

# Building Decarbonization & the CPUC

EPIC Policy & Innovation Forum

Energy Division – Abhilasha Wadhwa

October 28, 2021



California Public  
Utilities Commission

# Implementing SB 1477 (Stern, 2018)

- In March 2020, the CPUC adopted D.20-03-027 allocating \$200 million in funding approved pursuant to SB 1477.
- **BUILD – Building Initiative for Low Emissions Development Program**
  - \$78 million
  - Focus on new construction, mostly low-income
  - CEC is administrator
  - Mandatory tech assistance and bill savings requirement
- **TECH – Technology and Equipment for Clean Heating Initiative**
  - \$117 million
  - Focus on market development, upstream and midstream activities
  - [www.Switchison.org](http://www.Switchison.org)
- **Program Evaluation for both BUILD Program and TECH Initiative**
  - \$5 million
  - Emphasis on embedded M&V



# Building Decarbonization Across Proceedings

~\$335 million in additional funding to support building electrification

## Self-Generation Incentive Program (SGIP)

- 2020: \$44.6 million in funding for utilizing heat pump water heater (HPWH) technologies as thermal energy storage (i.e., load shifting)
- Current status: [SGIP HPWH staff proposal](#) released April 16, 2021. Decision expected in 2022

## PG&E's Water Saver Program & SCE's Smart Heat Pump Water Heater Pilot Program

- Proposed program would install smart controls and communications on existing heat pump water heaters and electric resistance water heaters to enable load shifting.
- Would also provide incentives to replace propane water heaters with load shifting heat pump water heaters.
- SCE program awaiting CPUC action

# Building Decarbonization Across Proceedings

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## San Joaquin Valley (SJV) Pilots

- SJV Pilots approved in December 2018 with \$56 million in funding
- 1,676 homes are eligible for the pilot
- Installations currently forecast to be completed in Q3 2022
- As of the end of April, there have been 614 applications submitted, and a total of 86 homes have been retrofitted (65 natural gas line extension/21 electrified homes).

## Mobilehome Park (MHP) Electrification Standard

- Phase 2b will review electrical service size to support future electrification of existing and new manufactured homes.
- Will determine if it is appropriate to adopt this service size as a standard for all future MHP utility conversions.

# Building Decarbonization Across Proceedings

## Total System Benefit (TSB) for Energy Efficiency (EE) Portfolio

- D.21-05-031 introduced new metric for Energy Efficiency programs, “Total System Benefit”
- This maximizes long term GHG emission reductions and grid benefits, away from kWh and therm savings
- TSB is an expression, in dollar value, of the lifecycle energy, capacity, and GHG benefits of an IOUs EE portfolio

# TECH Initiative's “Quick Start Grants”

## Quick Start Grants

### Grant Amounts

- \$50,000–\$250,000
- 6–12 grants likely

### Timeline

Date	Deadline
Sept. 20	Questions due 5:00 PM PDT
Oct. 1	Applications due by 5:00 PM PDT
Nov. 1	Application decisions announced
Jan. 7	All contracts must be finalized



# TECH Initiative's "Quick Start Grants" - Criteria



Directly result in installations and show a clear pathway to scale



Demonstrate exceptional qualifications and planning



Demonstrate results in one year



Support decarbonization in historically excluded customer groups



Provide cost sharing, maximize impact relative to budget



Are submitted by or include diverse business enterprises, non-profits, or community-based organizations



Demonstrate unique need for QSG funding

# Proposals Received

## Quick Start Grant Proposal Submissions

### 35 Total Proposals:



### Overarching Categories of Proposals:

- 1) Customer Targeting
- 2) Electrification + Solar
- 3) Emerging Technology Demonstration
- 4) Outreach and Marketing
- 5) Faster HPWH Installation
- 6) Affordable Housing and Renters

### Some Submissions in Ineligible Categories:

- 1) Technology Prototyping
- 2) Workforce Only (No Deployment)
- 3) Non-Residential

# Ideas for Future Investment and Research

# Variable-Speed Heat Pumps

## Challenge:

- **To make as market standard:** Inverter-driven units which run continuously but adjust the compressor's speed to meet the demand. E.g. The Daikin Fit system offers premium mid-efficiency inverter at an affordable rate.
- Current testing protocol does not recognize efficiency gains from the technology over standard 2-stage heat pumps.
- Manufacturers envision themselves as an aggregator to control multiple units in a demand response type of application.

## What can EPIC do for the technology?

- Support testing to prove out efficiency
- Work with Daikin to develop a proof-of-concept model for demand response aggregation of Fits.
- *Possible Inclusion in Investment Plan Strategy #28, #36*

# High-volume Hot Water, Natural Refrigerant Heat Pumps

## Challenge:

- **To make as market standard:** Efficient, high-volume water heating using natural refrigerant (CO<sub>2</sub>).
- E.g. Mitsubishi's QAHV model ideal for providing hot water and load shifting in multifamily buildings with 150-200 apartments, given their overall capacity and thermal storage.
- The QAHV uses R744 refrigerant (CO<sub>2</sub>; GWP = 1).
- Has been sold internationally and is set for introduction in North America Q1 2022



## What can EPIC do for the technology?

- Support proof of concept for a) energy modeling and b) residential (multi-tenant) and/or Commercial sites
- Collaboration of market awareness in CO<sub>2</sub> WH – both Commercial and Residential.
- The Mitsubishi QAHV is undergoing UL testing and certification. Currently, the QAHV does not meet potable-water certifications.

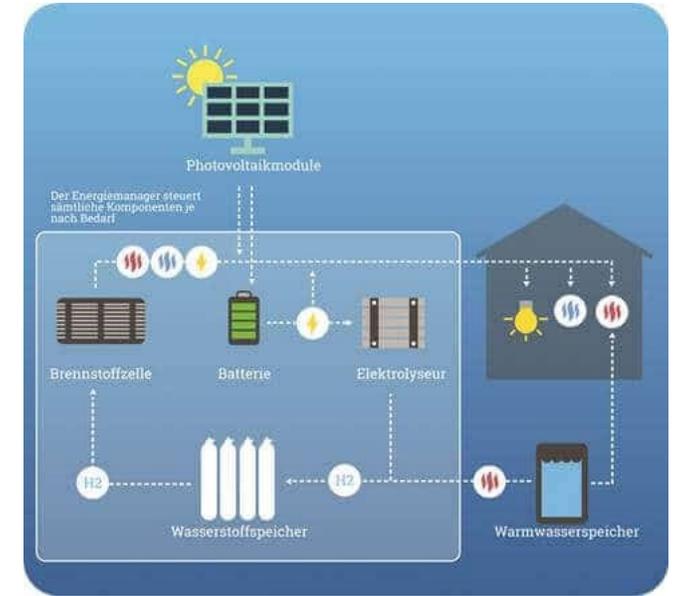
# Residential All-in-one System

- Energy storage + Heating + Ventilation + Hot Water system
- Electrolyzers combined with fuel cells, on a solar powered home
- Grid-independent
- Market-ready and operational pilots in European markets<sup>1</sup>

<sup>1</sup> Example technology and image source: <https://www.enapter.com/use-cases/picea>



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## What can EPIC do for the technology?

- Fund pilots to support scalable deployment in California markets
  - Motivate market competition for similar technologies
  - Possible Expansion of Investment Plan Strategy #30

# Appliance specifications for low-income/ rehabs



Source: <https://archive.kpcc.org/programs/take-two/2018/03/08/62102/rebuilding-after-the-fires/>

## Challenge:

- Multifamily major renovations are every 15 years
- Typical appliance warranties are 10 years
- Need hardier, low-maintenance models
- Use less space

## What can EPIC do:

- Fund development of low-maintenance, space efficient models with longer lifespan/ warranties
- *Possible Inclusion in Investment Plan Strategy #43*

# Low-GWP Refrigerant in Appliances



Source: <https://sahotwater.com.au/product/sanden-gaus-250-eqtb-heat-pump/>

## Challenge:

- Corrosivity issues
- Flammability issues
- Only one manufacturer in California markets
- Split unit creates planning challenges
- Expensive

## What can EPIC do:

- Get major manufacturers market-ready for 1 or 0 GWP refrigerant appliances (“< 5” , NOT “< 150” )
- *Possible modification “low GWP” threshold in Investment Plan Strategy #43*

# Climate Resilient Building “Build Back Better”

## Wildfire and Natural Disaster Resiliency Rebuild Program



Source: <https://www.bloomberg.com/news/articles/2018-11-12/camp-woolsey-fires-ravage-california-cities-photos>



Source: <https://6pb7okd0iub52hs2q41wz18v-wpengine.netdna-ssl.com/wp-content/uploads/2012/07/roof-truss-crane.jpg.webp>



### What can EPIC do:

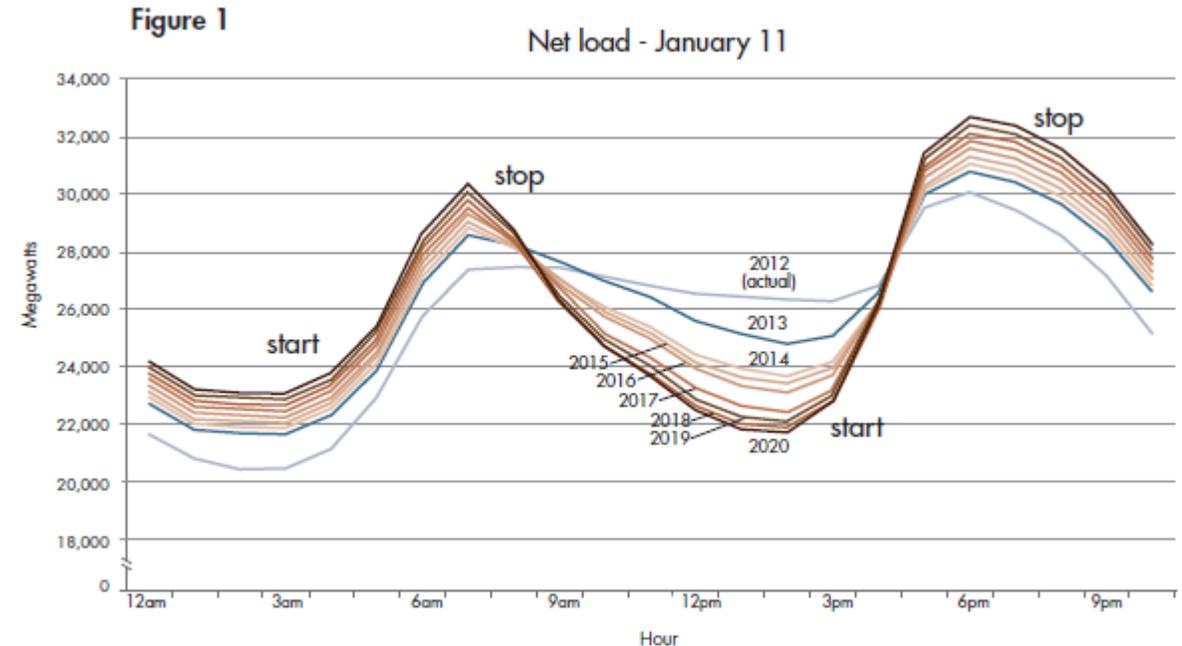
#### WNDRR Program:

- **\$50 million total program budget** Proposed Decision (pending Commission vote)
- Incentives to homeowners for all-electric rebuilding;
- Incentives 1.5 times higher for low income
- Resiliency Demonstration projects for different situations (wildfire, earthquakes, floods)
- Community Islanding projects (selected based on degree of community vulnerability)
- *Possible Inclusion in Investment Plan Strategy #44*

# Vehicle-to-Grid, Vehicle-to-Building Retrofits

Why: “Help the Duck fly!”

- Bi-directional charging already viable for new EVs and new chargers
- ~\$2 billion authorized in TE investments to date (CEC +CPUC)<sup>1</sup>
- ~ 425,000 passenger EVs registered CA<sup>2</sup>
- Car manufacturers may need motivation to fully get behind retrofit solutions

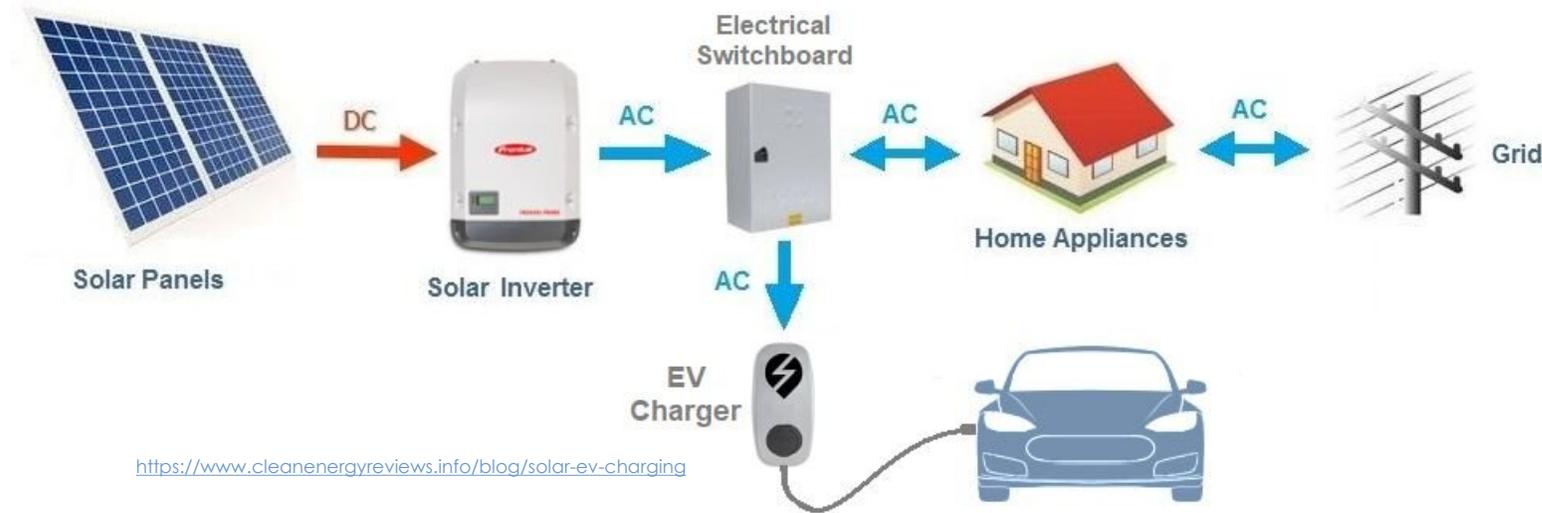


Source: CA Independent System Operator;  
[https://www.caiso.com/documents/flexibleresourceshelprenewables\\_fastfacts.pdf](https://www.caiso.com/documents/flexibleresourceshelprenewables_fastfacts.pdf)

<sup>1</sup> <https://www.energy.ca.gov/news/2021-05/california-announces-175-million-public-electric-vehicle-charging-13-rural>; <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/transportation-electrification/cpuc-te-en-banc-october-2021-slides.pdf>

<sup>2</sup> <https://afdc.energy.gov/data/10962> data as of Dec 31, 2020.

# Demo DC-DC charge and discharge ecosystem



## Current practice:

- Solar power to inverter to EV: DC-AC-DC
- ~5-10% (manufacturer-claimed) inverter efficiency losses<sup>1</sup>
- ~ 5-10% EV charger efficiency losses

<sup>1</sup> <https://efiling.energy.ca.gov/GetDocument.aspx?tn=221213>

## What EPIC can do:

- Accelerate DC-to-DC charging from Photovoltaic to EV<sup>2</sup>
- Demonstrate a two-way DC ecosystem (V2B) discharging to select DC appliances<sup>3</sup>

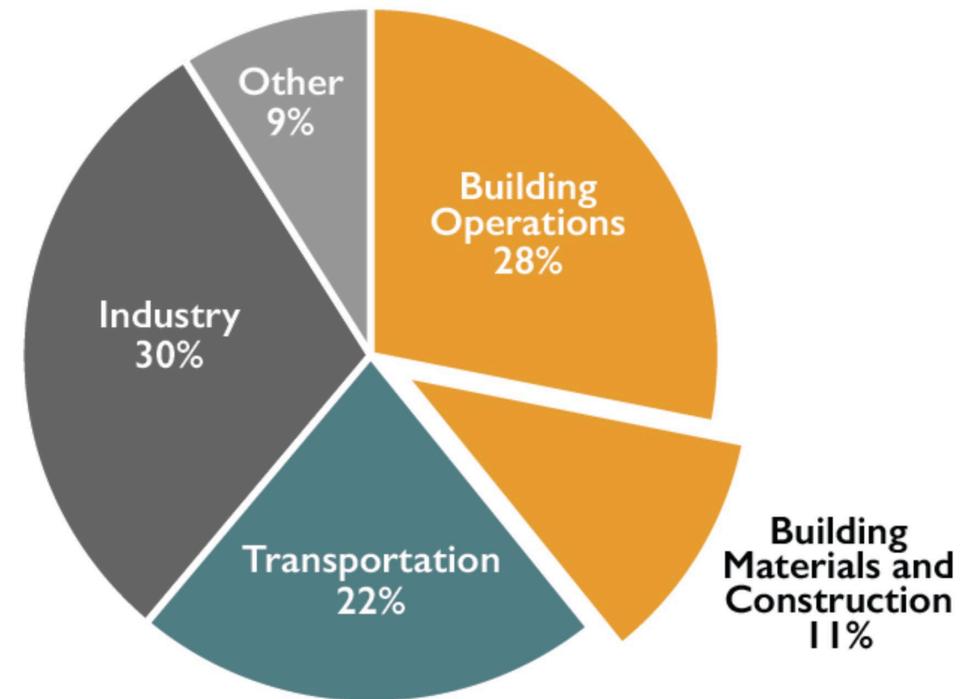
<sup>2</sup> [Direct high-speed charging of electric cars by solar panels \(tudelft.nl\)](https://www.tudelft.nl/).

<sup>3</sup> [DC Refrigerator vs AC refrigerator in off grid applications \(energymatters.com.au\)](https://energymatters.com.au/)

# Quantifying Embodied Energy in CA Buildings and Products

- Carbon footprint associated with building materials and products
- Currently sparse literature on how to quantify and embed counting of embodied energy in our programs
- Integration with Building Energy Code
- Need standardized methods to derive embodied energy for various programs/ situations/ time horizons

Global CO<sub>2</sub> Emission by Sector



Source: © 2018 2030, Inc. / Architecture 2030. All Rights Reserved. Data Sources: UN Environment Global Status Report 2017; EIA International Energy Outlook 2017



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## Discussion/ Q&As

Contact: [Abhilasha.Wadhwa@cpuc.ca.gov](mailto:Abhilasha.Wadhwa@cpuc.ca.gov)

