

DOCKETED	
Docket Number:	18-IEPR-09
Project Title:	Decarbonizing Buildings
TN #:	223816
Document Title:	Enabling Building Decarbonization With R&D
Description:	<p>This document supersedes TN# 223759</p> <p>Presentation by Laurie ten Hope at the June 14, 2018 IEPR Workshop on Achieving Zero Emission Buildings</p>
Filer:	Stephanie Bailey
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	6/14/2018 8:59:22 AM
Docketed Date:	6/14/2018

Enabling Building Decarbonization with R&D



Laurie ten Hope

June 14, 2018

California Energy Commission

Energy Research & Development Division



Getting to 2030 Goals

To summarize the E3 study, California needs:

- Advances in energy efficiency to reduce consumption
- Electrification of energy services in buildings
- More R&D needed for hard to electrify end uses
- Increased renewable power generation to about 70%
- Diversity in renewable energy systems and integrated solutions
- More electric vehicles

The study also finds:

- Consumer behavior is key to realizing decarbonization goals.



Energy Commission RD&D Programs

Reducing energy use across sectors and prioritizing technologies to optimize low carbon generation

Electric Program Investment Charge - \$125M/yr

- ▶ **Energy Efficiency & Demand Response**
- ▶ **Renewable Energy & Adv. Gen.**
 - ▶ **Smart Communities**
- ▶ **Smart Grid, Storage, DER**
- ▶ **Environmental**
 - ▶ Climate Adaptation and Infrastructure Risk Reduction
- ▶ **Electric Vehicle Grid Integration**
- ▶ **Market Facilitation**

Natural Gas R&D- \$24M/yr

- ▶ **Energy Efficiency**
- ▶ **Renewable Energy & Adv. Gen.**
- ▶ **Pipeline Safety**
- ▶ **Environmental**
 - ▶ **Methane Leakage**
 - ▶ Climate Adaptation and Infrastructure Risk Reduction
- ▶ **NG Transportation**



Promoting Low or No-Carbon Alternatives for Energy End Uses



a. High efficiency heat pumps in multifamily retrofits



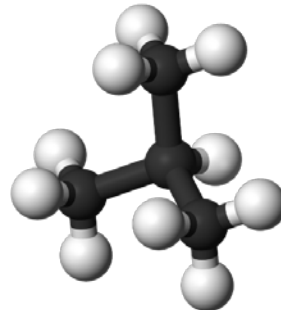
b. Electric heat pumps for space conditioning



c. Central heat pumps in new multifamily buildings



d. Electric hot water heat pumps for new homes



e. Low global warming refrigerants



f. Gas-fired heat pumps for water and air conditioning in restaurants



Promoting Low or No-Carbon Alternatives for Energy End Uses



a. Solar thermal and absorption chiller to provide hot water and cooling at a hotel



c. Induction cooking for food service



d. Residential heat pump dryer



b. Evacuated tube solar thermal system at a pharmaceutical plant



e. Ground-coupled heat pumps with helical coil heat exchangers



Promoting Low or No-Carbon Alternatives for Energy End Uses

A Novel Low-Cost, High-Efficiency Solar Powered Micro-CHP System



PV panels
15%-20%
Electric Efficiency
~\$100/m²



Solar thermal collectors
50%-60% Thermal
Efficiency
~\$100/m²



Solar CHP collector
15%-20% Electric Efficiency
50%-60% Thermal Efficiency
Total cost: ~\$100/m²

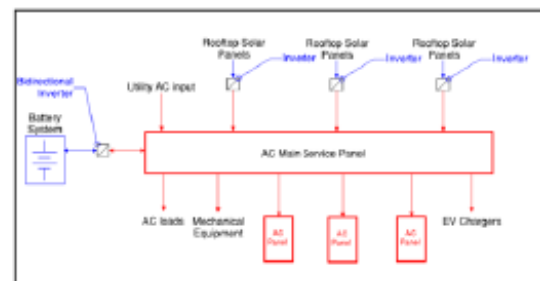
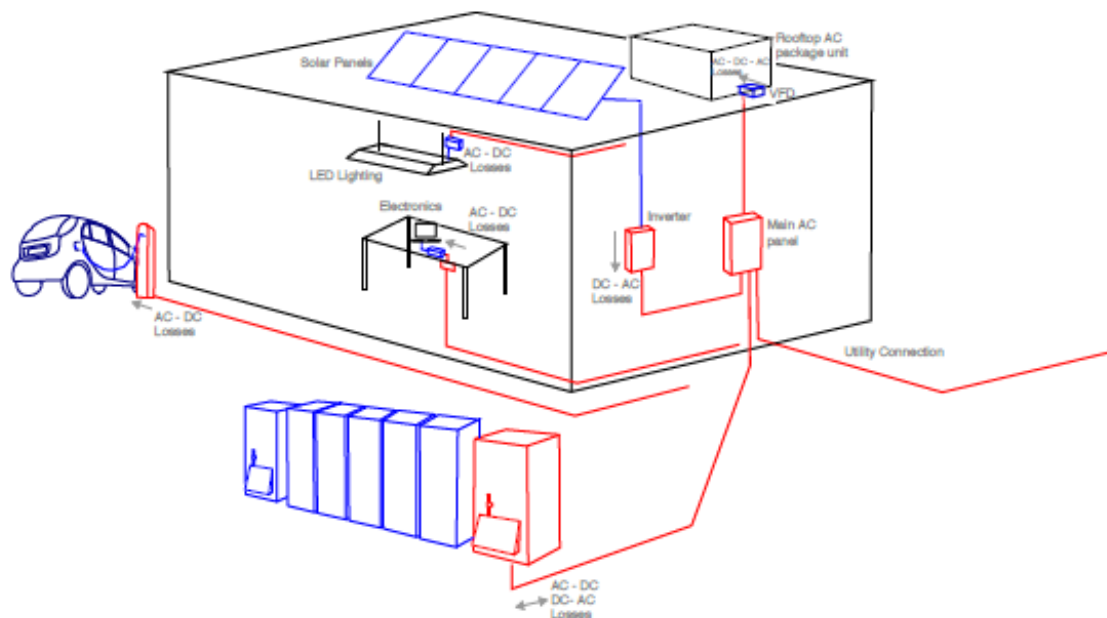




Direct Current Buildings and Facilities

Much of today's equipment uses direct current (DC). But electricity is delivered using alternating current (AC). Integrating renewable energy production, such as PVs, could enable direct DC use and increase the efficient use of site-generated electricity.

Commercial: AC with PV + EV + BS



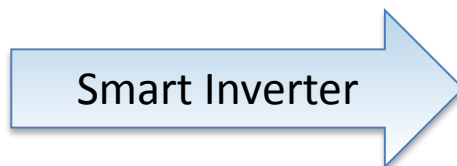


Potential Future Research Areas

- EPIC Investment Plan:
 - HVAC and Water Heating
 - Develop and Test California Climate Appropriate Advanced HVAC Systems, Water Heaters
 - Electrochemical Compression Systems
 - Designing and Manufacturing Improved Heat Exchangers
 - DC Buildings
 - DC Building Distribution Systems to Enable New ZNE Commercial Buildings
 - Development of Cost Competitive, Efficient Hybrid AC/DC Appliances
- Natural gas research – budget plan
 - Increase efficiency from natural gas using facilities
 - Improve building envelopes in existing buildings



Balancing Building Energy Demand and Grid Needs with DERs





Balancing Building Energy Demand and Grid Needs with DERs

Building-scale



Community-scale



Increasing Customer Connectivity and Empowerment

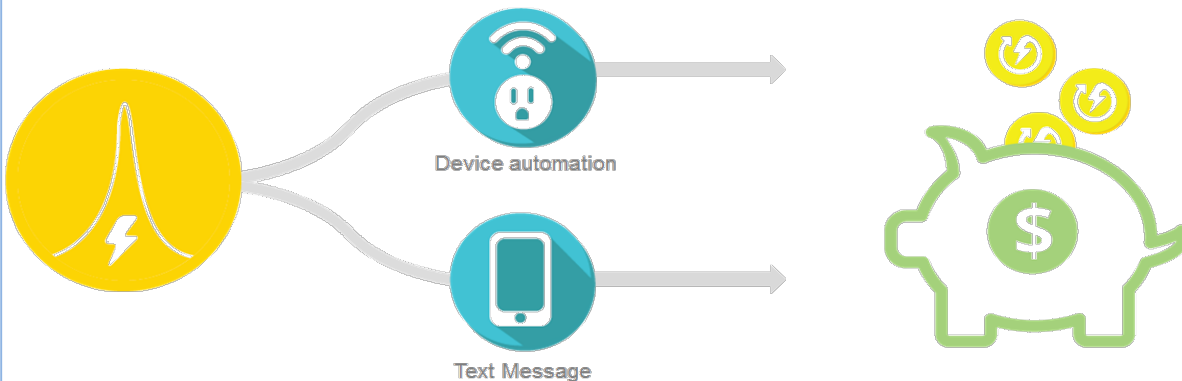
Alternative Energy Systems is automating price-based device management



Price Spike

Dispatch Reduction Event

Pay Customers

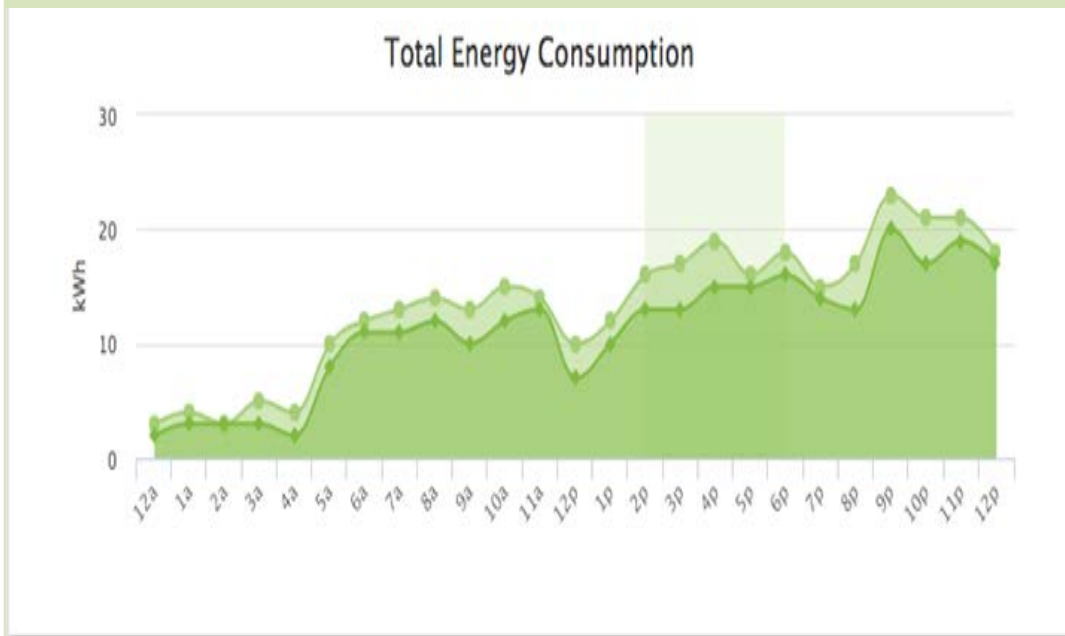


***OhmConnect** engages customers using social media and pays them to provide DR with revenue earned by selling their aggregated load reductions into wholesale energy markets*



Increasing Customer Connectivity and Empowerment

CIEE is expanding the ability of EMS to control of devices from multiple vendors



ZNE Alliance is demonstrating a continuously optimizing EMS at Pomona College





Research on Fugitive Methane Emissions in Buildings



Residential: Emissions equivalent to ~0.5% of the total sector natural gas consumption





For More Information on R&D Projects

The screenshot shows the EPIC Innovation Showcase website. At the top, there's a navigation bar with the CA.GOV logo, the California Energy Commission logo, and the text "ENERGY INNOVATION SHOWCASE". A search bar is also present. Below the navigation bar, a large banner reads "HIGHLIGHTING ENERGY INNOVATION BY THE NUMBERS". Underneath the banner, three statistics are displayed: "DOLLARS AWARDED \$470 MILLION", "PROJECTS AWARDED 279", and "MATCH FUNDING \$223 MILLION". The main content area is divided into two columns. The left column is titled "FEATURED PROJECTS" and contains three project cards. The right column is titled "TRENDING" and contains five category cards. Each card includes a representative image, a title, a brief description, and a "READ MORE" link.

FEATURED PROJECTS

- High-Fidelity Solar Power Forecasting Systems for Solar Plants**
This project will focus on the development and validation of tools capable of monitoring ...
[READ MORE](#)
- Demonstrating Energy Efficient Drying for Walnuts**
This project will demonstrate a novel infrared technology for walnut drying at pilot and ...
[READ MORE](#)
- Advance Wastewater Treatment Using Forward Osmosis**
This project will demonstrate an advanced water treatment technology that uses ...
[READ MORE](#)
- City of Fremont Fire Stations Microgrid Demonstration**
The project will design and build low carbon-based microgrids at three fire stations ...
[READ MORE](#)
- Very Low-cost MEMS-based Ultrasonic Anemometer for Indoor and HVAC Use**
This project will develop low-cost, lowpower, accurate, calibration-free, and compact ...
[READ MORE](#)

TRENDING

- LIGHTING**
- DISADVANTAGED COMMUNITIES**
- MICROGRIDS**
- WASTEWATER TREATMENT**
- RENEWABLES FORECASTING**

EPIC Innovation Showcase

► <http://innovation.energy.ca.gov>