



California
Energy Commission

Technology Advancements to Decarbonize the Industrial Sector

July 8, 2019

Erik Stokes

Energy Research and Development Division





Transforming the Energy Sector Through Push and Pull Policies

Technology Push:

- **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

Market Pull:

- **Codes and Standards**
 - Building and Appliance Efficiency Standards
 - Renewable Portfolio Standard
 - Low Carbon Fuel Standard
- **Incentive Programs**
 - California Solar Initiative
 - Utility Rebates
- **Public Procurement,**
 - Fleet targets for new ZEV purchases



Operationalizing the Innovation Pipeline



CalSEED

- Concept award - \$150,000
- Prototype award - \$450,000

Innovation Clusters

- Identify 1st target market
- Identify manufacturing and supply chain requirements
- Connections to industry and investment stakeholders

Phase I

BRIDGE

- Awards follow-on funding for successful federal- or CEC-funded R&D projects.

CalTestBed

- Statewide network of open-access testbeds for startups

Phase II

RAMP

- Accelerate time to reach MRL 8 at CA manufacturing facilities.

Procurement Assistance

- Overcome technology “lock in” barriers in customer procurement practices



Statewide Network of Cleantech Entrepreneurial Services



CalSEED



cyclotronroad **LACI**

- Since the ecosystem's inception:
 - Start-up companies have attracted over **\$100 million** in funding.
 - Ecosystem partners have secured **\$4.4 million** in federal funding to expand entrepreneurial services.



Energy Commission R&D Investments Helping to Support Industrial Decarbonization

Note: The projects discussed are examples of emerging technologies and not a state endorsement of any specific company or technology



Solar Thermal for Process Heating



- Parabolic Trough Collector is generally CSP technology best suited for industrial process heating.
- Structural support and installation contribute to ~70% of installed cost of parabolic trough collectors.
- Sunvapor technology replaces expensive steel assemblies with lumber That meets requirements for strength, rigidity and durability.
- By using lumber along with other design innovations, Sunfolding's innovation could lower installed cost by 75%.



IoT for Industrial Customers

Lightapp

- Piloted an energy management/monitoring system on the compressed air systems of over 100 industrial facilities in California to determine effectiveness.
- The software provided insights to the decision-makers at industrial plants to help reduce energy consumption and the other benefits including:
 - Troubleshoot plant pressure problems include leakage.
 - Adjust compressor setting to be more efficient
 - Defer purchase of new compressed air equipment
- One facility report a 30% efficiency gain over the base case.

Food and Beverage Concentrate using Forward Osmosis



- The Porifera Forward Osmosis Concentrator uses a non-thermal process that can achieve significantly higher concentration than other nonthermal processes.
- Overcomes limitations of current forward osmosis products on the market such as capital costs and bulkiness.
- Can pull water out of food and beverage products and concentrate products up to 10 times by volume, while retaining a fresh, natural taste.
- Data from first pilot sites (grape and tomato juice concentration) indicated annual energy savings from 38% to 72% and 45%-75% respectively.



Non-Vapor Compression Cooling for Cold Storage Warehouses

SkyCool Systems

HOME CONTACT

REDEFINING COOLING

Our panels turn the sky into a renewable resource and reduce the electricity use of air conditioning and refrigeration systems.

The image is a promotional banner for SkyCool Systems. It features a dark blue pickup truck parked on a grassy hillside with rolling hills in the background. In the foreground, two large, rectangular, blue solar panels are mounted on a metal frame. The text "SkyCool Systems" is in the top left, "HOME CONTACT" is in the top right, and "REDEFINING COOLING" is in large white letters in the center. Below that, a paragraph of text describes the product's benefits.



CO₂ Capture and Reuse from Industrial Sources

mosaic 

- Uses low-cost, solid adsorbent pellets instead of a liquid solvent
- Reduces the energy costs of removing carbon dioxide from biogas by up to 40 percent
- During a CEC project, the pellets removed carbon dioxide to the purity required to meet pipeline-quality natural gas standards

— **opus** 12

- Modular CO₂ conversion device that uses only water and electricity.
- Demonstrated the electrochemical reduction of carbon dioxide to 16 different products.
- First market application is onsite CO production.
- Successfully demonstrated converting CO₂ from raw biogas into methane.



MORE INFORMATION

Energy Research and Development

<https://www.energy.ca.gov/programs-and-topics/topics/research-and-development>

Energy Innovation Showcase

<https://www.energy.ca.gov/showcase/energy-innovation-showcase>

Empower Innovation (beta)

<https://www.empowerinnovation.net/>