California
Energy Commission
Research & Development

# The Need for Innovative Scalable Distributed Energy Resource Solutions in California's Industry

Vice Chair Janea A. Scott

July 31, 2019

**The California Energy Commission is the state's primary energy policy and planning agency**

**Established by the Legislature in 1974, seven core responsibilities guide the Energy Commission**

- Forecasting future energy needs
- Setting the state's appliance and building energy efficiency standards
- Supporting energy research development and demo projects
- Developing renewable energy resources
- Advancing alternative and renewable transportation fuels and technologies
- Certifying thermal power plants 50 megawatts and larger
- Planning for and directing state response to energy emergencies.

# California Policy Drives Innovation

**2020:**

- **1.8 GW of storage**
- **Title 24 solar on all new homes**

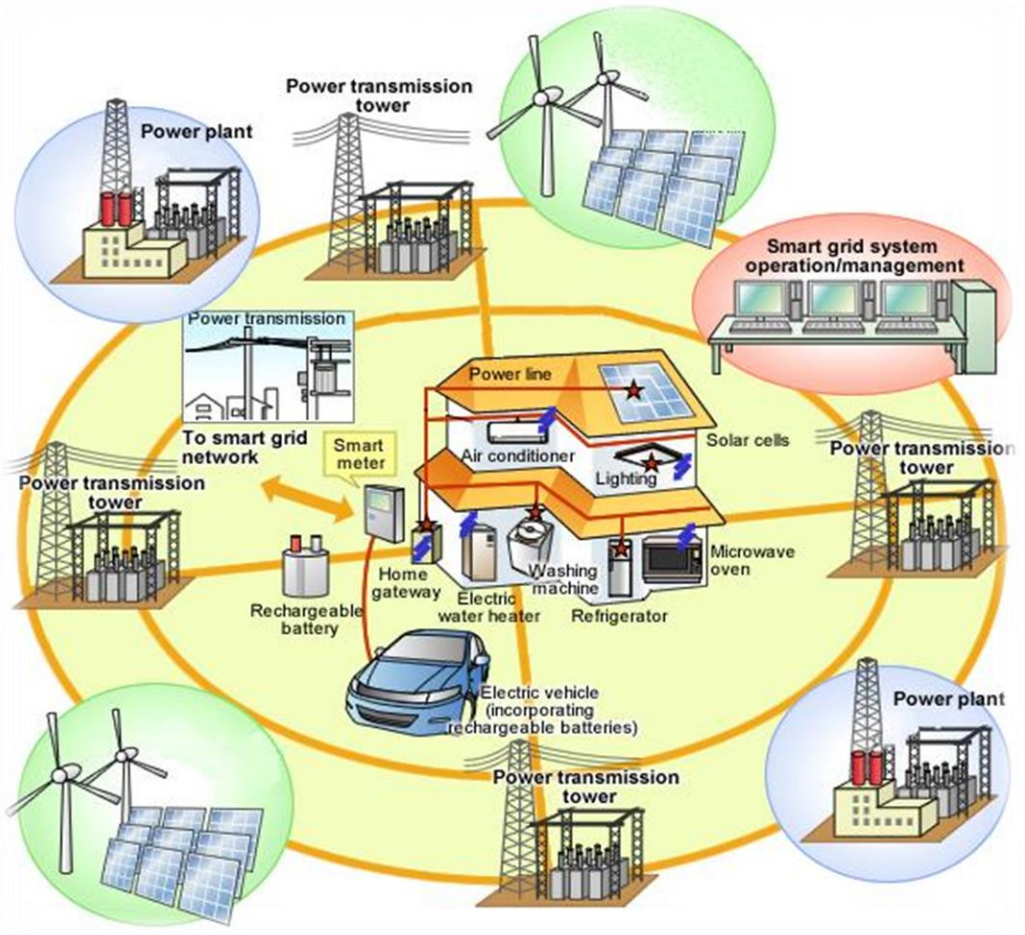
**2030:**

- **Double energy efficiency savings by 50%**
- **Increase RPS to 60%**
- **5 million ZEVs on California Roads**

**2045:**

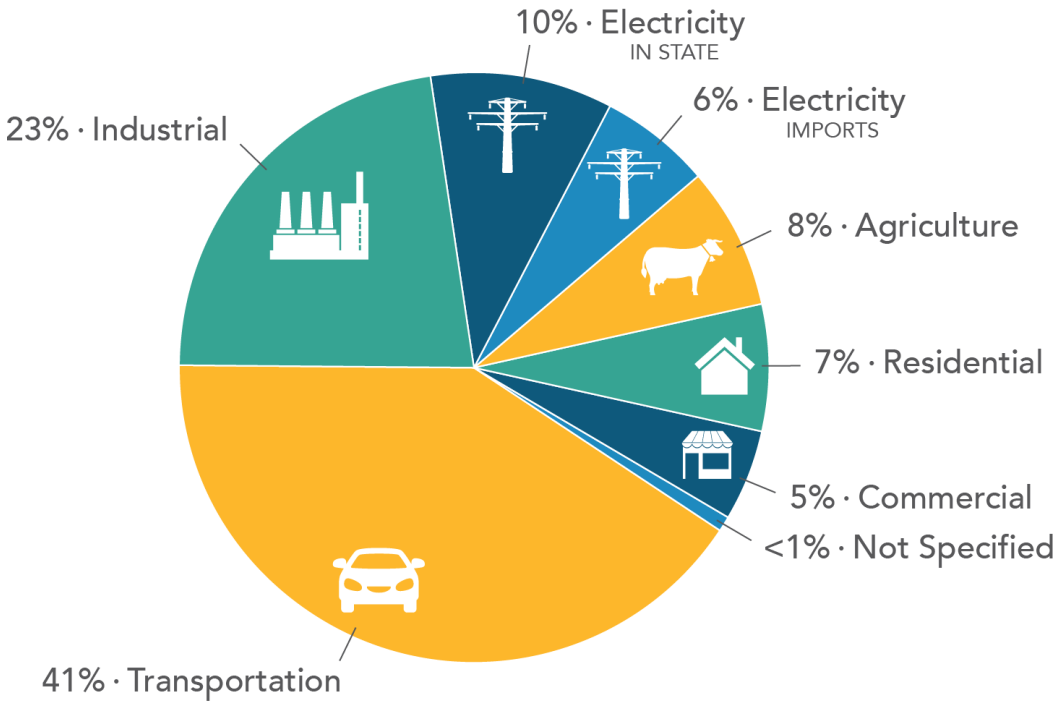
- **100% zero-carbon electricity**

**Increase access to clean energy in low-income and disadvantaged communities**



# Industrial and Agricultural Emissions

Industry and Agriculture Emissions account for 31% of total CA emissions




Source: California Air Resources Board

# California's Industrial Sector

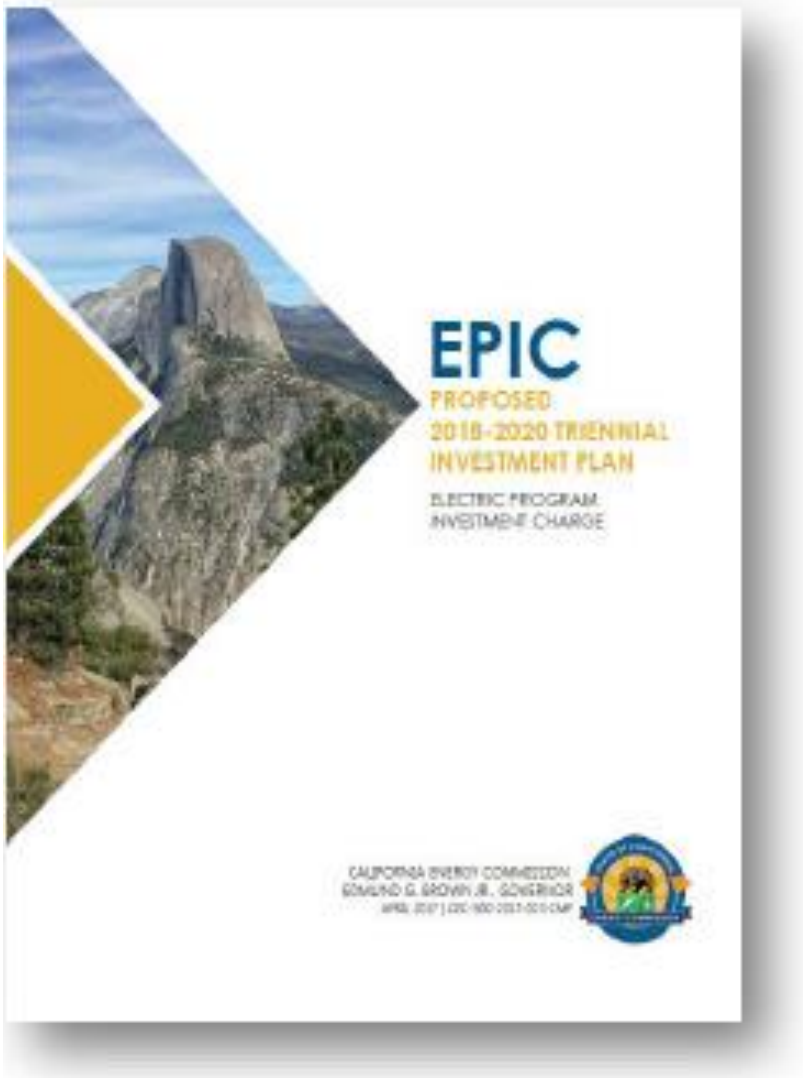
- Manufacturing and industrial production contribute nearly 10% of the State's gross domestic product or about $270 billion/year
- Diverse industries including oil refineries, oil and gas extraction, cement, steel, textiles, pharmaceuticals, chemicals, data centers, food processing
- Substantial job provider
- Large user of energy (15% of the state's electricity and 28% of the state's natural gas).
- Emits nearly a million metric tons of $CO_2$ equivalent emissions each year
- Climate mitigation calls for aggressive decarbonization:
  - 2050 GHG reduction strategy: 30% reduction in industrial energy demand relative to 2015 and a 90% reduction in refinery and oil & gas extraction energy demand

# Fostering Innovation Across the Energy Sector


**Energy Commission's Research and Development Division's Core mission**: strategically invest funds to catalyze change and accelerate achievement of policy goals to benefit ratepayers

- Electric Program Investment Charge (EPIC)
  ~$130 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

# Electric Program Investment Charge



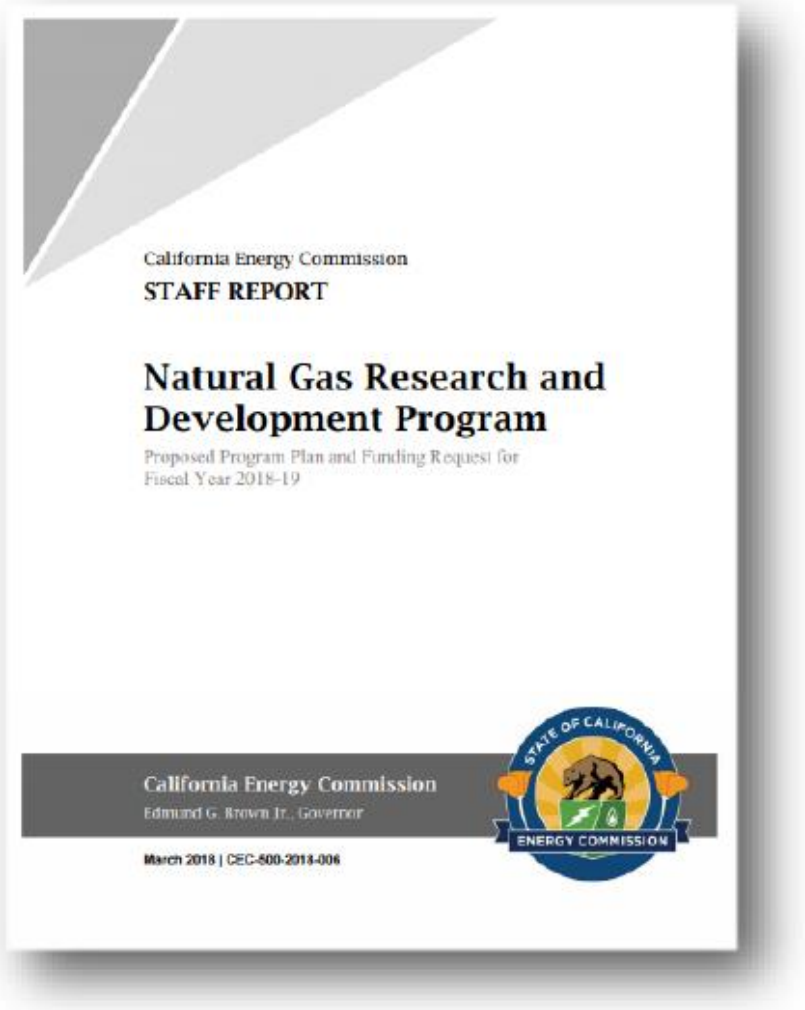

EPIC invests ~$130 million annually in high-impact research areas such as:

- Climate science and adaptation
- Energy efficiency
- Grid resilience and reliability
- Renewable generation
- Creating an Energy Innovation Ecosystem
- Water-Energy-Food-Nexus

# Natural Gas Research Development Program

The Natural Gas Research and Development Program invests ~ $24 million annually to:

- **Assure** system safety, reliability, and integrity
- **Stimulate** economic growth
- **Achieve** cleaner, more diverse, and environmentally sound energy options



# Industrial, Agriculture, and Water Research

## Objectives:

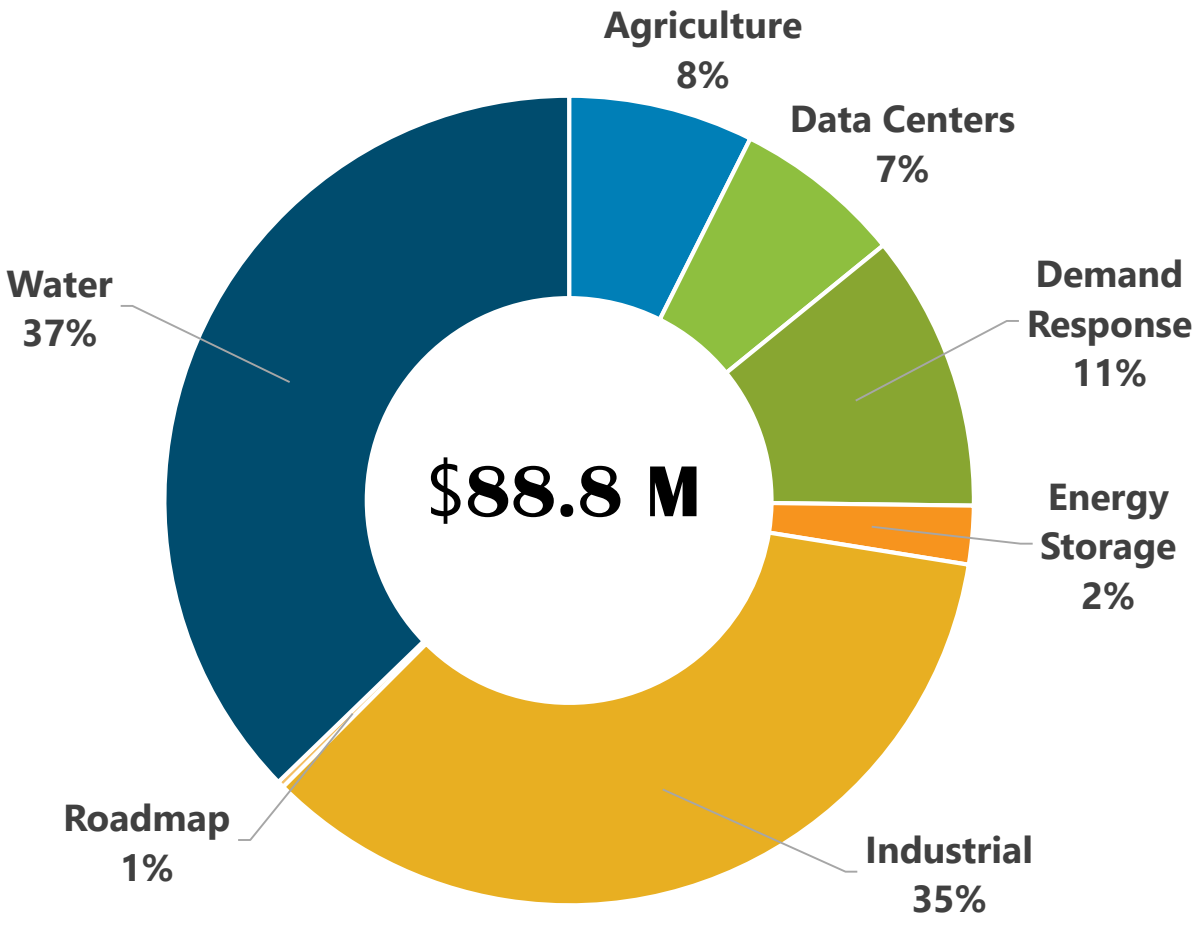
- Identify & develop breakthrough emerging technologies
- Decrease equipment and implementation costs
- Develop, test and demonstrate new or emerging technologies
- Develop and demonstrate strategies that deal with issues of renewable energy integration

## Examples of Past Research Areas

- Thermal: Advanced combustion and heat recovery
- Process improvements to reduce natural gas and electricity use
- Advanced filtration and membranes-wastewater and water reuse
- Solar thermal
- Agricultural irrigation optimization
- Load management
- Advanced sensors and controls
- Advanced materials, such as for heat exchangers or process improvement
- Low global warming refrigerants
- Industrial heat pumps

# Industrial, Agriculture, and Water Efficiency R&D Portfolio

*(Total Funds since 2013)*




| Sector | CEC Funds (millions) | Match Funds (millions) | # of Projects |
|---|---|---|---|
| Agriculture | $7.0 | $1.4 | 2 |
| Datacenter | $5.8 | $1.8 | 3 |
| Demand Response | $9.9 | $2.6 | 5 |
| Energy Storage | $1.7 | $0.9 | 1 |
| Industrial | $31.0 | $8.5 | 17 |
| Roadmap | $0.3 | $0.0 | 1 |
| Water | $33.1 | $8.9 | 18 |
| **Total** | **$88.8** | **$24.1** | **47** |

# Highlighted IAW R&D Projects

**Project Title:** Unlocking Industrial Energy Efficiency through Optimized Energy Management Systems

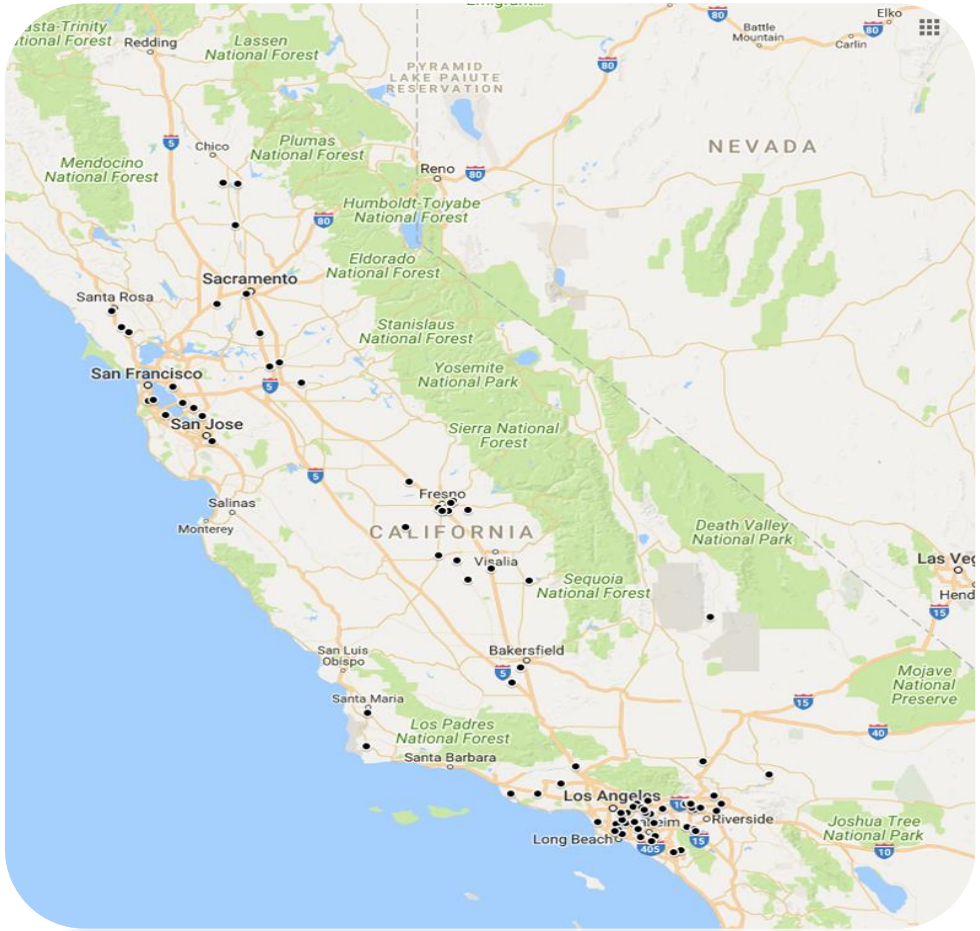
**Recipient:** The Regents of the University of California, Berkeley

**Agreement Number:** EPC-14-075

**Award:** $5 million

**Co-funded Amount:** $1.5 million

**Description:**
UC Berkeley, MIT, and the University of Chicago, have partnered with Lightapp Technologies to demonstrate a pre-commercial, software-based, optimized energy management system in industrial facilities. Together, they will demonstrate Lightapp's energy-monitoring system on compressed air systems in 100 California industrial plants served by the state's investor-owned utilities.




Lightapp participants and site locations

# Highlighted IAW R&D Projects

**Project Title:** Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use

**Recipient:** Porifera, Inc.

**Agreement Number:** EPC-14-065

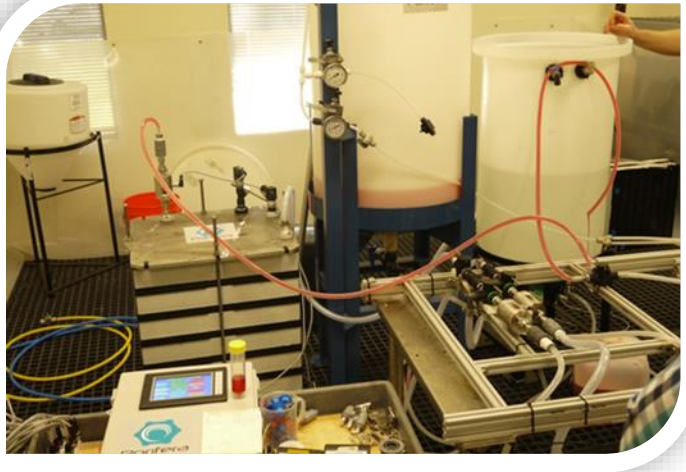
**Award:** $2.5 million

**Co-funded Amount:** $628,000

**Project Location:** Los Gatos Tomato Products, Huron, CA; Anheuser-Busch, Fairfield, CA; & Jackson Family Wines, Geyserville, CA

**Description:**
The Porifera forward osmosis concentrator dewaters fruits and vegetables for production of food and beverage concentrates and purees, potentially replacing energy intensive thermal evaporators. Additionally, water is extracted from the concentrated product for reuse on-site.

**Results:** Technology achieved significant energy savings, high purity water recovery and preservation of food and beverage products qualities.



Lab testing of fruit/vegetable concentrates.

# Highlighted IAW R&D Projects

**Project Title:** Conversion of Low Value Waste Heat into High Value Energy Savings

**Recipient:** Gallo Cattle Company

**Agreement Number:** PIR-15-007

**Award:** $1.2 million

**Co-funded Amount:** $400,000

**Project Location:** Gallo Cattle Company, Atwater, CA

**Description:**
This project demonstrates a new innovative system that extracts waste heat from biogas to electricity generators and uses the heat for heating and chilling purposes in a food processing facility.

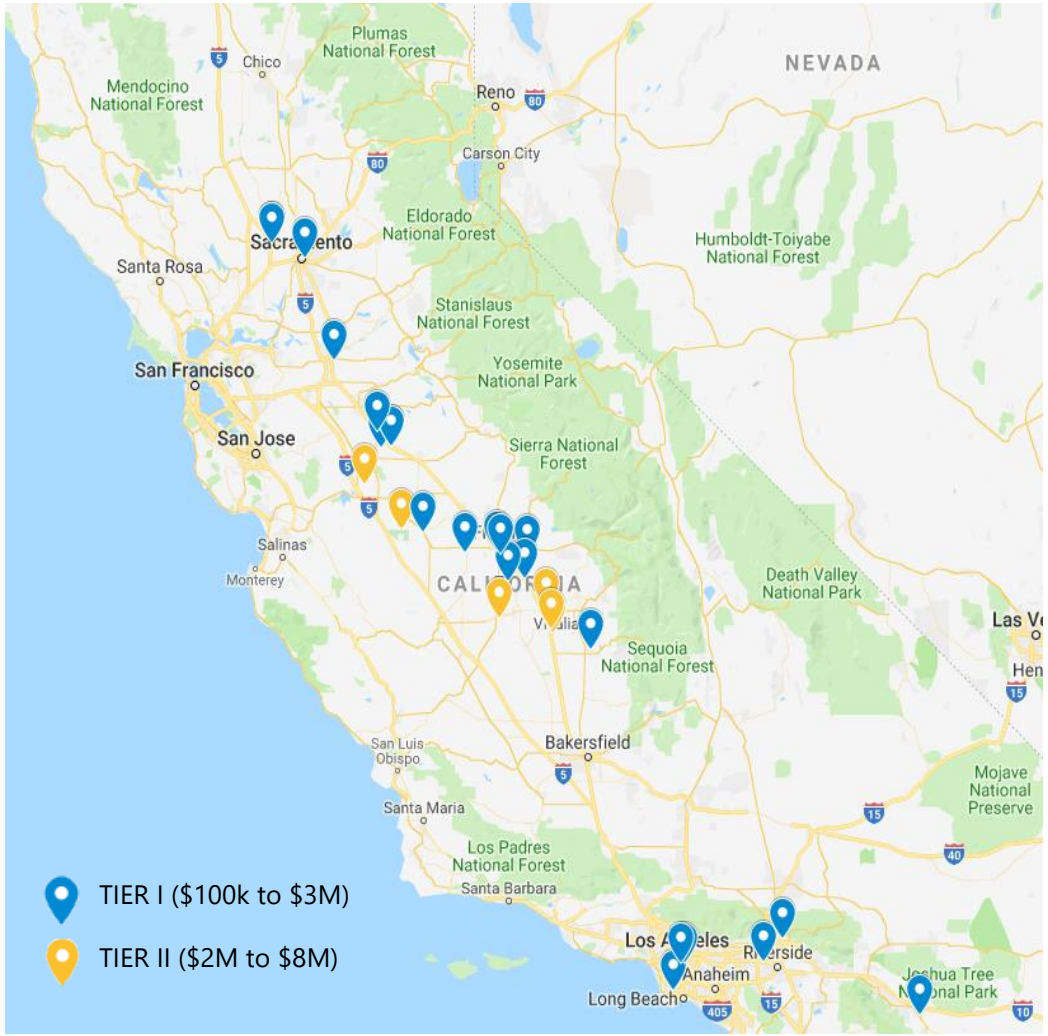
**Results:** Reduced natural gas use by approximately 23% and electrical use by 38% for chilling and heating.

# Food Production Investment Program (FPIP)

## *$74 million from the California Climate Investments Program*

- Funds drop-in and emerging energy technologies at food production facilities with the goal of reducing greenhouse gas (GHG) emissions.
- Helps producers replace high-energy-consuming equipment and systems with market-ready and advanced technologies.
- Accelerates adoption of state-of-the-art energy technologies that reduce energy use, costs, and GHG emissions.

# FPIP Investments to Date




- **$44 M** invested in **21 PROJECTS**
- **28 TOTAL SITES**
  - 3 Northern California
  - 19 Central Valley
  - 6 Southern California
- **55,000 MT $CO_{2E}$*** projected annual emissions reduction

* Preliminary estimates from applications – full quantification will occur after completion of project measurement and verification

# Project Highlights

## Sun-Maid Compressed Air System Optimization Project

**Agreement:** FPI-18-006

**Amount:** $805,500

**Co-funded Amount:** $805,500

**Facility Type:** Dried and Dehydrated Food Manufacturing

**Facility Location:** Kingsburg, CA

**Project Description:** Replacement of aged, inefficient compressed air system with optimized compressed air system - variable frequency drive compressors, compressor control system, and waste heat recovery for dessicant air dryer.


*Project will install high efficiency, oil-less centrifugal air compressors with heat recovery capability*

# California Dairies High-Temperature Solar Thermal System Project

**Agreement:** FPI-18-005

**Amount:** $3M

**Co-funded Amount:** $600,000

**Facility Type:** Milk Processing

**Facility Location:** Visalia, CA

**Technology:** Solar Thermal

**Project Description:**
Installation of 2000 intelligent mirror array collectors and associated components to provide pre-heating for boilers used in milk processing, resulting in reduced natural gas consumption and greenhouse gas emissions

*Skyven IMA technology installed in Richardson, Texas*

# Cumulative Projected Benefits

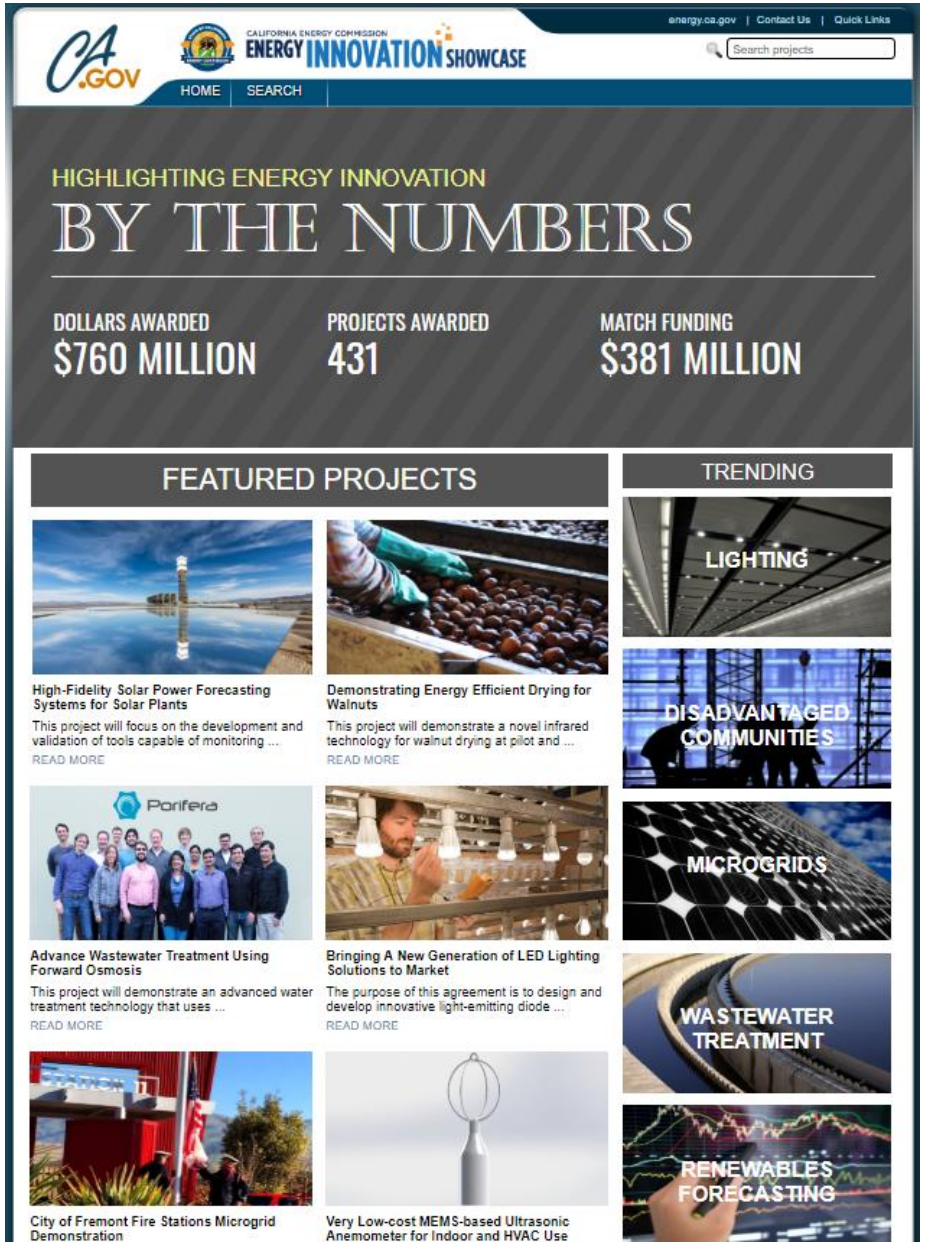
Annual energy savings and GHG emission reductions are equivalent to:*

11,677 passenger vehicles

Electricity consumed by 9,591 homes

6,188,815 gallons of gasoline

* Preliminary estimates from applications – full quantification will occur after completion of project measurement and verification




# Contacts and Resources

- **Information on Energy Commission research projects funded since 2016 are in the EPIC Innovation Showcase in 2016**
  - http://innovation.energy.ca.gov
- **Information on Energy Commission's R&D Program:**
  - https://www.energy.ca.gov/programs-and-topics/topics/research-and-development
- **Food Production Investment Program (FPIP)**
  - https://www.energy.ca.gov/programs-and-topics/programs/food-production-program

# Opportunity to Shape Waste Heat Recovery Research

Energy Commission is seeking comments on the following:

- What industries have large volumes of ultra-low (<250º F) or ultra-high temperature (>1,600º F) waste heat?
- What research is needed on advanced technologies or materials (including coatings) for recovering waste heat cost effectively in ultra-low heat or ultra-high temperatures?
- Should research focus primarily on the ultra-low or ultra-high temperature waste heat or other temperature ranges?
- What advanced heat recovery technology improvements are needed to increase wide spread deployment by industry?
- What are the cost and technical targets that must to be met to drive customer adoption (such as minimum rate of return or minimum percent heat recovery)?
- What complementary technologies and approaches can be combined to increase the value proposition of waste heat recovery systems?

Responses due August 6, 2019

**Enter your comments to docket 19-ERDD-1 at:**
**https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=19-ERDD-1**

California Energy Commission

# Thank You

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