

Innovating Our Way to a Low-Carbon Future

Presentation at the UC Solar Thermal Symposium



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California Energy Commission



Driving Innovation: California's Climate is Changing

2 of 3

SOUTHERN CALIFORNIA BEACHES

may completely erode by

2100 without large-scale interventions



If greenhouse emissions continue to rise, average wildfire area burned statewide

WILL INCREASE

77%

by the end of the century

MORE FREQUENT **EXTREME WEATHER** IS EXPECTED
WITH SWINGS BETWEEN

HEAVY RAIN & DROUGHT



By mid-century, *extreme-heat health events* could occur

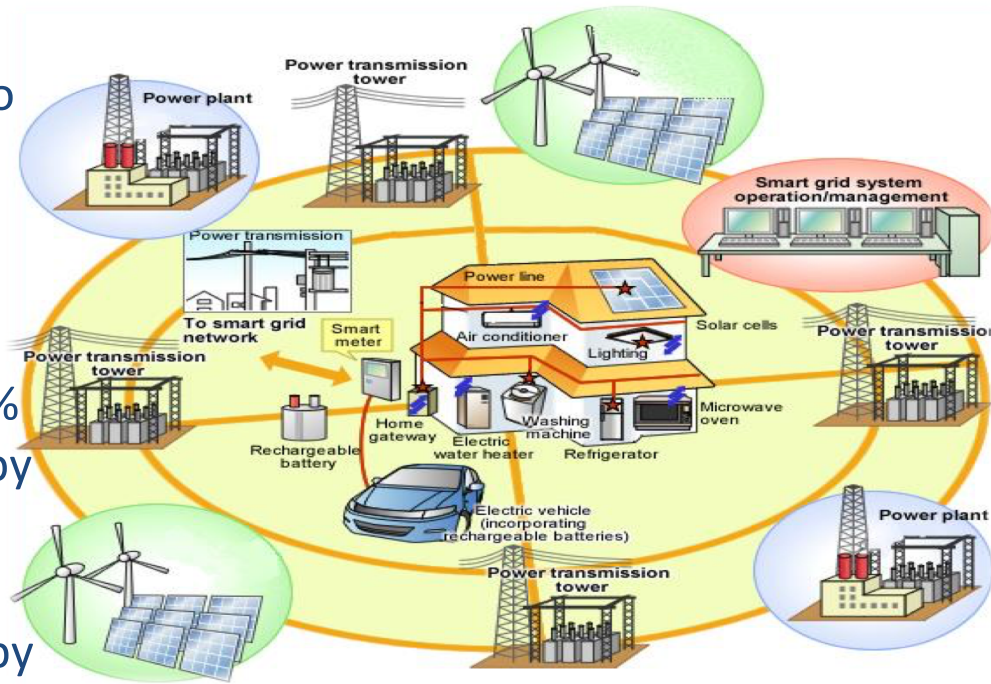
10x

more often in the Northern Sierra







Policy Drives Innovation

- **Increase electricity from renewables** to 50% by 2025, 60% by 2030 & 100% by 2045
- **Reduce GHG** to 40% below 1990 levels by 2030
- 1.3 GW of storage by 2020



- **Double energy efficiency** savings by 50%
- 1.5 million ZEVs by 2025
- **Increase access** to clean energy in disadvantaged or low-income communities

Climate Mitigation Calls for Aggressive Decarbonization

		Sector	2050 GHG reduction strategy
	Efficiency	Buildings	34% reduction in total building energy demand, relative to 2015
		Transportation	24% reduction in per capita light-duty vehicle miles traveled relative to 2015
		Industry	30% reduction in industrial energy demand relative to 2015 90% reduction in refinery and oil & gas extraction energy demand
	Electrification	Buildings	100% new sales of water heaters and HVAC are electric heat pumps
		Light-duty vehicles	35 million ZEVs (96% of total) and 100% of new sales are ZEVs
		Trucks	47% of trucks are BEVs or FCEVs (31% of trucks are hybrid & CNG) 88% electrification of buses, 75% of rail, and 80% of ports
	Low carbon fuels	Electricity	96% zero-carbon electricity (including large hydro)
		Advanced Biofuels	46% of total (non-electric power generation) fossil fuels replaced with advanced biofuels
	Non-combustion GHGs	Reductions in methane and F-gases	62% reduction in methane and F-gas emissions relative to 2015 42% reduction in other non-combustion GHGs relative to 2015

Source: Energy+Environmental Economics

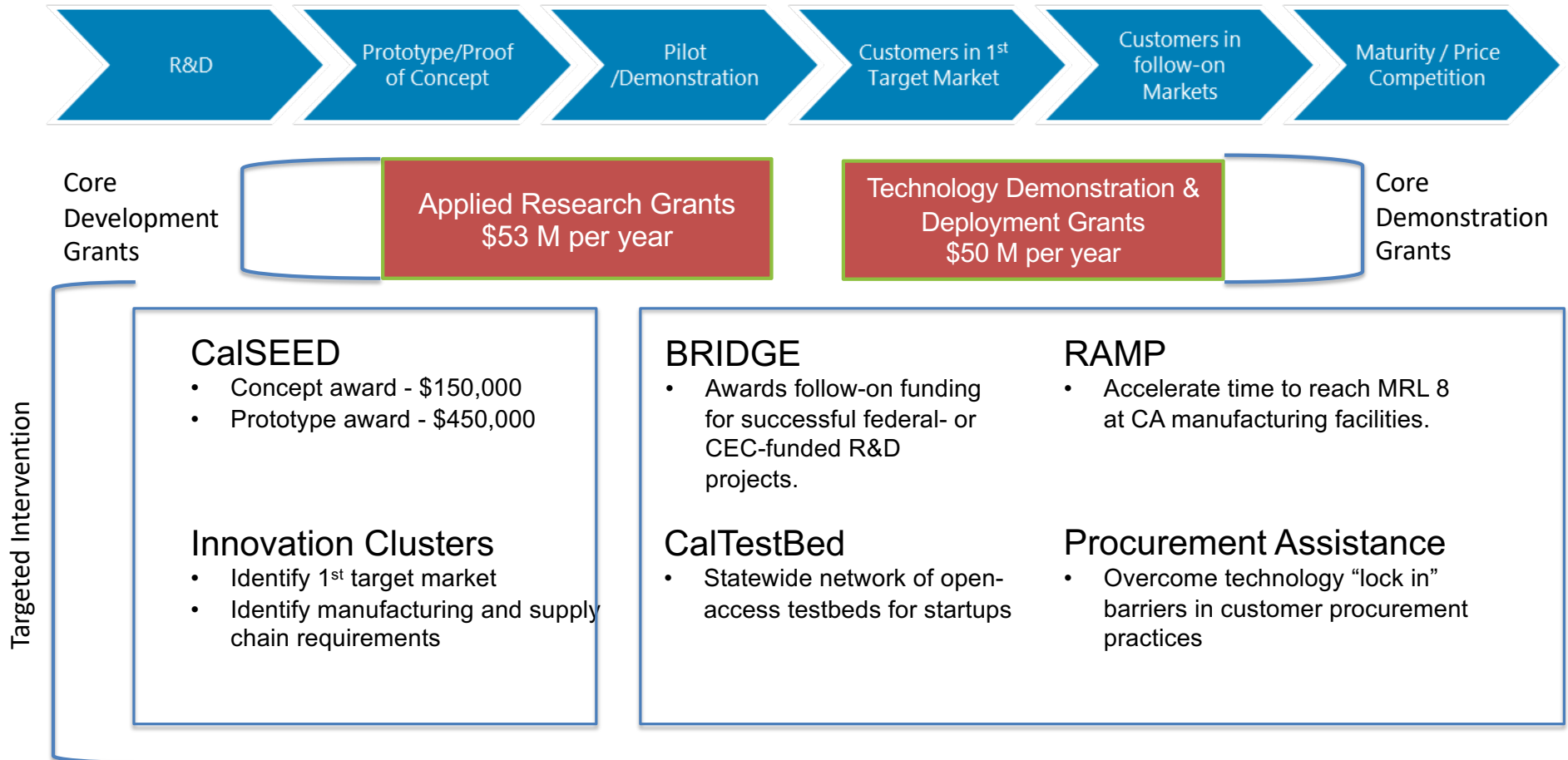


Foster Innovation Across the Energy Sector

- Strategically invest funds to catalyze change and accelerate achievement of state policy goals
- Advance energy technology, facilitate customer learning and strategic targeted intervention
- Main Programs:
 - Electric Program Investment Charge (EPIC), \$133 million annually
 - Natural Gas Research, Development and Demonstration Program, \$24 million annually
 - Food Production Investment Program, \$124 million biennially
 - Low Carbon Fuels R&D Program, \$18 million, one-time general fund expenditure authority



Innovation Ecosystem | Overview



CEC's Energy Research Drives Technology & Strategic Innovation

Electric Program Investment Charge (EPIC)

\$133M/year

- Energy Efficiency & Demand Response
- Renewable Energy & Advanced Generation
 - Smart Communities
- Smart Grid, Storage, Distributed Energy Resources
- Environmental
 - Climate Adaptation and Infrastructure Risk Reduction
- Electric Vehicle Grid Integration
- Market Facilitation

Natural Gas R&D

\$24M/year

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

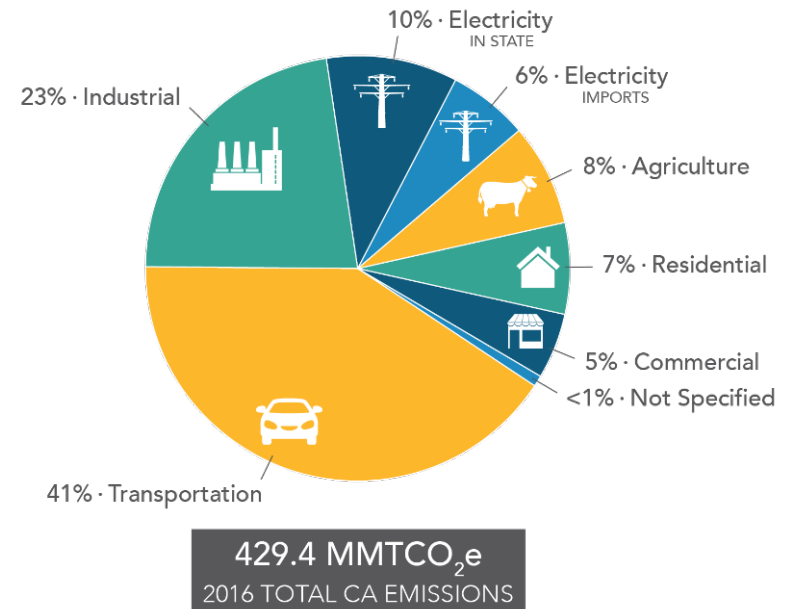
- All funded projects must result in benefits to investor owned utility ratepayers
- All funds are competitively awarded



Objectives of Industrial Energy Efficiency Research

Test and demonstrate new or emerging technologies

- Emphasize those with high potential to reduce energy use and GHG emissions
- Potential to decrease equipment and implementation costs
- Understand efficacy, cost, non-energy benefits and potential for widespread deployment
- Provide grid flexibility

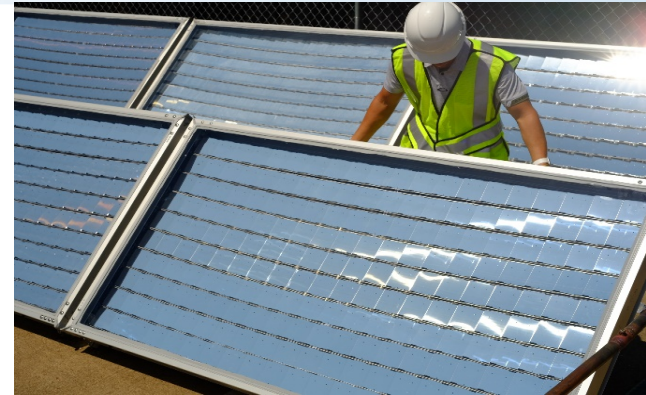




Demonstrating Solar Thermal in Industrial Applications



- ▶ Program: Natural Gas R&D Program
- ▶ Applicant: ergSol
- ▶ Demonstration site: Treasury Wine Estates, Sonoma
- ▶ CEC Grant: \$1,200,000 (Match \$300,000)
- ▶ GHG Status: Capped ($\geq 25,000$ MT CO₂e)
- ▶ Technology: Roof Mounted Solar Thermal
- ▶ Installing solar thermal evacuated tube collectors with the potential to meet 40% of the facility's natural gas consumption.



- ▶ Program: Food Production Investment Program
- ▶ Applicant: California Dairies, Inc. – Visalia
- ▶ CEC Grant: \$3,002,821 (Match \$600,000)
- ▶ GHG Status: Capped ($\geq 25,000$ MT CO₂e)
- ▶ Technology: Roof Mounted Solar Thermal
- ▶ Installing 2000 collectors to provide pre-heating for boilers used for milk processing

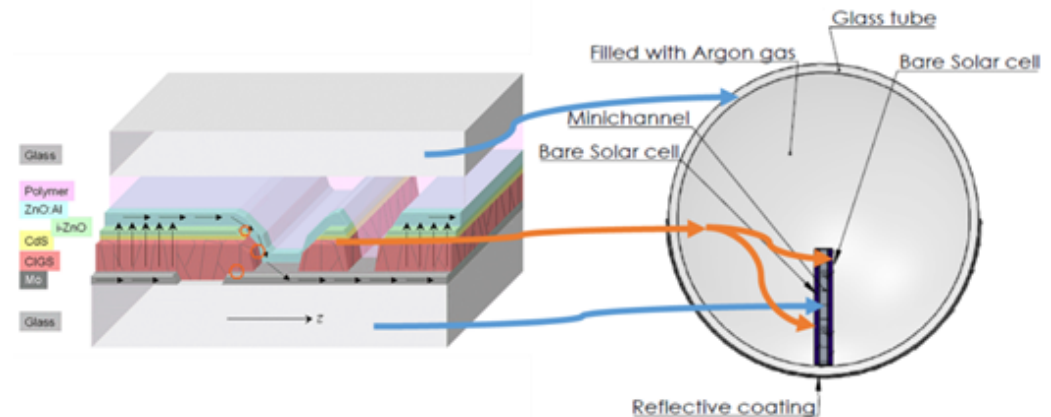


Developing A Low-Cost, High-Efficiency Solar Powered Micro-CHP System

Purpose

- Develop a novel, low-cost, high-efficiency solar combined heat and power (CHP) system capable of producing electricity for building loads and heat for hot water and space heating.
- Non-imaging optics for solar concentration
- Aluminum mini-channels for thermal collection
- Commercially-available solar cells for electricity production
- Successfully demonstrated the potential to produce both electricity and heat at efficiencies of 40 percent and 15 percent, respectively

Researchers: UC Merced; Grant: \$816,659





Upcoming Initiative (FY 2019/2020 Natural Gas R&D Plan)

NG R&D Program Goal: Reduce dependence on fossil-derived natural gas by advancing clean, efficient, fuel-flexible, and low emission renewable DG/CHP; and accelerating decarbonization through development and deployment of renewable gas.

Solar Heating, Cooling, and Power for Industrial Applications

- Technological advances to facilitate the adoption of solar heating, cooling, and power for industrial applications.
- State of the art solar thermal systems which could be a combination of solar thermal heating, heat driven cooling technologies, heat to power technologies, or hybrid systems
- Develop integration approaches that lower the system cost and expand its application in the industry.



Active and Upcoming Solicitations

Active

- GFO-19-901 – Food Production Investment Program 2019
Due Date: 12/4/19

Upcoming

- Demonstrating Replicable, Innovative Large Scale Heat Recovery Systems in the Industrial Sector
- Advanced Refrigeration and Heat Pumps for the Industrial Sector

<https://www.energy.ca.gov/funding-opportunities/solicitations>



2020/21 Natural Gas R&D Budget Plan

- Approximate Funding: \$24 million
- Potential areas:
 - Energy efficiency
 - Renewable energy and advanced generation
 - Natural gas infrastructure safety and integrity
 - Energy-related environmental research
 - Natural gas related transportation
- Workshop in January 2020

Subscribe:

<https://www.energy.ca.gov/programs-and-topics/programs/natural-gas-program>



More Information

- To learn more about CEC's R&D projects- Energy Innovation Showcase:
innovation.energy.ca.gov
- To sign up for future solicitations, Energy Commission Listserver and select "Opportunity"
www.energy.ca.gov/listservers/
- Information on the Energy Commission's Research Programs
<https://www.energy.ca.gov/programs-and-topics/topics/research-and-development>
- Staff contacts
 - Rizaldo Aldas, rizaldo.aldas@energy.ca.gov (Renewable Energy Generation)
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 - Kevin Uy, kevin.uy@energy.ca.gov (Food Production Investment Program)



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Thank you