Industrial Energy Innovation in California

NASEO-NARUC Joint Forum on Industrial Demand Flexibility

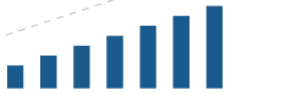
Energy Research and Development Division

California Energy Commission

June 11, 2024

PRIMARY FUNCTIONS OF THE

CALIFORNIA ENERGY COMMISSION



Advancing State Energy Policy

Investing in Energy Innovation

Developing Renewable Energy

Preparing for Energy Emergencies

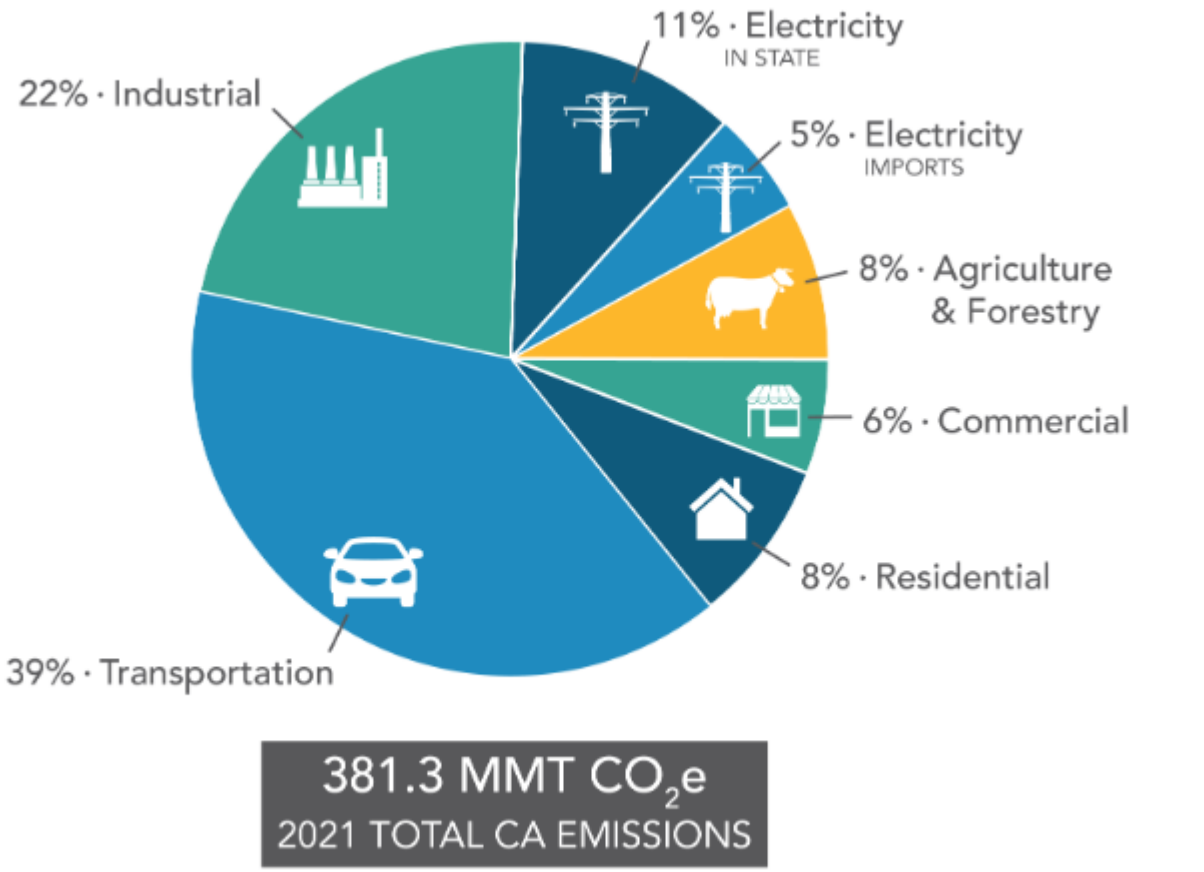
Achieving Energy Efficiency

Transforming Transportation

Overseeing Energy Infrastructure

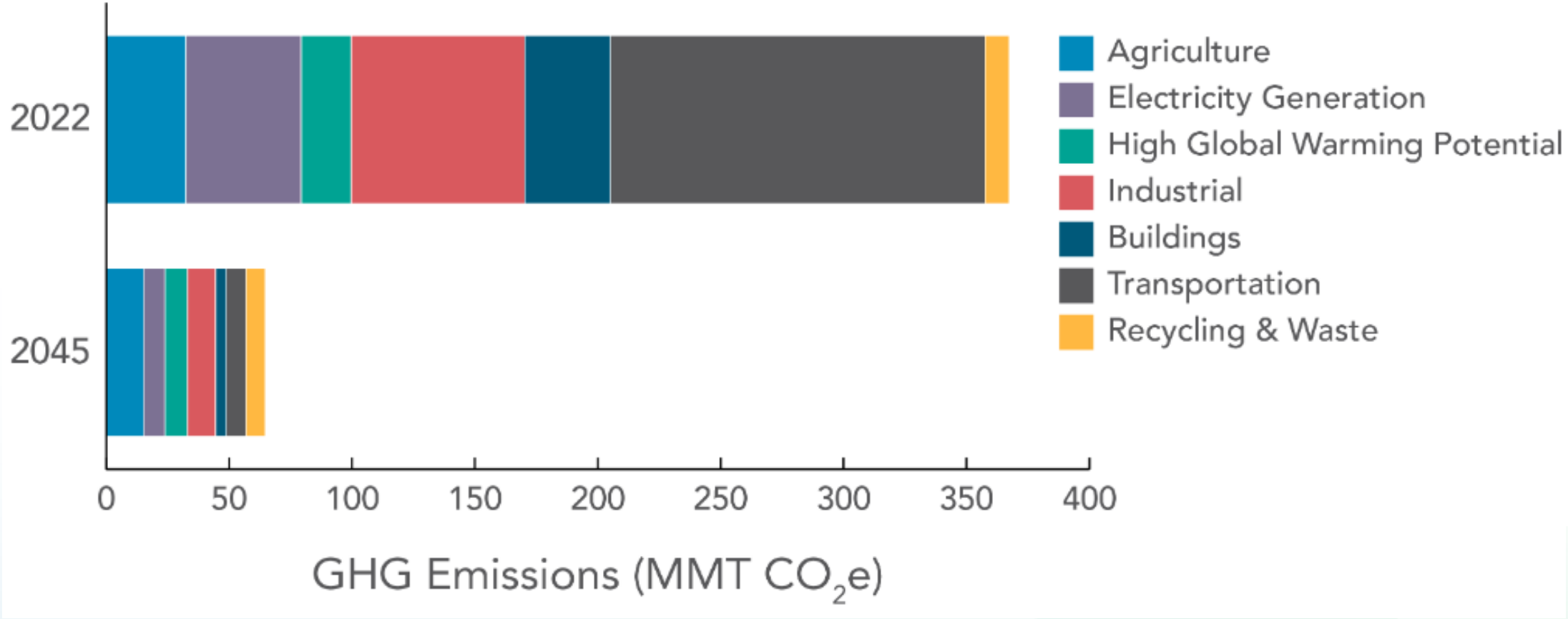
Intergovernmental Collaboration

Industrial Sector Contributes Second Highest GHG Emissions



Source: CARB

Carbon Neutrality in California by 2045



Source: CARB

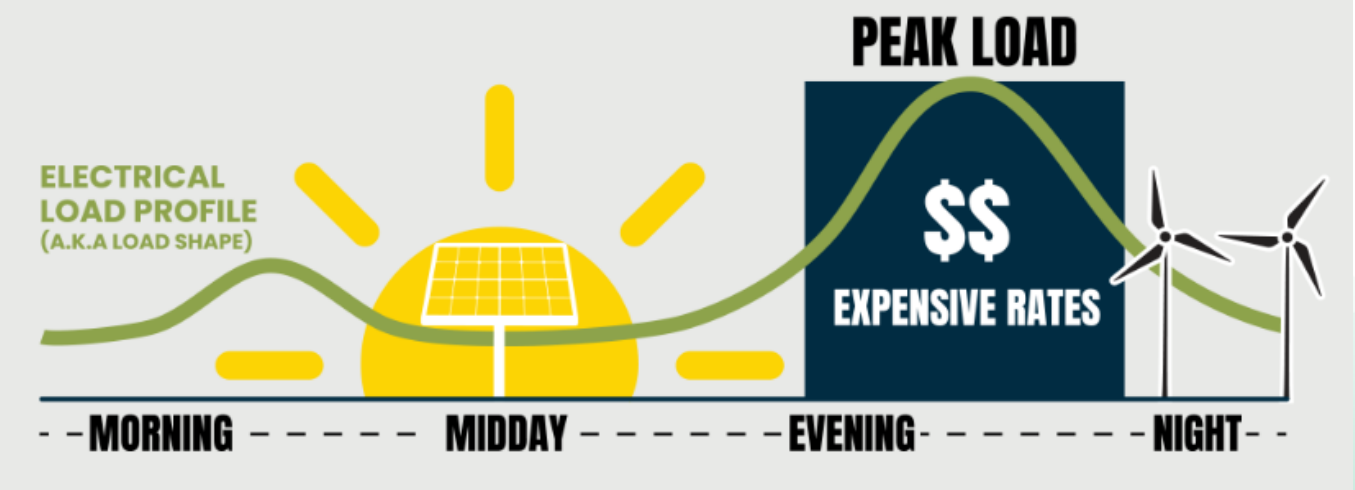
Load Flexibility and the Industrial Sector

Opportunities

- Electric grid benefits
  - Maximize use of surplus renewable energy
  - Increase grid reliability
  - Be a key electricity supply resource
- Cost savings
- Support new load flexibility technologies

Challenges

- Value proposition not well-defined
  - Few viable control strategies
  - Unclear business case
  - Risk averse
- Lack of data on industries with most load shifting potential

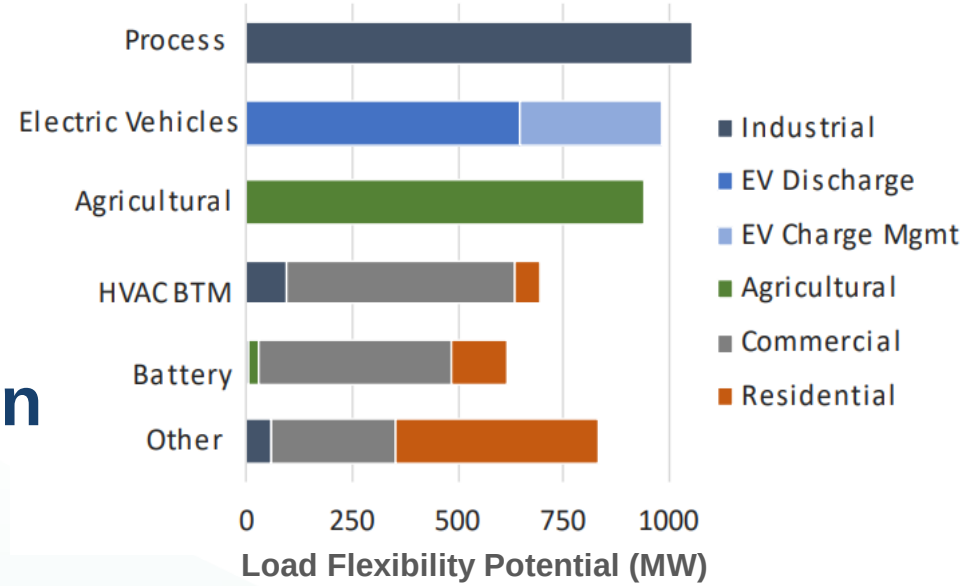


Source: CalFlexHub, LBNL (lbl.gov)

California Demand Flexibility Policy

New CEC Load Shift Target: 7 GW by 2030*

- Require **hourly-varying electric rate options** (CEC Load Management Standards)
- Publish a machine-readable database of time-varying rates (CEC MIDAS)
- Require certain devices to **adjust demand in response to dynamic signals** (CEC Flexible Demand Appliance Standards)**
- Demonstrate **customer response to dynamic price signals** (CPUC CalFUSE Framework)



*Senate Bill 846 Load-Shift Goal Report, California Energy Commission (2023)
** California Energy Commission, Flexible Demand Appliance Standards Docket Log

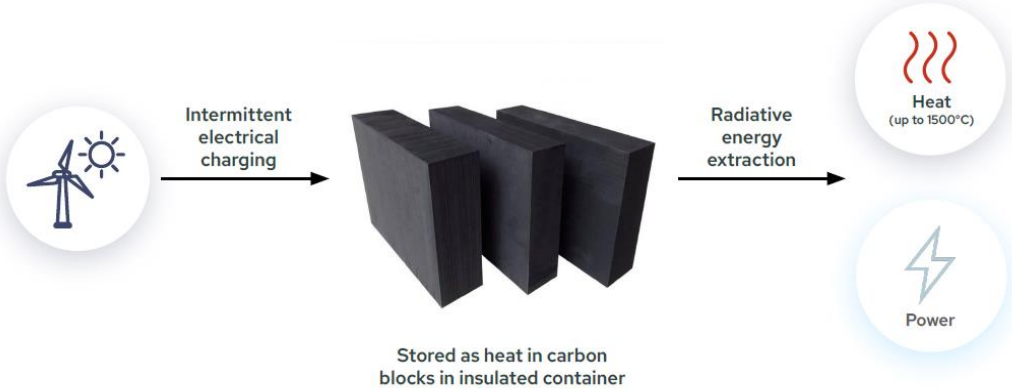
CEC'S Grant Programs: Fostering Innovation Across the Energy Sector

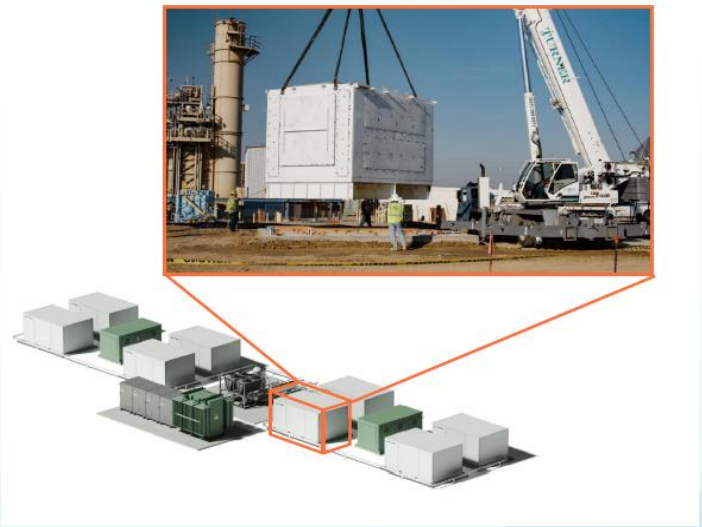
Core mission: strategically invest funds to catalyze change and accelerate achievement of policy goals

- ✓ Electric Program Investment Charge (EPIC)
- ✓ Gas Research and Development Program
- ✓ Industrial Decarb and Grid Support Program (INDIGO)
- ✓ Food Production Investment Program (FPIP)

Load Flexibility in Industrial Heat

Antora Energy - Long Duration Thermal Storage





Above: Graphical depiction of Antora's storage technology

(Source: Antora Energy)

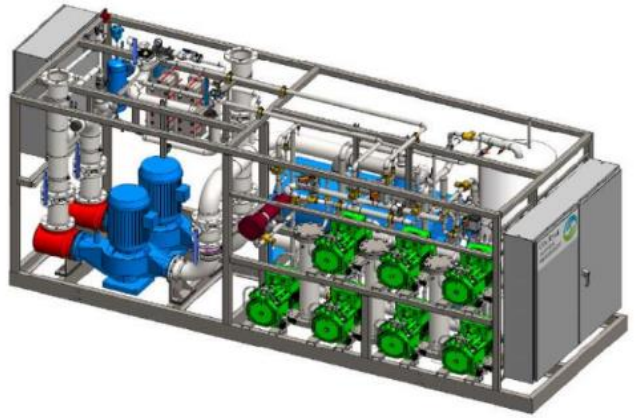
Right: Installation of Antora's pilot scale system and rendering of Antora's full storage plant

(Source: Antora Energy)

- **1500 Wh/L:** Energy density of carbon – Antora's thermal storage medium
- **1500°C:** Temperature Antora's system can deliver to industrial customers
- **>40%:** Conversion efficiency of Antora's thermophotovoltaic heat engine
- **5 MWh:** Capacity of Antora's pilot-scale system

Load Flexibility in Industrial Cold Storage

- **University of California, Santa Barbara**
  - Harnessing the Potential of AI in Industrial Refrigeration Systems
- **Electric Power Research Institute**
  - IndFlex – Demand Flexibility in Industrial Refrigerated Warehouse
- **Prospect Silicon Valley**
  - Dynamic, Grid-Flexible Cold Storage Refrigeration with Advanced CO2 Heat Pump, Thermal Storage and Defrost Controls
- **Amy's Kitchen**
  - Thermal Ice Energy Storage in Food Processing



Source: Amy's Kitchen

Load Flexibility in the Water Sector

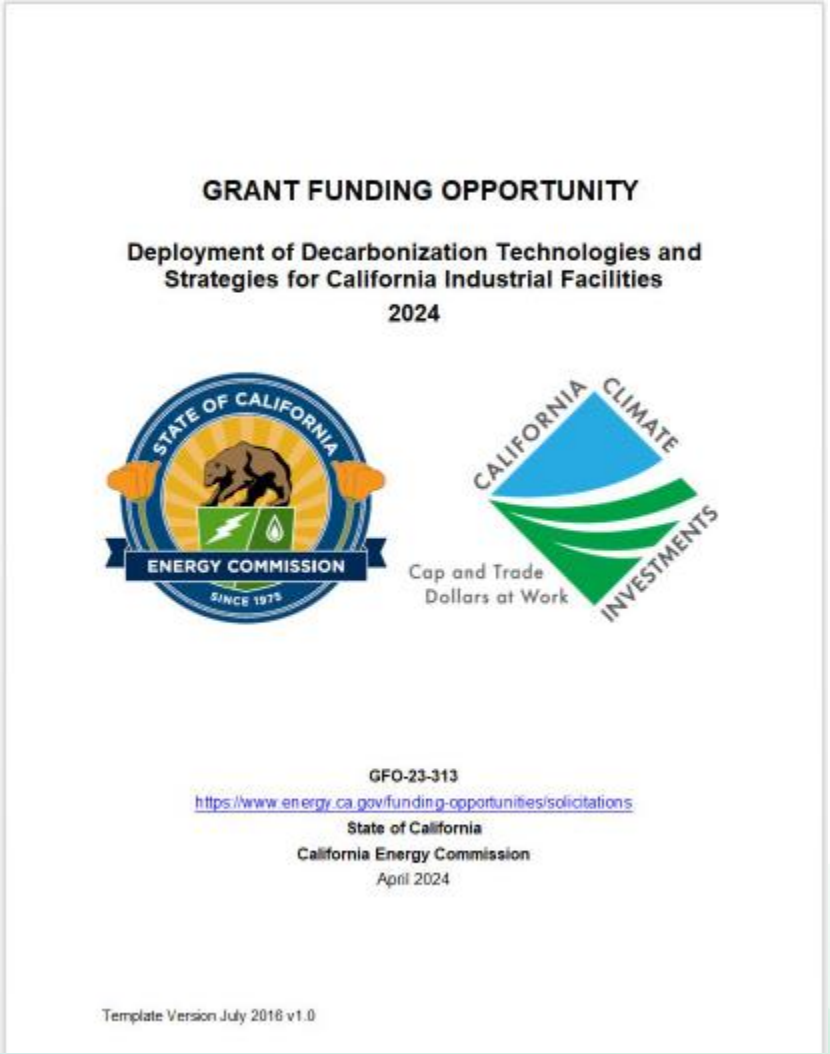
- **University of California, Davis**
  - Statewide simulation of 700+ water systems
  - Smart pumping has the statewide potential to:
    - Shift energy demand by up to 1,000 GWh annually, and
    - Reduce peak demand by up to 321 MW.
  - Moulton Nigel Water District
    - Developed and demonstrated WaterWatch software to optimize energy use and demand & enable load shift program participation
    - Reduced average energy demand by 4.2%, annual energy use by over 311 MWh and annual carbon dioxide emissions by 48 million MT
    - Response limited by tank storage capacity, pumping capacity, water demands and energy rates

Opportunities

Active

New CEC Funding for Industrial Projects (INDIGO)

- Industrial facilities and others
- Examples of eligible technologies
  - process heat electrification
  - non-thermal separations
  - alternative processes
  - energy efficiency
  - load flexibility
- Priority population benefits



GRANT FUNDING OPPORTUNITY

Deployment of Decarbonization Technologies and Strategies for California Industrial Facilities 2024

GFO-23-313

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

State of California

California Energy Commission

April 2024

Template Version July 2016 v1.0

GFO-23-313	Proposed Funding Amount: $46.2M	Deadline: 06/17/24

Closed

New CEC Funding for Food Processing Facilities (FPIP)

- Food processors
- Examples of eligible technologies
  - energy efficiency
  - refrigeration optimization
  - industrial heat pumps
  - waste heat to power
  - wastewater treatment
  - renewable energy microgrids
  - fuel switching
  - grid support

GRANT FUNDING OPPORTUNITY

FOOD PRODUCTION INVESTMENT PROGRAM
2024

GFO-23-305-02
https://www.energy.ca.gov/funding-opportunities/solicitations
State of California
California Energy Commission
[January 2024] April 2024

Template Version July 2015 v1.0

GFO-23-305	Proposed Funding Amount: $36M	Deadline: 05/09/24

Coming Soon

Industrial, Agricultural, and Water Flexible Load Research Hub*

- Estimated 2 GW of average annual load shifting potential
- Research needed to increase operational load flexibility
  - Address technical barriers and develop technologies to advance flexible demand management
  - Inform future load flexibility policies
  - Respond to GHG and price signals
  - Shed loads during peak hours plus reduce operating costs

* EPIC Investment Plan Initiative 17

Solicitation Number: TBD	Proposed Funding Amount: $17M	Deadline: TBD

Active

VPP Approaches for Load Flex (VPP-FLEX Solicitation)

- Demonstrate VPPs as long-term, reliable grid resources
- Ensure the resource creates a net benefit to the grid and participants
- Partner with local government or non-profit entities to increase participation by and engagement with customers
- Demonstrate automated load shifting

GFO-23-309	Funding Amount: $21M	Deadline: 07/01/24

Additional Information

Program Contacts

- INDIGO and Industrial, Agriculture and Water R&D: Ilia Krupenich, ilia.krupenich@energy.ca.gov
- FPIP: Cyrus Ghandi, cyrus.ghandi@energy.ca.gov
- Demand Flexibility: Akruti Gupta, akruti.gupta@energy.ca.gov

Web Resources

- Find a partner and other resources:
  - https://www.empowerinnovation.net/

Funding opportunities

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

Project database

- https://www.energizeinnovation.fund

Thank You!