reduce Pollution

Future of Leveraging Distributed Energy Resources (DERs)

- Increased direct control of devices -> increased event performance and reliability
- DERs monitoring and responding to price signals
- Additional smart devices that can be controlled such as smart electricity panels and smart appliances
- Behind-the-meter batteries exporting energy to electrical grid
- Vehicle-to-home (V2H), vehicle-to-building (V2B), vehicle-to-grid (V2G)
- Increased community solar deployments
- Microgrids capable of islanding during periods of grid stress or outages
- Deployment of virtual power plants
- DERs providing additional grid services such as spinning reserves, non-spinning reserves, and frequency regulation
- Something about front-of-the-meter?