CEC EPIC 3 Program Activities

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CALIFORNIA'S INVESTMENT IN CLEAN ENERGY INNOVATION

EPIC is California's premier public interest research program investing over $130 million annually to unleash innovation.

Entrepreneurial Ecosystem

$143 million invested

Through EPIC, the CEC is building a world-class ecosystem supporting clean energy entrepreneurship.

Resiliency & Safety

$151 million invested

Helping communities, businesses, and public agencies build a safer, more resilient energy system.

Building Decarbonization

$194 million invested

Improving the affordability, health, and comfort of buildings.

Grid Decarbonization & Decentralization

$207 million invested

Improving the cost competitiveness and performance of key technologies.

Industrial & Agricultural Innovation

$119 million invested

Scaling specialized technology solutions to drive energy efficiency without compromising production.

Transportation Electrification

$32 million invested

Supporting advances that reduce the cost of electric vehicle ownership and support the grid.

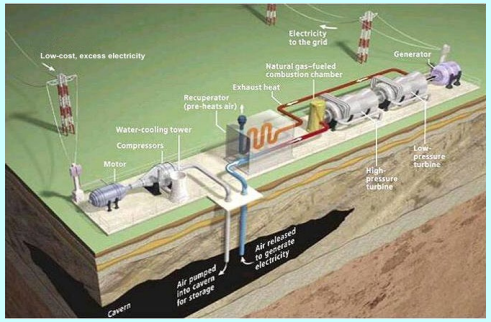
Total investment, 2012-2020

California Energy Commission EPIC Program

CEC EPIC Third Investment Plan (2018-2020)

- THEME 1: Advance Technology Solutions for Continued Energy Savings in Buildings and Facilities
- THEME 2: Accelerate Widespread Customer Adoption of Distributed Energy Resources
- THEME 3: Increase Grid System Flexibility and Stability from Low-Carbon Resources
- THEME 4: Increase the Cost-Competiveness of Renewable Generation
- THEME 5: Create a Statewide Ecosystem for Incubating New Energy Innovations
- THEME 6: Maximize Synergies in the Water-Energy-Food Nexus
- THEME 7: Develop Tools and Analysis to Inform Energy Policy and Planning Decisions
- THEME 8: Catalyze Clean Energy Investment in California's Disadvantaged Communities

California Energy Commission has a Long History of Energy Storage Research



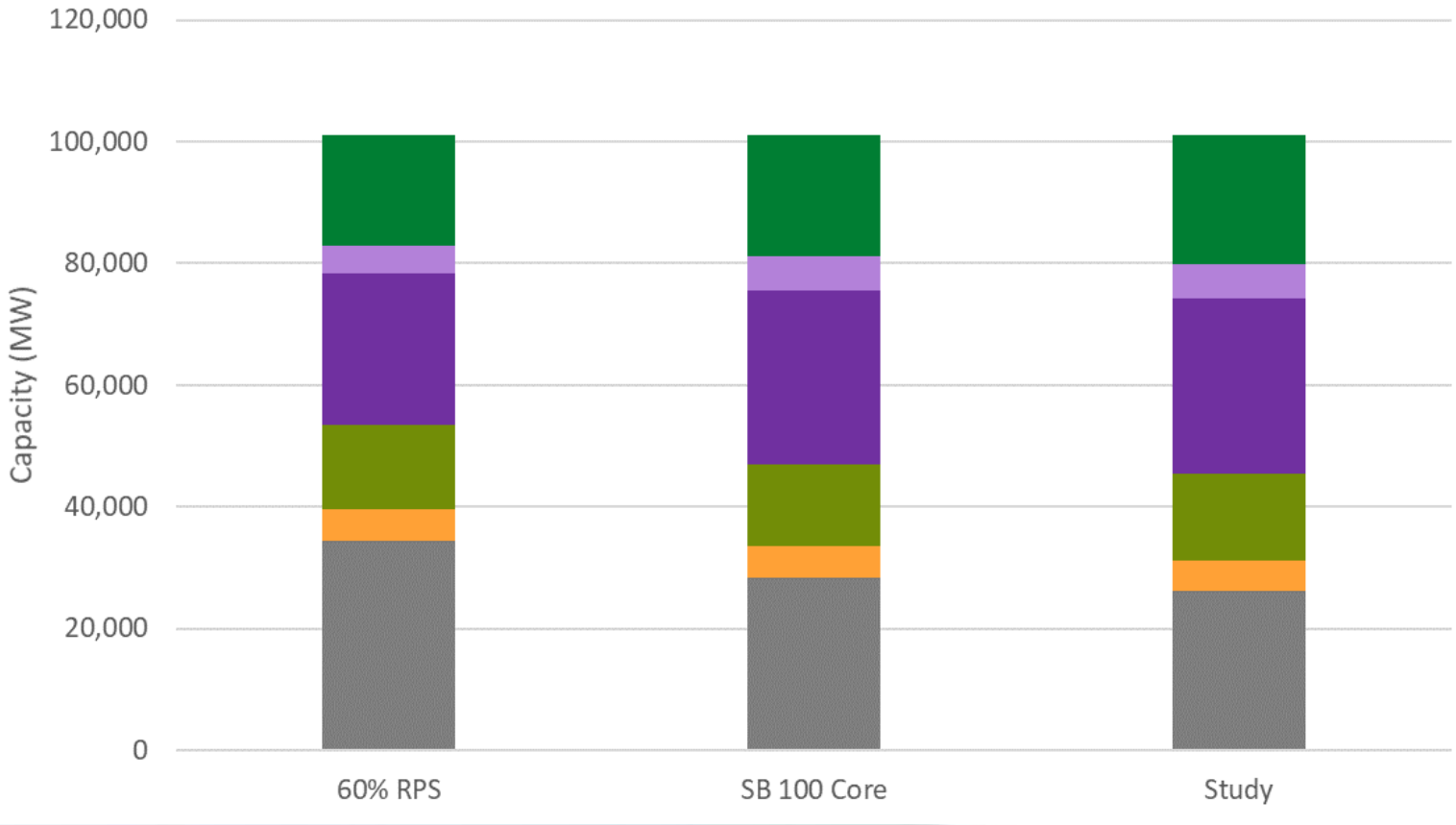
Growing Need for Energy Storage in California

(CPUC Integrated Resource Plan)

Table 5. New Resource Buildout of 2019-2020 RSP (Cumulative MW)

Resource Type	2020	2021	2022	2023	2024	2026	2030
Wind	-	34	1,950	1,950	2,737	2,737	2,837
Wind on New Out-of-State Transmission	-	-	-	-	-	-	606
Utility-Scale Solar	2,000	4,000	6,000	8,000	8,000	8,000	11,017
Battery Storage	152	2,453	2,453	2,453	3,299	6,127	8,873
Pumped (long-duration) Storage	-	-	-	-	-	973	973
Shed Demand Response	-	222	222	222	222	222	222
Natural Gas Capacity Not Retained	-	-	-	-	-	-	(30)

Planning for California's SB-100 Goals
Latest Modeling Results: System Resource Adequacy



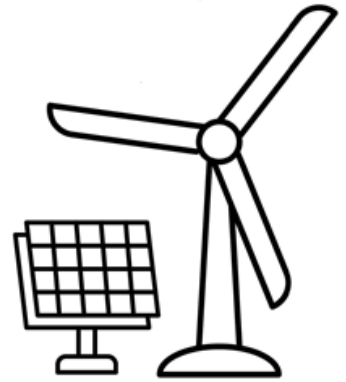
Solar Marginal ELCC: 2%
Wind Marginal ELCC: 19%

"Variable renewable" resources include wind and solar.
"Zero carbon firm" resources include hydro, nuclear, geothermal, hydrogen, biomass.

For reference, the 2018 August CPUC committed System RA resources totaled 47 GW.

Demand: High Electrification; Resource Options: All; Year: 2045

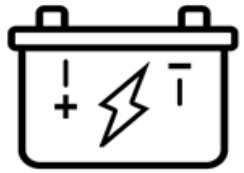
Planning for California's SB-100 Goals To Achieve Clean Energy



Solar & Wind

3X

Solar and wind build rates need to nearly triple*



Battery

8X

Battery storage build rates need to increase by nearly eightfold**

For reference:

- The 2018 August CPUC committed System RA resources totaled 47 GW.
- Demand: High Electrification; Resource Options: All; Year: 2045

2020 was a Pivotal Year for Critical Energy Storage Research

- Over $100 Million Invested in Energy Storage in 2020 (EPIC Funds and Awardee Provided Match Funding)
- Evaluating the Performance of Lithium Ion and Non-Lithium-Ion Energy Storage Technologies in a Variety of Microgrid Applications
- Supporting New and Emerging non-Lithium-Ion Technologies
- Field Demonstrations of non-Lithium Ion Longer Duration Energy Storage
- Validating Capability of Second-Life Batteries to Cost-Effectively Integrate Solar Power for Small-Medium Commercial Building Applications
- Assessing Long-duration Energy Storage Deployment Scenarios to Meet California's Energy Goals

California Investments in Emerging Energy Storage Technologies

- California Energy Commission has invested in a diverse portfolio of energy storage technologies
  - Short-term, long-term and seasonal energy storage technologies
    - Lithium-Ion
    - Advanced battery chemistries
    - Flow batteries
    - Flywheel systems
    - Thermal energy storage
    - Advanced pumped hydro
    - Compress air energy storage
    - Green hydrogen

Developing non-Lithium-Ion Energy Storage Technologies to Support California's Clean Energy

Group 1 Develop/Validate New and Emerging Non-Lithium-Ion Energy Storage Technologies ($8.6M EPIC Funding, $8.0M Match Funding)

Antora Energy

Solid-state Long Duration Energy Storage for Industrial Applications

Testing in industrial application

form energy

Aqueous Air-Breathing Energy Storage System for Multi-Day Resiliency

Targeting commercial / wholesale grid applications

eZinc

Commercialization of Lowest-Cost, Long Duration Energy Storage Systems

Testing in agricultural application

Developing non-Lithium-Ion Energy Storage Technologies to Support California's Clean Energy

Group 1 Develop/Validate New and Emerging Non-Lithium-Ion Energy Storage Technologies
($8.6M EPIC Funding, $8.0M Match Funding)

SALIENT ENERGY

California Zinc-ion Energy Storage Development and Validation Project

A high-capacity and long-life aqueous rechargeable zinc battery using a metal oxide intercalation cathode

ANZODE

Zinc Batteries for California Electrical Customer Power Backup

Anzode's rechargeable zinc-manganese batteries provide good performance, safety, and low cost for backup power and energy storage, compared to gas generators and lithium-ion.

Developing non-Lithium-Ion Energy Storage Technologies to Support California's Clean Energy Goals

Group 2: : Develop/Validate Green Hydrogen Energy Storage Systems ($4.0M EPIC, $1.9M Match Funding)

DASH Clean Energy

Demand Based Renewable Hydrogen Power-to-Power Project

The Palmdale Water District (PWD) wind-to-hydrogen project will be the nation's first integrated grid connected hydrogen-based energy storage system.

T2M Global

Ultra-high Efficiency, Lower-Cost, Green Electrolytic H2 for Microgrids in California

T2M Team proposes to develop and validate a 100-kW Class Green Electrolytic H2 Energy Storage System - Advanced Electrolysis System (AES) with Waste Heat Integrated Fuel Cell - as a sustainable electricity-in/-out solution for microgrids in disadvantaged communities in CA.

Technology & Investment Solutions, LLC

Project will field test a small-scale skid mounted Hy2green hydrogen energy storage system integrated with solar PV renewable generation at an existing anaerobic digestion facility. The project will test the Hy2green hydrogen system's metal hydride hydrogen storage performance and optimize the energy management systems. The project will validate the ability of metal hydrides to store hydrogen in a long duration energy storage application, and gather lessons learned to inform future deployments of metal hydride energy storage, a technology with the potential to support California's energy goals.

Demonstrating Long Duration and Title 24-Compatible Energy Storage Technologies

Group 1 Longer-duration Storage –(400 kw/10 hours)
($27.0M EPIC Funding, $39.0M Match Funding)

Rincon Band of Luiseno Indians

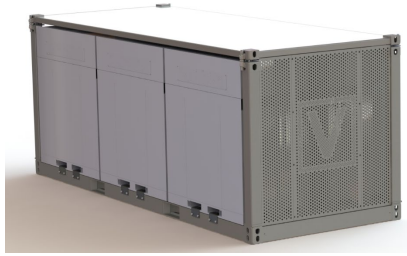
- Vanadium Redox Flow Battery + Flywheel
- Casino and Resort

INVINITY ENERGY SYSTEMS

AMBER KINETICS

Indian Energy

- Vanadium Redox Flow Battery, Zinc Hybrid Cathode Battery, And Flywheel
- Camp Pendleton military base



INVINITY ENERGY SYSTEMS

Eos Energy Storage

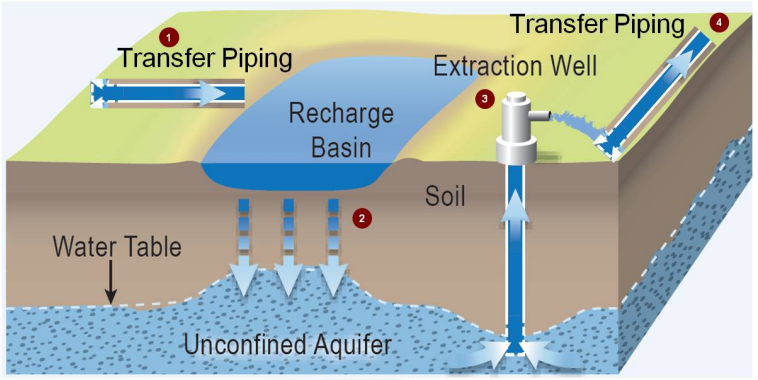
Kinetic Energy Storage Corporation

Demonstrating Long Duration and Title 24-Compatible Energy Storage Technologies

Group 1 Longer-duration Storage –(400 kw/10 hours)
($27.0M EPIC Funding, $39.0M Match Funding)

Antelope Valley Water Storage

- Aquifer Pumped Hydro
- Groundwater storage facility



Charge Bliss

- Zinc Hybrid Battery
- Medical Center in Under-resourced Community

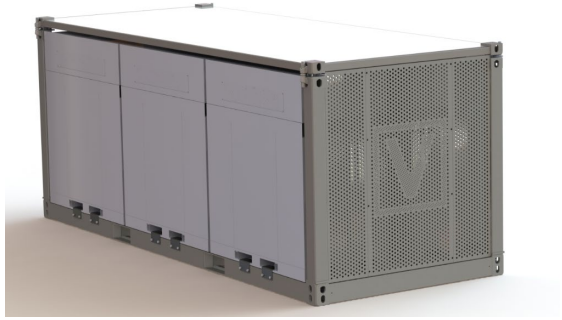
Eos Energy Storage

Demonstrating Long Duration and Title 24-Compatible Energy Storage Technologies

Group 2: Native American Tribal Communities - (50 kw/10 hours)
($4.9M EPIC Funding, $6.6M Match Funding)

GRID Alternatives

- Vanadium Redox Flow Battery
- Fire station for the Soboba Band of Luiseño Indians



INVINITY ENERGY SYSTEMS

Indian Energy

- Flywheel
- Drinking water for the Viejas Band of Kumeyaay Indians

Kinetic Energy
Storage Corporation

Demonstrating Long Duration and Title 24-Compatible Energy Storage Technologies

Group 3: Low-Income & Disadvantaged Communities - Awards Summary (50 kw/10 hours) ($4.0M EPIC Funding, $1.0M Match Funding)

Antelope Valley Water Storage

- Aquifer Pumped Hydro
- Groundwater storage facility

MADISON FARMS ECHO, OREGON
ASR REGENERATION

200 HP MOTOR WITH VERTICAL LINE SHAFT PUMP – 8" PIPE, AQUIFER LEVEL 520 FEET BELOW LAND SURFACE.

200 HP MOTOR STARTING VFD & 100 HP REGENERATION VFD WITH LOCAL CONTROL PANEL.

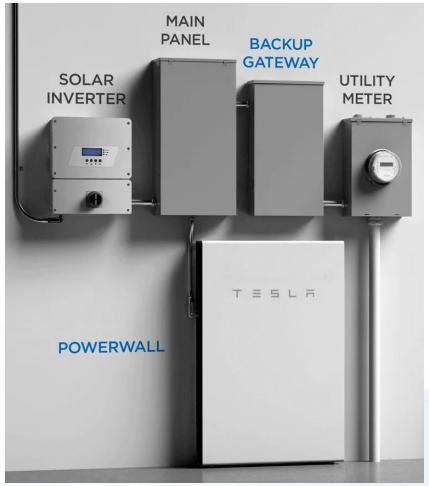
Willow Springs Water Bank

Demonstrating Long Duration and Title 24-Compatible Energy Storage Technologies

Group 4: Residential Storage - 15 Sites for each Grant with Locations in 3 Climate Zones ($3.0M EPIC Funding, $800K Match Funding)

UC Riverside

New Technology for Autonomous, Plug And Play, Behind-the-meter Solar-battery Unit



TESLA

BoxPower

Modular Containerized Solar Plus Energy Storage System

BOXPOWER

Electric Power Research Institute

Evaluate Performance Among Multiple Commercial Systems and Compare Home Performance With And Without Energy Storage

sonnen

LG Chem

GENERAC

Validating Capability of Second-Life Batteries to Cost-Effectively Integrate Solar Power for Small-Medium Commercial Building Applications

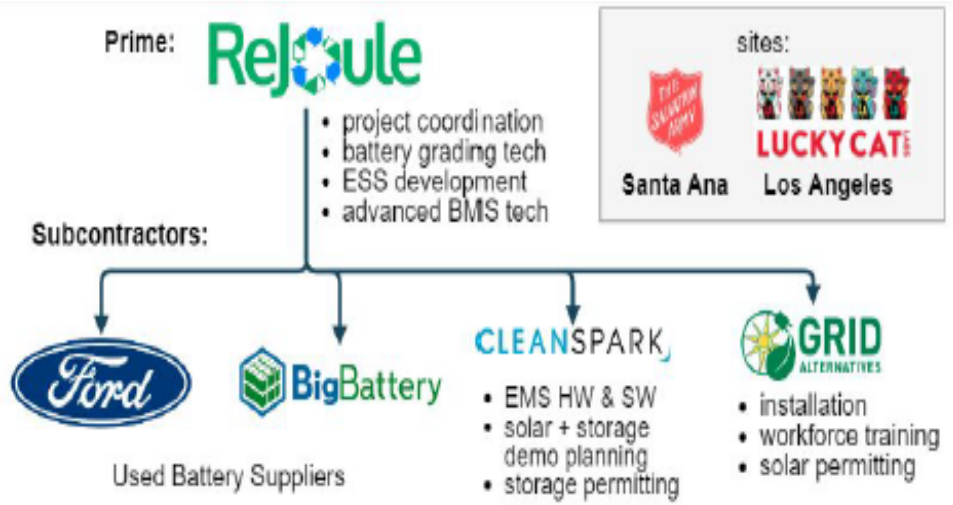
($10.8M EPIC Funding, $3.1M Match Funding)

RePurpose Energy Inc.—

To design, build, test, and demonstrate an integrated sol and energy storage system—c microgrid—incorporating second-life batteries originally used in Nissan electric vehicles (EV).

To validate the batteries' abilit to integrate solar PV and provide energy resilience to th food co-op.

RePurpose Energy will also conduct a series of laboratory-based cycling tests to identify the degradation rate and effective useful life of used EV battery cells.

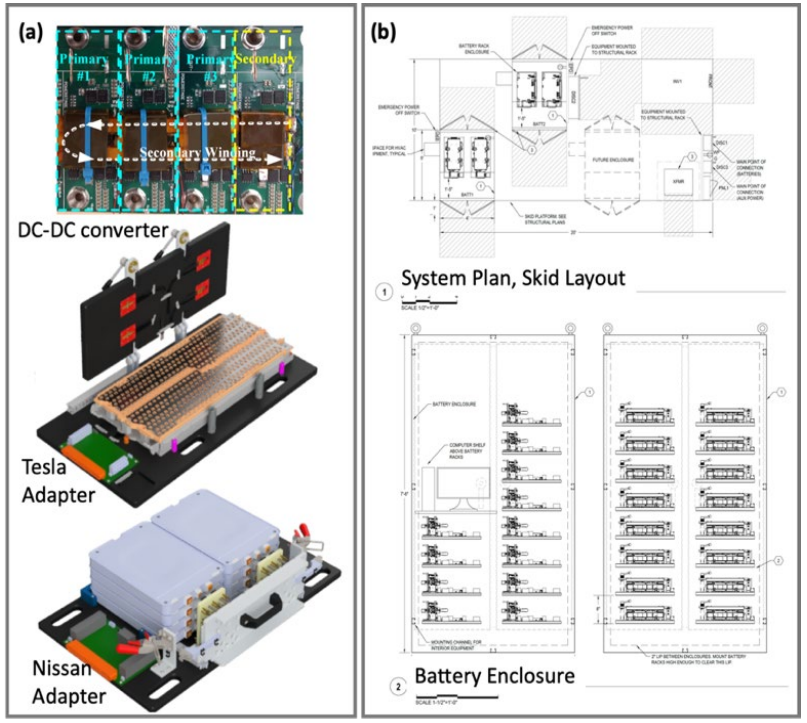


Rejoule Inc.—

The goal of this project is to validate the technical and economic feasibility of repurposing used electric vehicle (EV) batteries in a solar + storage application to provide resiliency benefits for commercial buildings.

Validating Capability of Second-Life Batteries to Cost-Effectively Integrate Solar Power for Small-Medium Commercial Building Applications

Smartville, Inc--
Characterize the degradation of repurposed electric vehicle battery modules and validate the ability of these resources to provide building resiliency and load shifting services. The goal is to allow multiple second-life battery form factors and module types, from multiple original equipment manufacturers, to be integrated and actively exchanged within a single system architecture.



San Diego State University Research Foundation—

Develop and integrate of cost-effective second-life EV batteries with a solar photovoltaic system.

The goal of this project is to ensure that second-life EV batteries will last for a minimum of 10 years as part of a grid storage application with a degradation rate of 3% or less annually.

The proposed algorithms (predictive thermal management, proactive maintenance, active balancing, and demand management) will greatly extend the durability of the second-life EV batteries in grid energy storage applications.

Assessing Long-duration Energy Storage Deployment Scenarios to Meet California's Energy Goals

($2.8M EPIC Funding, $821K Match Funding)

UNIVERSITY OF CALIFORNIA MERCED

- Will consider a variety of specific energy technologies in the categories of storage, generation, and grid structure
- Will utilize cost modeling to forecast the future costs of long duration energy storage

Energy+Environmental Economics

- Will develop a new modeling toolkit to assess the long duration energy storage needs of California.
- Will work with energy storage and microgrid experts from UCSD and long duration energy storage system developers from Form Energy

Developing Lessons Learned, Best Practices, Training Materials and Guidebook for Customer Side of the Meter Energy Storage

($1.0M EPIC Funding, $244K Match Funding)

Center for Sustainable Energy™

- Create an Electronic Energy Storage Guidebook (Guidebook) to help Authorities Having Jurisdiction (AHJs) fully understand and conduct a comprehensive permitting review, approval, and inspection process.
- Conduct interviews with AHJs and stakeholders to gather feedback on their lessons learned and best practices, which will form the framework for the Guidebook.
- After Guidebook completion, the team will develop training materials and work with leading AHJ and industry stakeholders to deliver comprehensive trainings throughout California.
- The Guidebook will interface with The Solar Foundation and NREL's SolarAPP, an instant online solar permitting tool for code compliant residential systems.
- Grant provides funding for 2 years of training and guidebook update/maintenance support.


epic
symposium
2021 EPIC Symposium
December 14-15, 2021 | Virtual Event
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ENERGY COMMISSION
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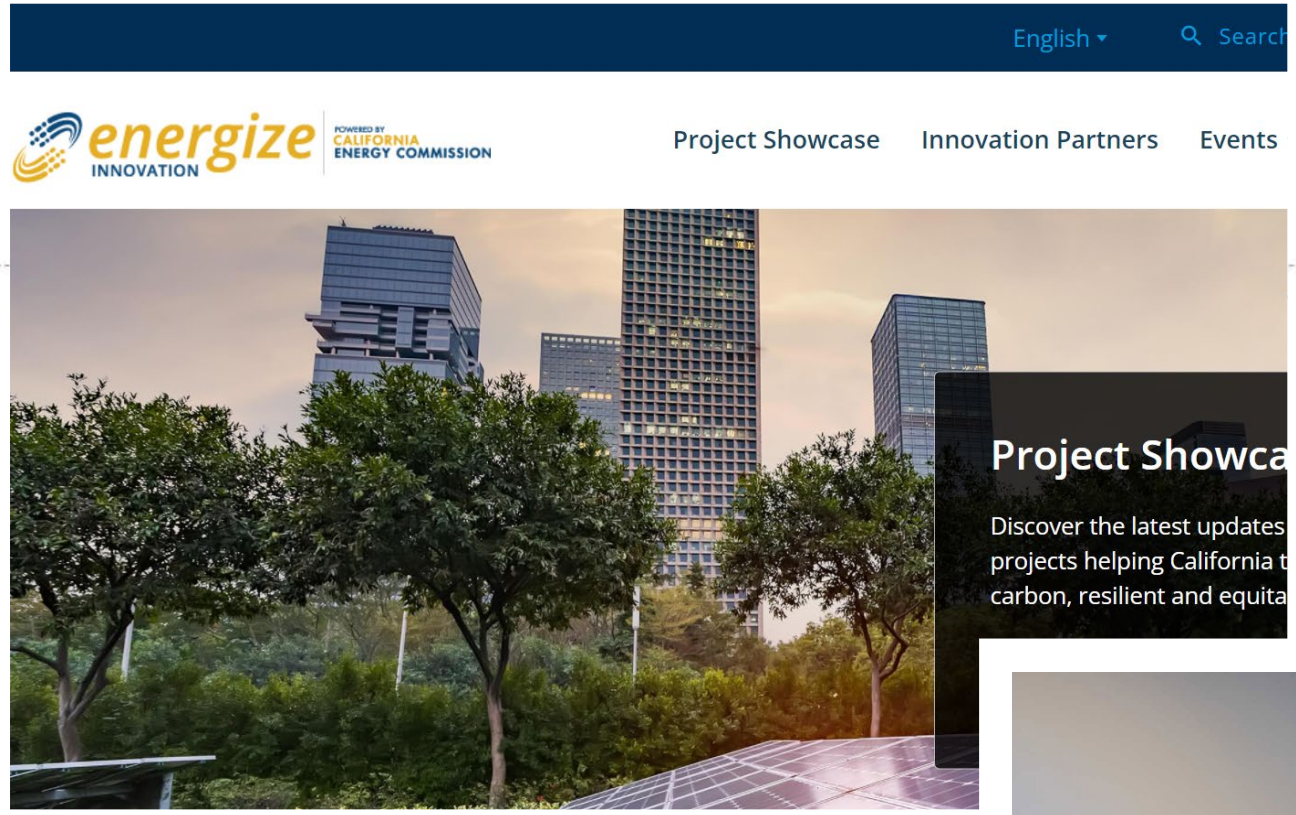
Registration is Open
For More Information and to Register:
https://www.energizeinnovation.fund/events/epic-symposium



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Open Discussion