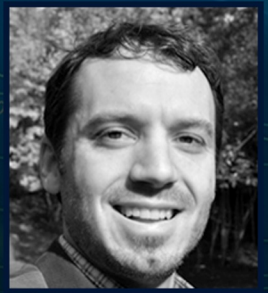
CALFLEXHUB SYMPOSIUM

NOVEMBER 3 | 8am-4pm PT



DENVER HINDS

ALBERT CHIU

JERINE AHMED

EMILY NICHOLS

LOAD FLEX LESSONS: **CALIFORNIA UTILITIES**

SPEAKERS: Denver Hinds, Senior Engineer, SMUD; **Albert Chiu**, Product Manager, PG&E; **Jerine Ahmed,** Technology Area Lead, SCE; **Emily Nichols,** Senior Strategist, Momentum

2023

CalFlexHub

BERKELEY LAB

STATE OF CALIFORNIA ENERGY COMMISSION

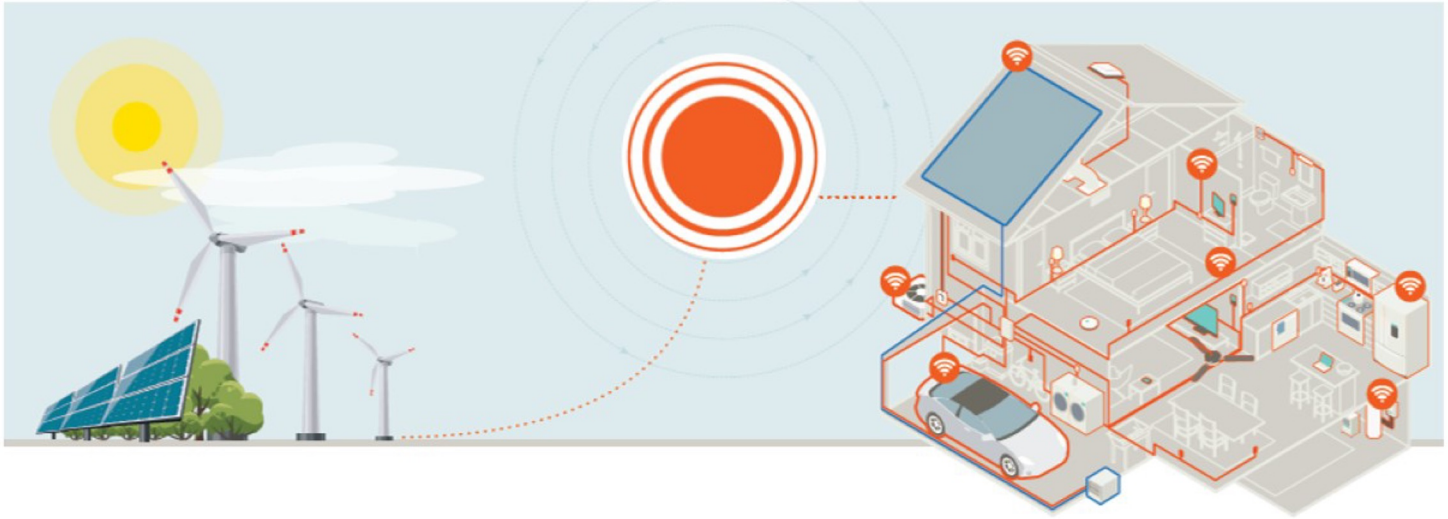
MOMENTUM

SMUD DER Flexibility Pathways

Denver Hinds

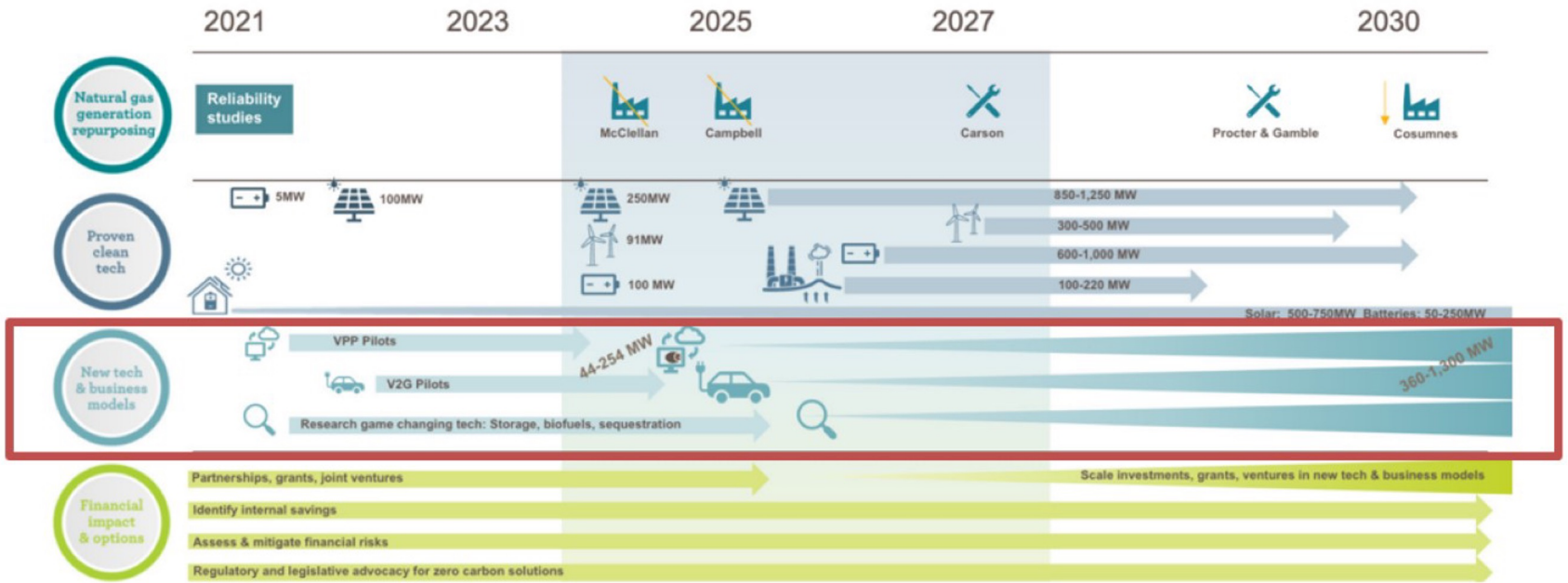
R&D, Senior Electrical Engineer

November 3, 2023

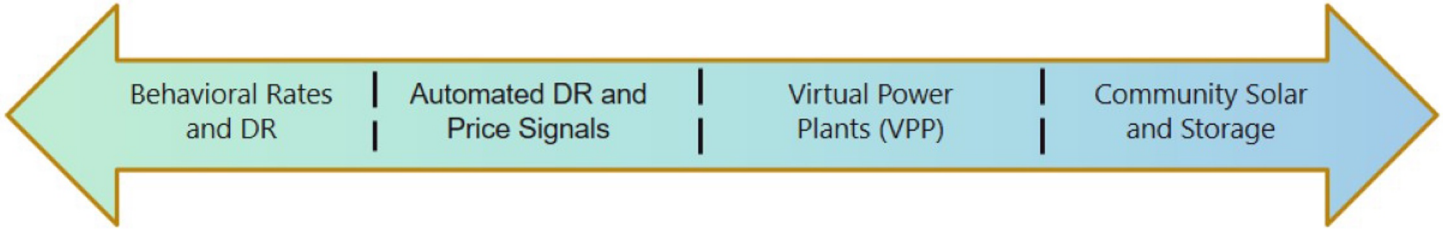


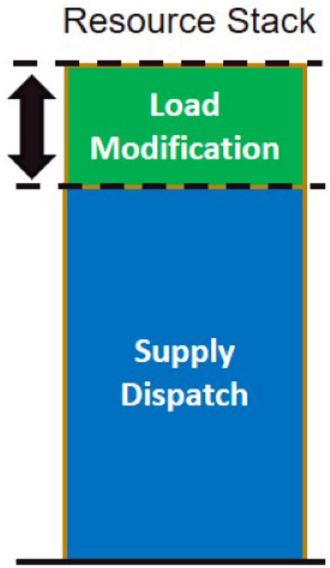
SMUD

2030 Zero Carbon Timeline



Load Flexibility Spectrum





Load Flexibility Portfolio

Residential Programs	$ Event	$ Signal	Control
• **Peak Corps (legacy)** • One-way devices for AC load control, emergency only			✓
• **Peak Conserve (new)** • Two-way devices for AC load control, economic dispatch			✓

• **My Energy Optimizer**
  • Starter (optimize to TOD rate)
  • Partner (smart thermostats)
  • Partner+ (control of batteries)
	✓	✓	✓

• **PowerMinder** • Load shifting with Wi-Fi connected HPWH		✓	
• **Managed EV Charging** • Smart charging w/ staggered discounts		✓	

Commercial Programs	$ Event	$ Signal	Control
• **PowerDirect®** • Load reduction through automated control	✓		
• **Temperature Dependent Pricing** • Load reduction through automated control	✓		
• **Commercial BESS** • Battery storage optimization for commercial customers	✓		
• **StorageShares** • Virtual alternative to BESS			✓
• **Commercial VPP** • To be designed			✓

CalFlexHub Symposium
Utility Panel

November 3rd , 2023

Together, Building
a Better California

Residential battery storage for load management

Are batteries able to respond to price arbitrage regardless of the customer's current rate?	**Batteries were able to respond to both TOU rate structures and market day-ahead prices without exposing the customers to any actual changes in their rate. For example, customers on a tiered rate were able to respond to the time of use rate structure without shifting the customer to a TOU rate. Similarly, all participants were able to respond to market conditions without being exposed to day-ahead market prices.**
How are the batteries able to respond to a time of use rate structure (TOU-C)?	The batteries responded to a time of use rate structure in one of two ways. The first response was a base setting that could be selected by the customer when they installed the battery. For the customer-selected TOU setting the battery discharged at the beginning of the peak price window. The second type of response was through price arbitrage. When implementing price arbitrage, the battery discharged when the rolling average price was at its peak. As a result, the battery discharged in the middle of the peak price window rather than at the start of the peak price window.
How are batteries able to respond to day-ahead market prices (RTP)?	The battery responded to day-ahead market conditions and discharged during the highest price period of the day, which typically occurred from 6-7 PM during the study period.

CalFUSE pilot with Valley Clean Energy

AgFIT Pilot Description.

- Three-year pilot from 2022 through 2024.
- Large agricultural participants are given incentives to automate irrigation pumps.
- Participants on TOU are provided automation technology, then shift to dynamic pricing.
- There are no demand charges and participants have bill protection.
- Customer receives dynamic offer prices for 1 to 7 days ahead and can schedule pump run times accordingly.
- AgFIT participants had a subscription component to their 2022 bills based on 2021 usage.

Photo from Polaris website

Key takeaways for two agricultural participants during PY2022.

- The pilot makes it simple for participants to decide when to purchase load based on price.
  - The pricing method had complex elements not fully reflected in the user interface.
- Automation enables load response for **BOTH** TOU and Dynamic Pricing tariffs.
  - On TOU with automation, participant response is concentrated during peak pricing hours.
  - On dynamic pricing with automation, participant response to high prices is spread out across more hours than TOU.
  - Both participants responded to TOU price signals when pumps were automated.
  - Under dynamic pricing, one participant responded more on high-priced days than low-priced days, while the other participant did not differentiate its response across those day types.
- Subscription pricing does not accurately reflect intermittent Ag pumping loads.
  - Can still provide a good hedge against persistent high prices.
  - May not provide a good hedge against more isolated price spikes.

Voice automation for residential load management

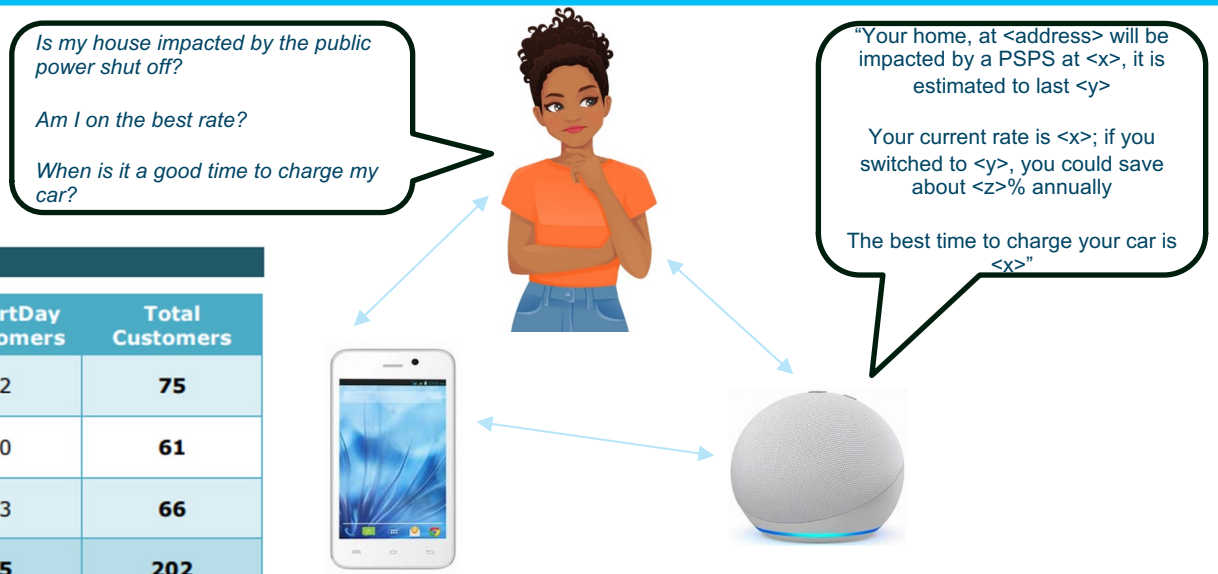


TABLE 7: ANALYSIS DATASET CUSTOMER COUNTS

Customer Segment	High Price Customers	Flex Alert Customers	SmartDay Customers	Total Customers
Non-Solar TOU	70	45	2	**75**
Solar	53	47	0	**61**
Non-Solar Non-TOU	7	48	3	**66**
Total Customers	**130**	**140**	**5**	**202**

* Customers could sign up for multiple notifications (rows will not sum to total); customer counts reflect customers with complete load data available for analysis.

TABLE 9: HIGH PRICE NOTIFICATION LOAD IMPACTS

Hour	Reference Load (kW)	Modeled Treatment Load (kW)	Impact (kW)	90% Confidence Interval	Percent Impact
4:00 PM	1.04	1.01	0.03	(-0.19, 0.13)	3.3%
5:00 PM	1.08	1.03	0.05	(-0.21, 0.12)	4.6%
6:00 PM	1.11	1.05	0.05	(-0.20, 0.08)	5.6%
7:00 PM	1.08	1.04	0.04	(-0.17, 0.09)	3.8%
8:00 PM	1.15	1.02	0.12	(-0.27, 0.03)	12.2%

CalFlexHub Symposium
Utility Panel

November 3, 2023

Jerine Ahmed – Sr Engineer

Customer Programs and Services

DR Resource Programs

Agricultural Pumping Interruptible (API)

Direct load control program; Signal sent to devices that shut off equipment when events are called. Customer receives bill credits; no penalties.

Reliability

Base Interruptible Program (BIP)

Customers/Aggregators must reduce load to a Firm Service Level (FSL) within 15 or 30 minutes of notification. High excess energy charges during event periods; substantial bill credits year-round.

Summer Discount Program (SDP)

Cycling of A/C device; summer bill credits based on tonnage and level of cycling; available to residential + commercial customers

Smart Energy Program (SEP)

Provides residential customers monthly summer bill credits; available to customers with qualifying Programmable Communicating Thermostats (PCTs)

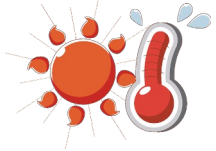
Capacity Bidding Program (CBP)

Aggregator program provides capacity + energy payments for actual load reductions during events; monthly bids (set pricing paid to aggregators, savings vary by month).

Price-Responsive

Critical Peak Pricing (CPP)

"Dynamic Pricing". Typically 12-15 events/year, higher energy costs from 4:00-9:00 PM in exchange for reduced on-peak demand costs throughout the summer.



Real Time Pricing (RTP)

"Dynamic Pricing". Hourly rates differentiated by temperature bands, season, and weekdays vs. weekends/holidays. Based on highest recorded temperature for previous day in downtown LA.

Demand Response Contracts (DRC)

Like CBP, except SCE has contracts with DR Providers (aka Aggregators). Includes Local Capacity Resources (LCR), Preferred Resources Pilot (PRP), and Aliso Canyon Energy Storage (ACES)

Demand Response Auction Mechanism (DRAM) Contracts

SCE procures DR RA capacity from third-party DR Providers (DRPs). DRPs are responsible for bidding the energy of these resources into the CAISO wholesale energy market.

Emergency Load Reduction Program (ELRP)

a flexible Demand Response (DR) program

CalFuse Pilot

Smart Heat Pump Water Heater Program

Program Overview

- Behind the Meter (BTM), thermal energy storage, demand response program that rewards customers for installing or activating control devices on electric resistance or heat pump water heaters
- Program is expected to launch in Q1-2024 and will run through 2027
- Participants must enroll in a time-of-use (TOU) rate plan if they are not already on one
- As a controls program for existing and new water heaters, Smart HPWH Program will complement rather than duplicate water heater replacement programs such as SGIP HPWH, TECH Clean California and Energy Savings Assistance (ESA) Program

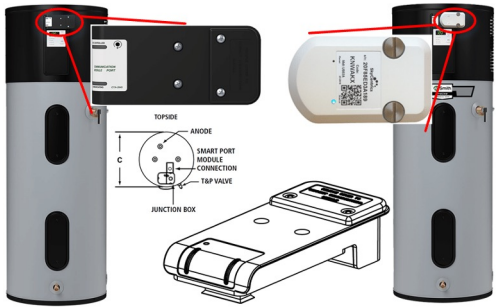
Program Objectives

- Reduce/shift distribution electric grid capacity need
- Reduce residential and commercial greenhouse gas emissions
- Avoid electricity costs, due to increased use of low-cost mid-day electricity generation
- Reduce energy bills for participants
- Enable improved grid management through the control of participants' energy use

Smart Heat Pump Water Heater Program

Connectivity Technologies

- ERWHs and HPWHs may require a connectivity device, or have built-in Wi-Fi connectivity, depending on the model and network availability
- When needed, connectivity devices are planned to be provided to participants by the Program at no-cost



Incentives

- The Program includes incentives for customers to shift the electrical load of their water heater to avoid peak hours (4:00 p.m. to 9:00 p.m. daily)
- The Program will provide customers with a one-time sign-up incentive and an ongoing participation incentive
- Incentives will be available for residential single-family homes, multifamily buildings, and small businesses
- The program will prioritize low-income, public sector, and both residential and small business customers in disadvantaged communities (DACs)

Grid Responsive Heat Pump Water Heater Study

Objectives

1. Monitor and study the field performance of HPWHs retrofitted in 12 homes in the SJV Electrification & DR DAC pilots
2. Analyze the in-field energy efficiency and demand response capabilities of HPWHs
3. Collaborate with/inform the SJV Electrification & DR DAC pilots

Expected Outcomes

1. Serve as technical advisor to SJV Electrification and DR DAC pilots: HPWH equipment selection, DR event design
2. Characterize the baseline performance of HPWHs: thermal performance, sizing vs needs, seasonal impacts
3. Characterize the EE and DR performance of HPWHs: Electrical usage, DR communications and control strategies capabilities (compare with JA13 specs)
4. Document any findings related to installation/maintenance, customer experience. Potential inform future training.