



Decoding Grid Integrated Buildings Summit

November 12-13, 2019

California Endowment Oakland Office



**BUILDING
DECARBONIZATION
COALITION**



GRIDWORKS

Agenda

9:30 - 9:45am	Overview of Day 1
9:45 - 10:45am	Problem Solver Panel: What are the emerging solutions to address the problem statements identified on Day 1?
10:45 - 11:30am	Break out 1: Solutions for Electrical Panels
	Break out 2: How to address the distribution grid
11:30 am - 12:15 pm	Reconvene and report out from break outs
12:15 - 12:30pm	Wrap and Next Steps

Day 2: Problem Solver Panel

- Cisco Devries, OhmConnect
- Billi Romain, City of Berkeley
- Spencer Harrison, NeoCharge
- Matt Golden, Recurve
- Chad Conway, Span
- Sean Armstrong, Redwood Energy



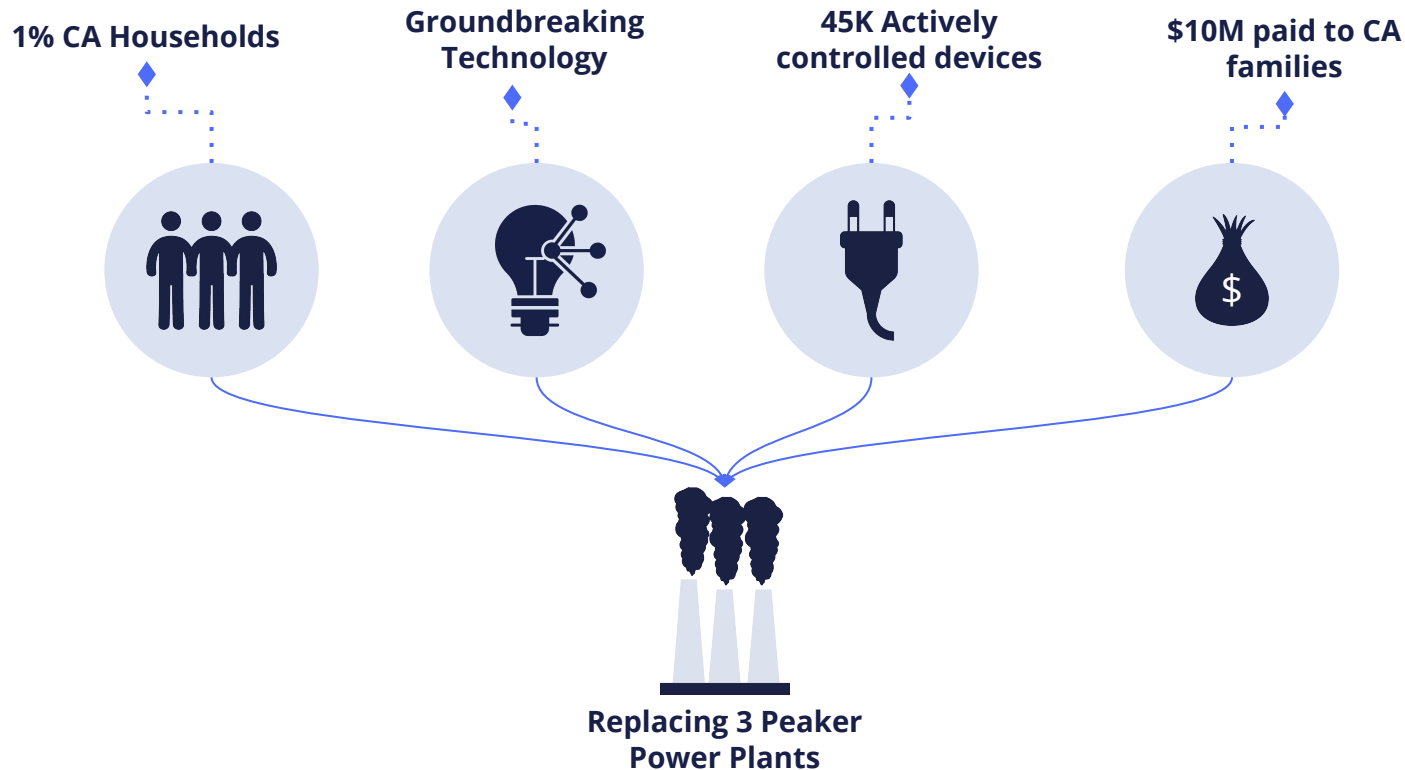
ohmconnect

Save Energy. Get Paid.

November 2019

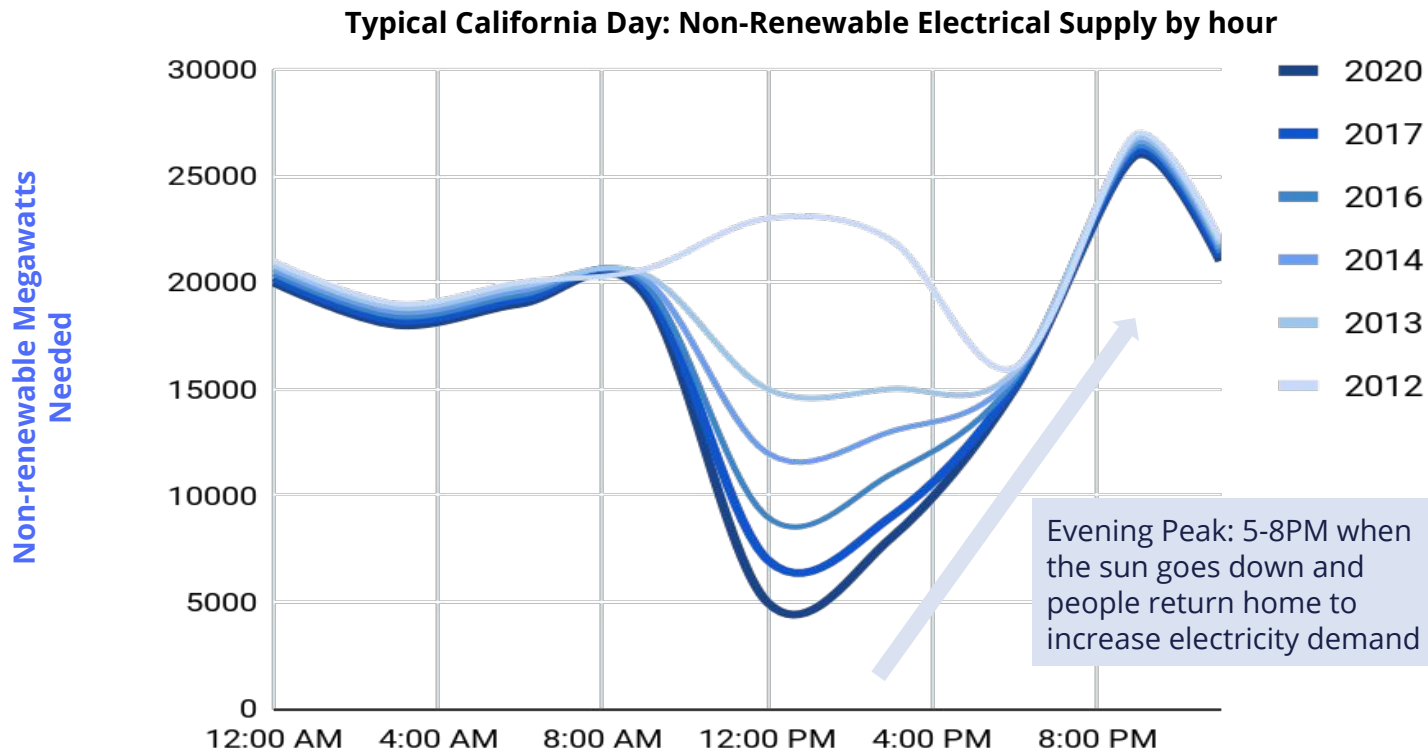
OhmConnect is fueled by 142,000 enrolled users across California

Three traditional peaker power plants would cost \$192M to build



Renewable generation is breaking the electric grid

Key Problem: Solar power & residential demand creates evening peak; met by firing up old gas power plants



Three Solutions: Residential Flexibility Wins

Demand flexibility through virtual power plants is the best solution

1. Peaker Plants

McGrath Peaker
Central Valley, CA (2012)



→ 45 MW gas peaker

2. Battery Storage

Tesla Battery Station,
Kauai, HI (2017)



→ 52 MW storage facility

3. OhmConnect Plant Central Valley, CA (2018)



→ 50 MW Virtual Power Plant

Fossil Fuel Free Buildings in Berkeley

November 13, 2019



Berkeley Passed a Natural Gas Prohibition



FOX NEWS LIVE

U.S. World Opinion Politics Entertainment Fox Nation More : Q Login Watch TV

Hot Topics

OPINION · Published July 20

Daniel Turner: California's latest descent into liberal madness – Berkeley bans natural gas

OPINION By Daniel Turner | Fox News



Berkeley became first US city to ban natural gas. Here's what that may mean for the future

The California city on Tuesday voted to ban natural gas hook-ups in new buildings, in a historic move

Los Angeles Times LOG IN

Sections

OPINION

Op-Ed: Berkeley banned natural gas. The rest of California should too

San Francisco Chronicle

LOCAL // BAY AREA & STATE

Berkeley becomes first U.S. city to ban natural gas in new homes

Sarah Ravani | July 21, 2019 | Updated: July 21, 2019 5:38 p.m.

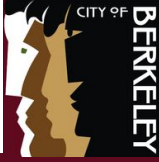
Bloomberg Sign In Subscribe

Menu Search

Berkeley Is the First City in America to Ban Gas From New Homes

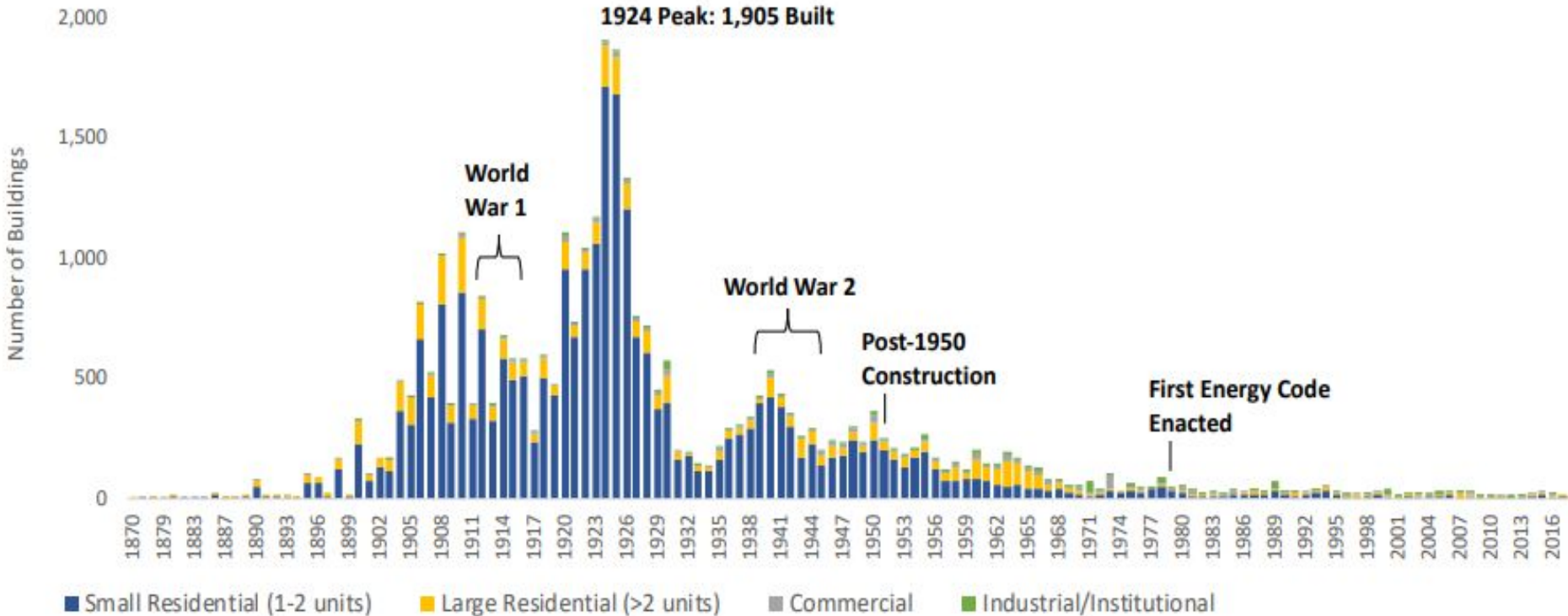
By [David R. Baker](#) and [Mark Chediak](#)
July 17, 2019, 9:30 AM PDT
Updated on July 17, 2019, 12:14 PM PDT

How do we engage our existing buildings??



Berkeley Building Stock Breakdown

All Buildings, Year Built



Require an Energy Assessment at Time of Sale



FOR SALE

Jualeah Shaw
REALTOR®
& MORTGAGE LOAN PROFESSIONAL




catalystrealestate
PROFESSIONALS

CalBRE #01500103
NMLS #1573498

510.695.7353
www.jualeah.com

Home Energy Score Program Features



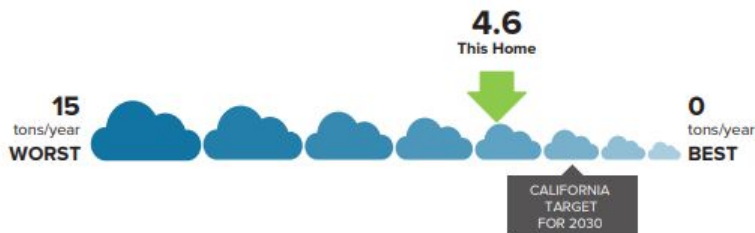
Home Energy Score details



Official Assessment | ID#290908

Home Energy Score is an easy way to see how energy efficient this home is compared to other homes. A higher score is better. This report also contains ways you can make your home more efficient and more comfortable.

This home's carbon footprint



Water Heating Fuel	Count	Percent
Electric	9	1.05%
Natural Gas	847	98.95%

Air Conditioning Type	Count	Percent
heat_pump	5	0.4%
mini_split	2	0.2%
none	1253	95.5%
packaged_dx	6	0.5%
split_dx	46	3.5%

Primary Heating System Type	Count	Percent
baseboard	19	1.4%
boiler	42	3.2%
central_furnace	1027	78.3%
heat_pump	5	0.4%
mini_split	2	0.2%
wall_furnace	213	16.2%
wood_stove	4	0.3%

Berkeley's Transfer Tax

Existing Seismic Retrofit Program

- **Eligibility**

- Voluntary program for residential properties or mixed-use with 2+ units
- Specific seismic improvements listed in guidelines (e.g. bolting, foundation)
- Permit required

- **Amount:**

- Up to 1/3 of the base 1.5% transfer tax rate
 - For an average Berkeley home currently selling for \$1.2M, this is a \$6,000 rebate

- **Process:**

- 1 year after transfer to complete seismic retrofit work
- Resident submits application, if work approved after final inspection then the City sends applicant a check

Proposing a List of Measures

Electrification



Replace knob and tube wiring



Panel upgrade, AFCI Breakers, and wiring for circuits and outlets (240v)



Electric heat pump space heating/cooling

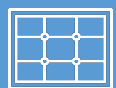


Electric heat pump water heater (replacing gas only)

Resilience



Electric vehicle charging station



Renewable energy generation installation



Solar + Storage



Battery storage

Energy Efficiency



Attic Insulation + Air Sealing



Window Replacements



Duct Replacement

Thank You!



Billi Romain

Sustainability Manager

Office of Energy and Sustainable Development

(510) 981-7432

BRomain@CityofBerkeley.info





Demand Flexibility as a Resource

Efficiency, Demand Response, Storage and Electrification

Matt Golden, CEO Recurve
matt@recurve.com

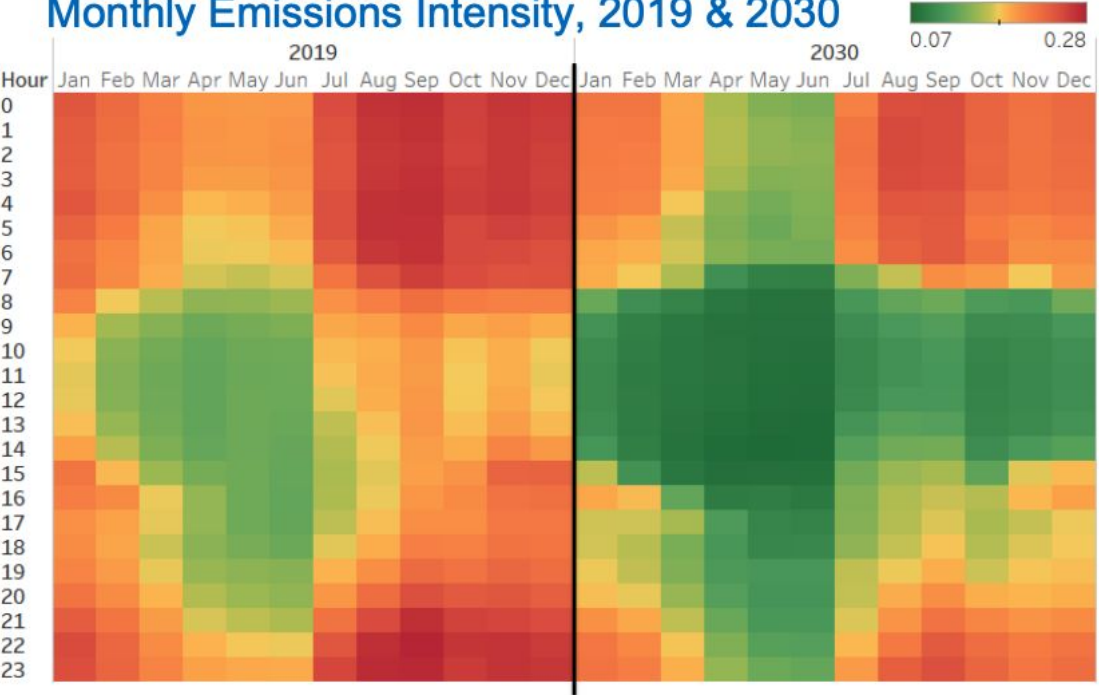
Decarbonization



CALIFORNIA ENERGY COMMISSION

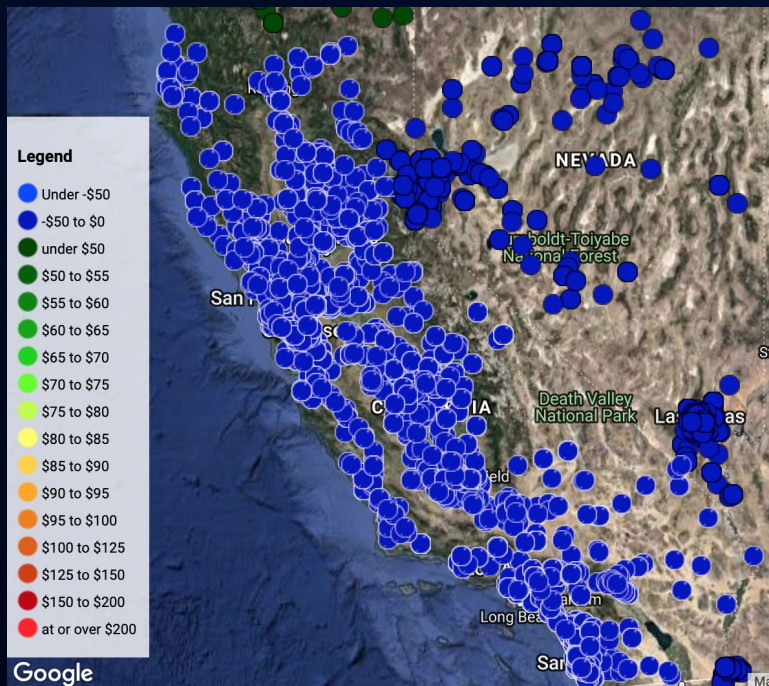
Electricity CO₂ Intensity

Monthly Emissions Intensity, 2019 & 2030

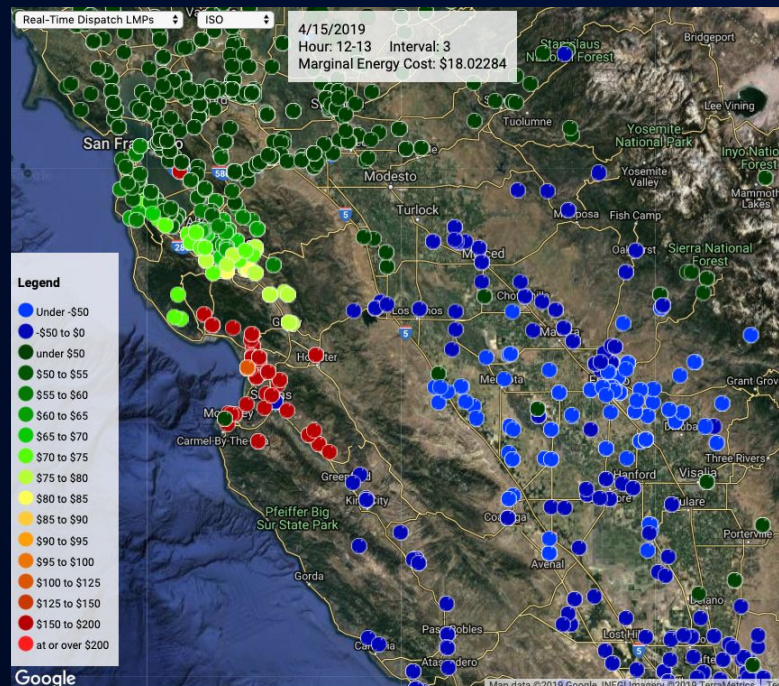


Renewables Require Load Balancing

March 23, 1:15 pm: Negative Pricing



April 15, 12:15 pm: Huge Variability

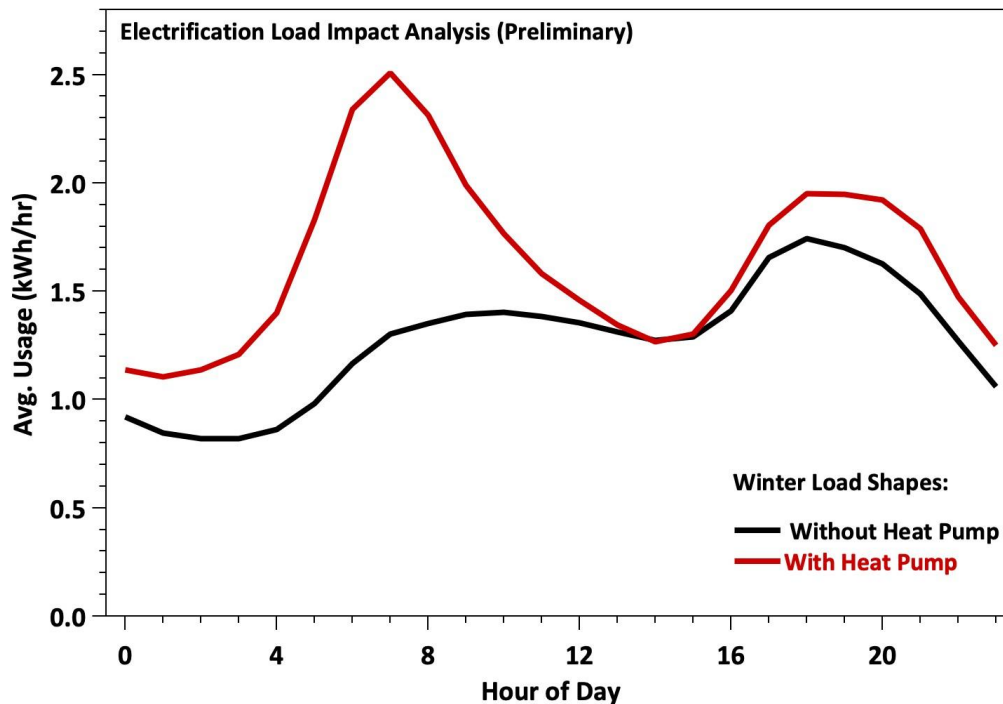


RECURVE

> 800 GWh renewables curtailed in 2019

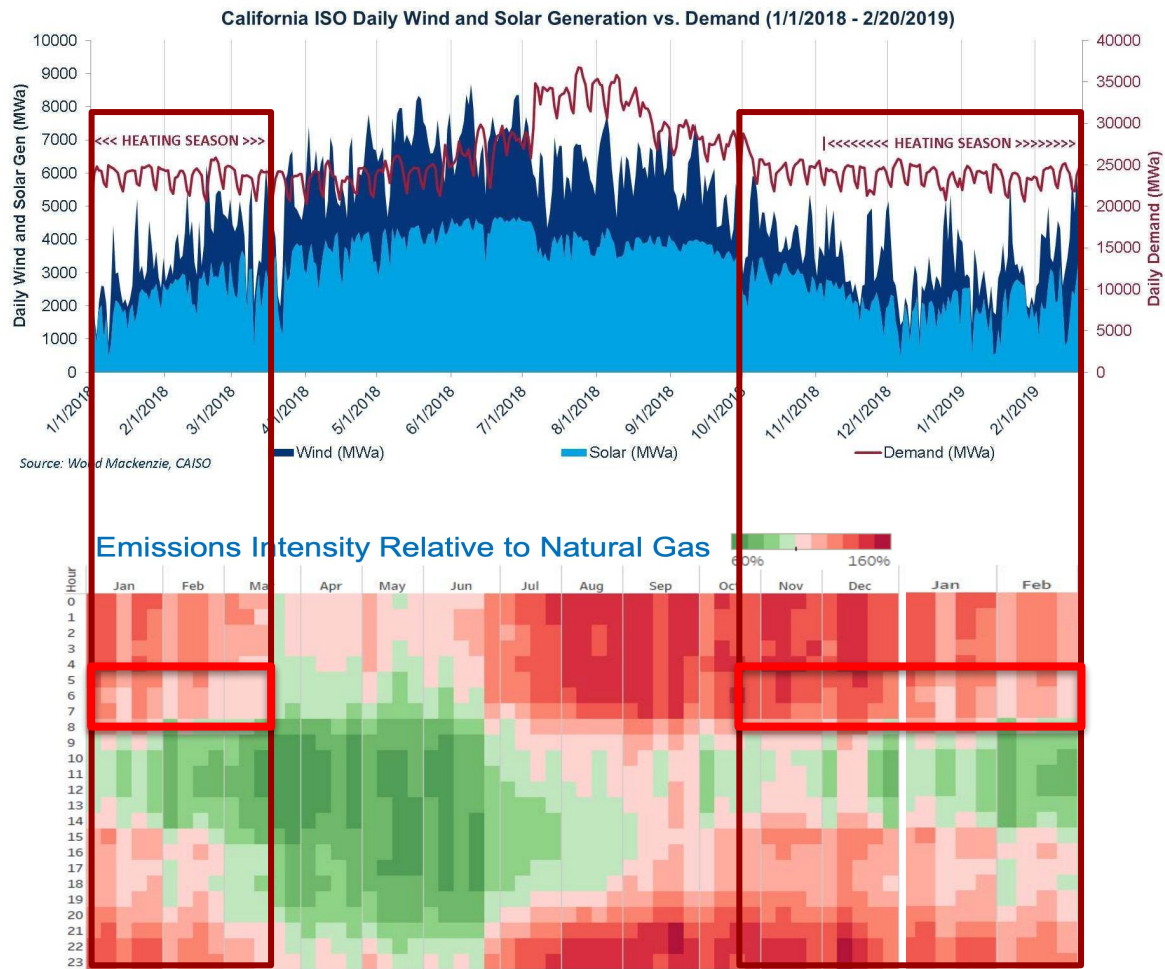
Electrification Will Require Balancing New Winter Peaks

Winter Load Shapes:



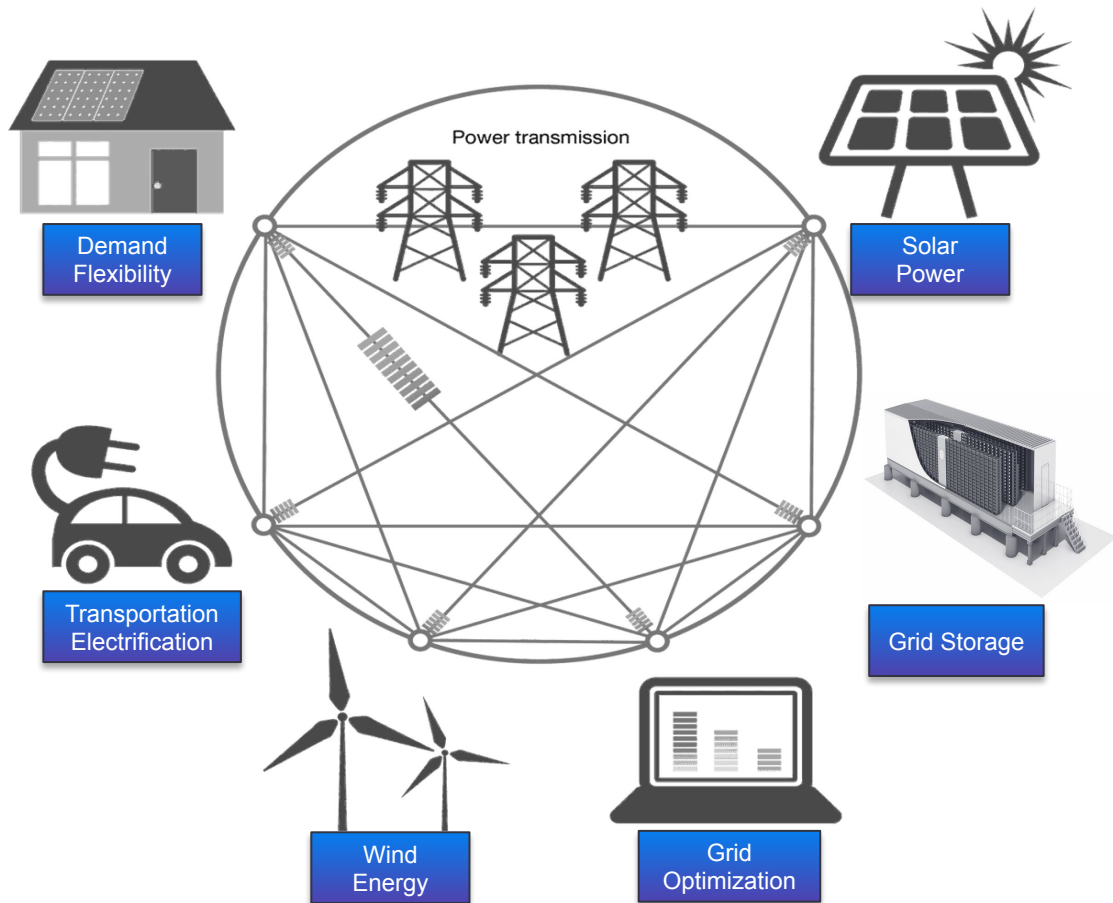
Heat Pump Buildings vs. Gas Heated Buildings

Electrification to Decarbonize and Build Load

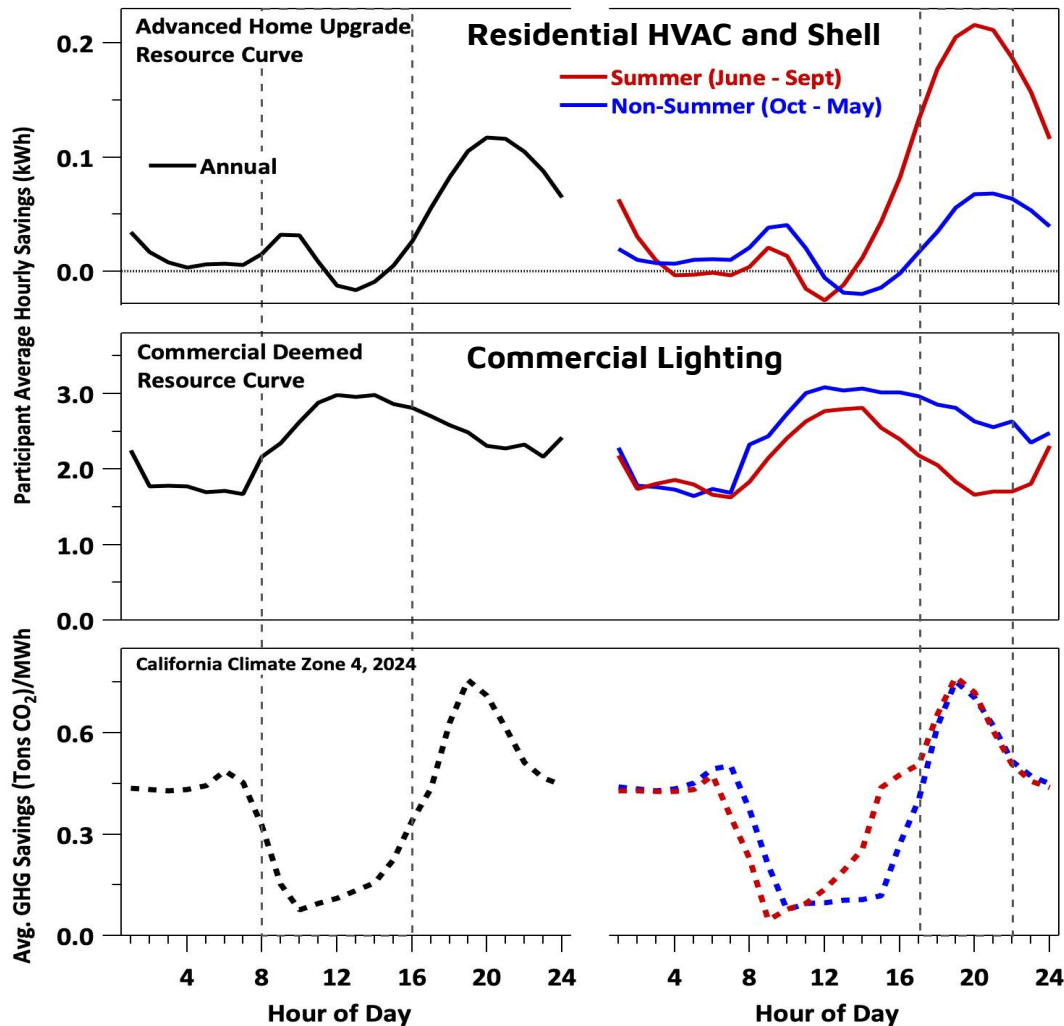


Making Markets for Behind the Meter Demand Flexibility

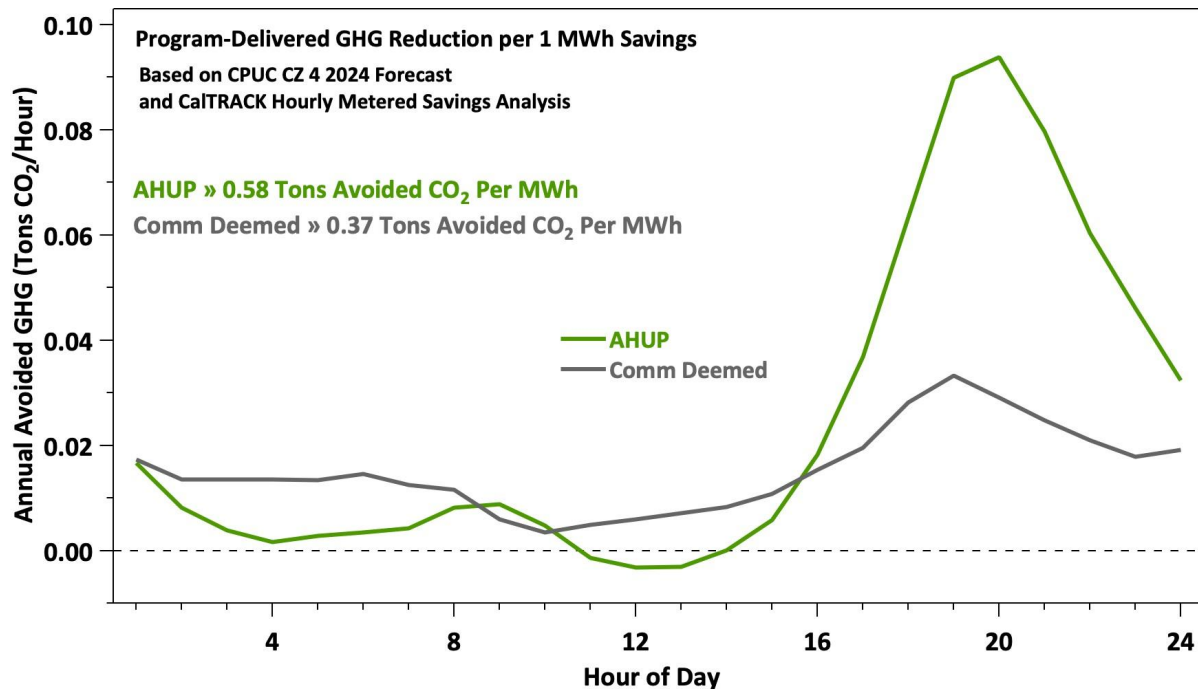
- Load shifting
(e.g., Storage, DR)
- Load shaping
(e.g., EE, Solar)
- Load balancing
(e.g., EVs, Heat Pumps)



Not All Energy Efficiency is of Equal Carbon Value

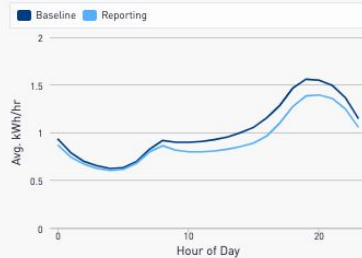


Residential HVAC Delivers 59% More Avoided CO₂ Per MWh

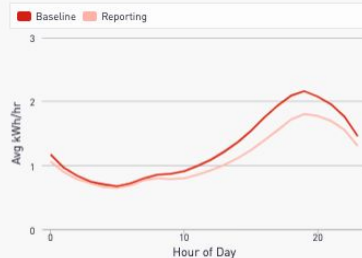


FILTERS (3) ▾ Climate_Zone 4 Year 2020 zProgram Home Energy Savings

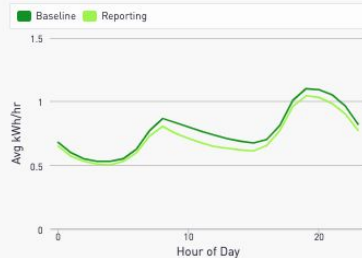
Annual Baseline and Reporting Load Shapes



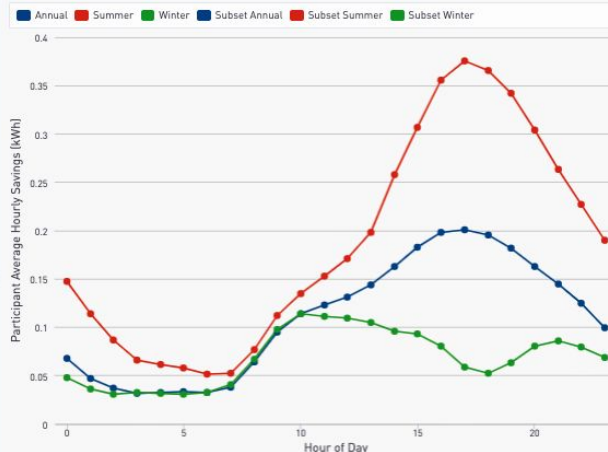
Summer Baseline and Reporting Load Shapes



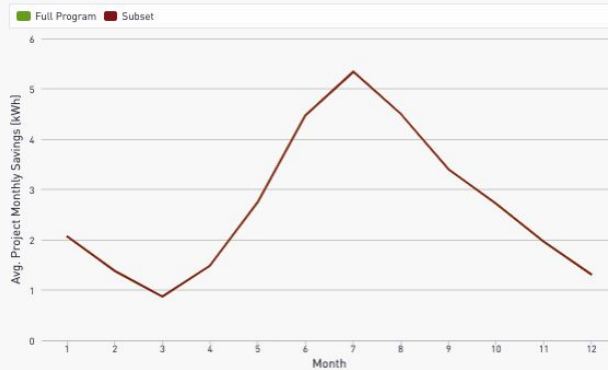
Winter Baseline and Reporting Load Shapes



Resource Curve - Full Program (dots), Cohort (Lines)



Monthly Savings



Program Average

965 kWh

Annual Participant Savings

11 %

Annual kWh Savings

213 kWh

Summer Peak Participant Savings

Subset

965 kWh

Annual Participant Savings

11 %

Annual kWh Savings

213 kWh

Summer Peak Participant Savings

100%

Percent of All Projects

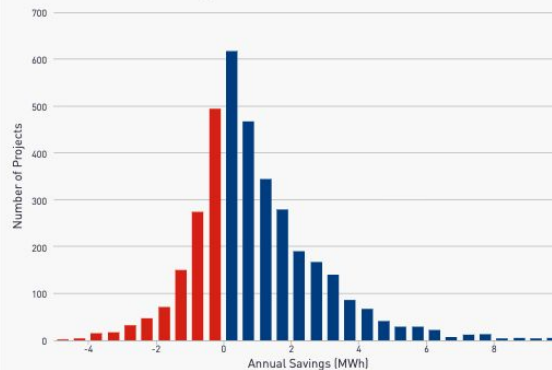
17 %

Summer Peak kWh Savings

30 %

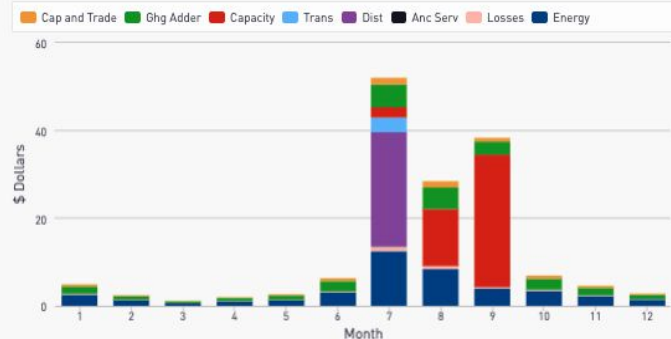
% Negative Savers

Distribution of Annual MWh Savings

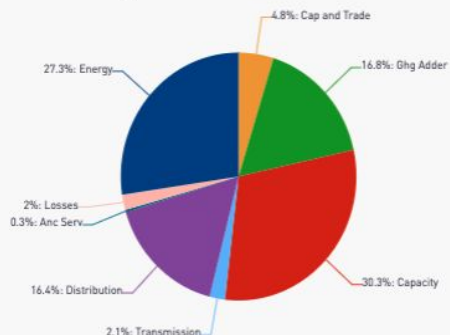
Electric
FlexiwattsResidential
HVAC and
Shell

FILTERS [3] ▾ Climate_Zone 4 Year 2020 zProgram Home Energy Savings

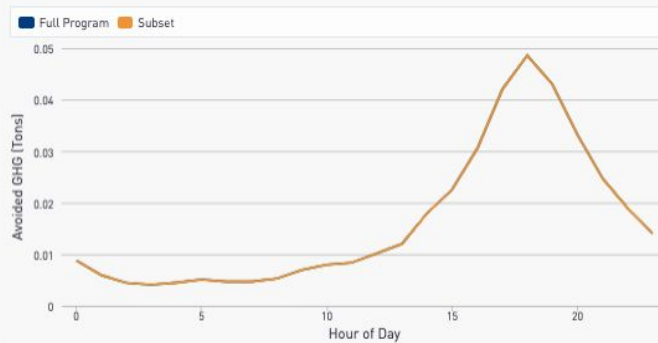
Average Project Electric Utility Avoided Costs



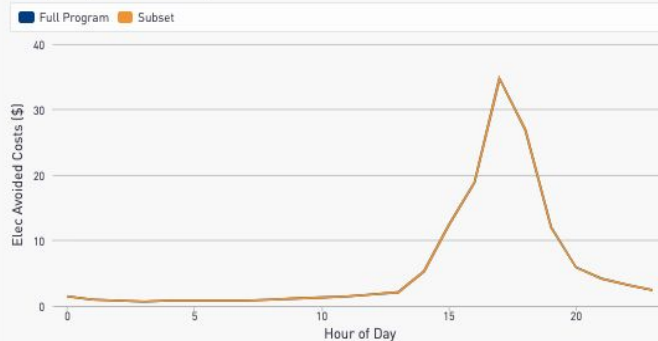
Avoided Cost Profile (Positive Only)



Average Project Marginal GHG Savings



Average Project Electric Utility Avoided Costs



Program Average

.397 Tons

Project Annual GHG Savings
From Electricity.41
Tons/MWh

Avoided GHG per MWh Savings

\$146.97

Project Annual Electric Utility
Avoided Costs

\$.152/kWh

\$ Avoided Cost per kWh Savings

Electric
Avoided
CostResidential
HVAC and
Shell

RECURVE

SHAPE THE FUTURE OF ENERGY

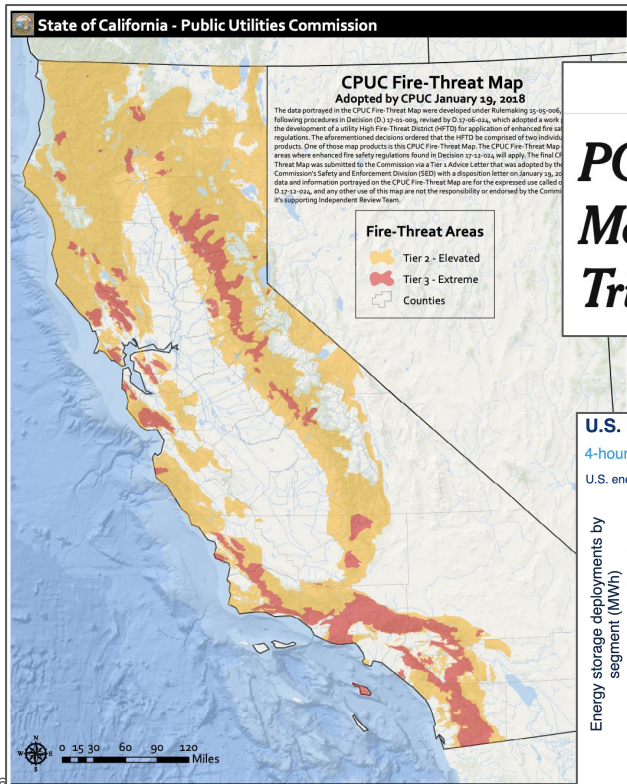


Matt Golden, CEO
matt@recurve.com

SPAN

FLEXIBLE ENERGY FOR THE MODERN HOME

More customers are asking for battery systems



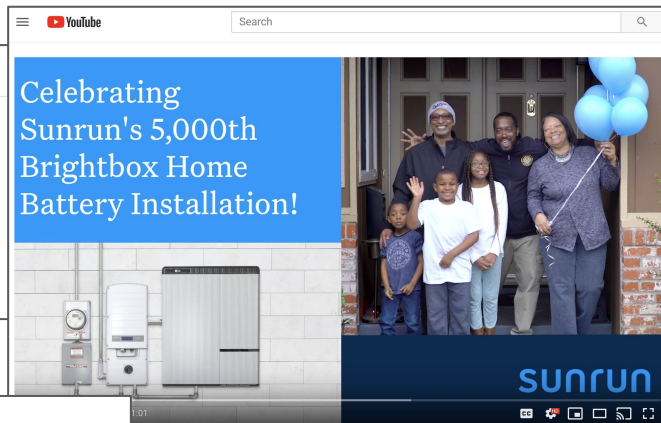
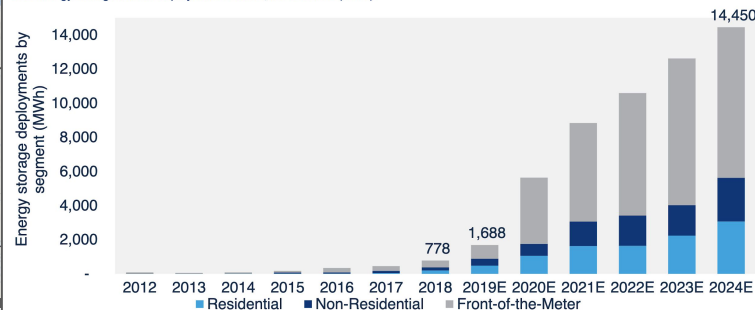
The New York Times

PG&E's Wildfire Plan Includes More Blackouts, More Tree Trimming and Higher Rates

U.S. market will reach 14.5 GWh in annual deployments by 2024

4-hour systems becoming the norm for front-of-the-meter systems; average BTM durations inch toward 3 hours

U.S. energy storage annual deployment forecast, 2012-2024E (MWh)



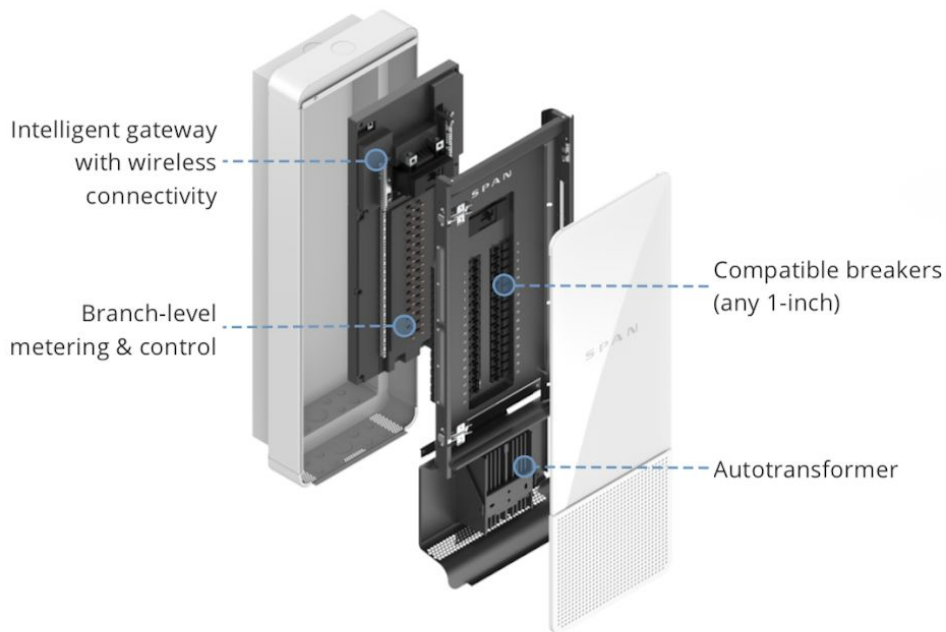
Solar + Storage Installations Without Span



Solar + Storage Installations With Span



Span: Introducing the New Electrical Panel



Electrical

- 200A Main Breaker
- 225A Bus

Environmental

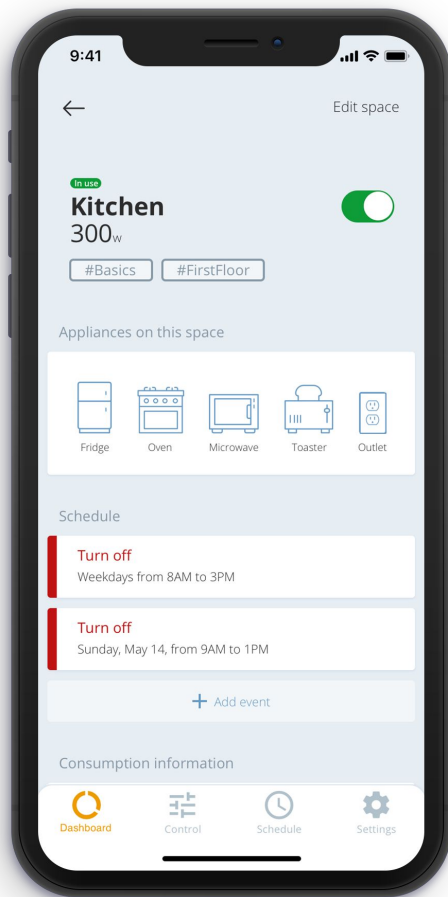
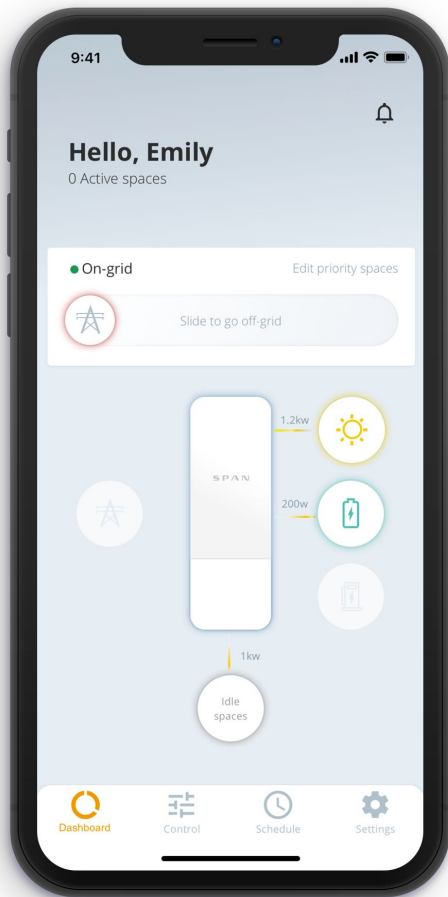
- Indoor or Outdoor

Gateway

- Ethernet, WiFi, Bluetooth, Cellular

System

- Supports AC or DC Coupling



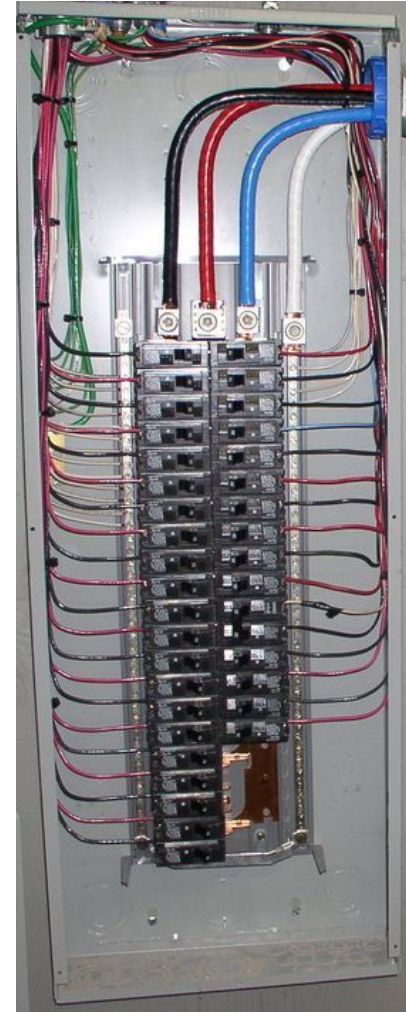
CUSTOMER APP

Flexibility and control
in the palm of your hand

Low Amperage Solutions to the Problem of Equity in Access to Power

By Sean Armstrong
Redwood Energy

400 Amp, 96,000 Watt Panel



200 Amp
48,000 Watt Panel



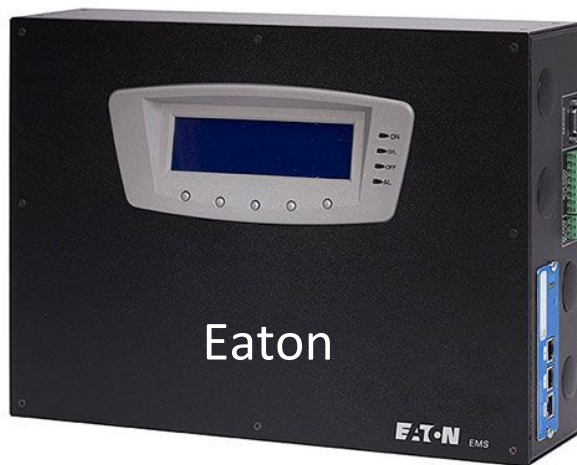
100 Amp
24,000 Watt Panel



50 Amp
12,000 Watt Panel



”Smart” SubPanels That Can Maintain Existing Panel Amperage with Load Management



Load Sharing Between Dryers, Water Heaters and Cars with the Dryer Buddy and NeoCharge



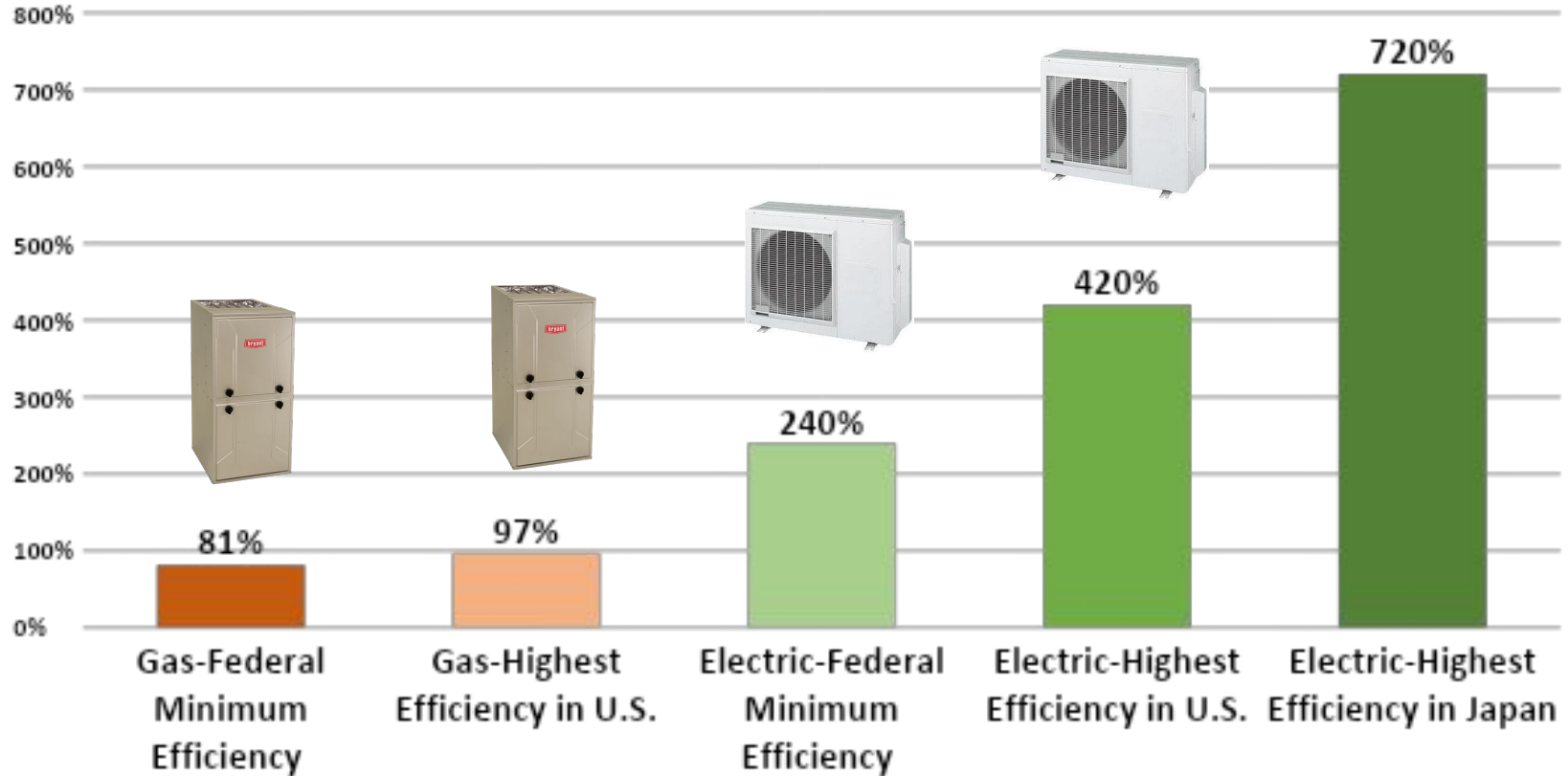
Retrofit Ready Condensing Washer/Dryers 1400W at 120V

Make And Model	Magic Chef MCSCWD20W3	Haier HLC1700AXW	Summit SPWD2201SS	Deco DC4400CV	LG WM3488HW	Whirlpool WFC8090GX
						
Price	\$720	\$1,000	\$1,000	\$1,200	\$1,300	\$1,500
kWh/year	85 kWh/year	65kWh/year	65kWh/year	96kWh/year	120 kWh/year	180kWh/year
Drum Capacity (cu. ft.)	-	2.0	2.0	3.5	2.3	2.8
Volts/Amps	-	120V/10A	115V/12A	110V/15A	120V/15A	240V/30A

Retrofit Ready Cooking Replacements for 1400W at 120V



Greater Efficiency = More Heat with Less Power



Retrofit-Ready HVAC—1200W at 120V








JP SERIES 115 VOLT SYSTEMS

PRODUCT LAUNCH GUIDE

Product Overview

The new JP Series offers a 115 volt product perfect for replacement of window air conditioning units or existing 115 volt systems. This product comes standard with a remote controller and remote control holder.



	Sanden CO2 	Rheem Prestige Hybrid 	AO Smith Voltex Hybrid 	Bradford White AeroTherm 	Steilbel Eltron Accelera 
Description	Split heat pump water heater	Hybrid (WIFI option adds \$150/tank)	Hybrid	Hybrid	Hybrid
Gallons	43, 83	50, 65, 80	50, 66, 80	50, 80	58, 80
Voltage (V)	208/230	208/240	208/240	208/240	220/240
Dimension (ft)	27.5H x 35W x 11D	74H x 24Diam.	69H x 27Diam.	71H x 25Diam.	60H x 27Diam.
Ref. Type	R744 (CO2)	R134a	R134a	R134a	R134a
Ambient Temp. Range (F)	-20 – 110	37 – 145	45 - 109	35 – 120	42 – 108 / 6 – 42
Power (W)			4,500	550 – 4,500	650 - 1500
Max Amps (A)	13	15 – 30	30	30	15
Heating (BTUh)	15,400	4,200	-	-	5,800
Heating (COP)	5.0	-	-	-	-
Energy Factor	3.09 – 3.84	3.55 – 3.70	3.06 – 3.61	2.40 – 3.39	3.05 – 3.39

Need: Cold Climate Heat Pump Boilers



Retrofit-Ready Water Heaters: Ariston/HTP

*Coming Soon.

1200W at 120V

NUOS EVO

80 - 110



Wall-hung heat pump water heater



- COP 3,4 WITH AIR TEMPERATURE AT 20°C (EN 255-3)
 - COP 2,6 WITH AIR TEMPERATURE AT 7°C (EN 255-3)
 - WORKING IN HEAT PUMP MODE WITH AIR TEMPERATURES FROM - 5 TO 42°C.
 - ECOLOGIC GAS R134A ALLOWS TO REACH WATER TEMPERATURES UP TO 62°C IN HEAT PUMP MODE
 - CONDENSER COILED AROUND THE BOILER (NOT IMMERSED IN THE WATER)
 - LOW NOISE* (SILENT FUNCTION)
 - BOILER IN TITANIUM ENAMELLED STEEL
 - ADDITIONAL HEATING ELEMENT
 - ACTIVE ANODE (PROTECH) + MAGNESIUM ANODE
- LCD DISPLAY
- GREEN, BOOST, AUTO, ANTILEGIONELLA FUNCTIONS AND TIME SETTING OF THE WITHDRAWALS



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