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UCSD Research Concept Proposal Form

Additional submitted attachment is included below.

CALIFORNIA ENERGY COMMISSION

CALIFORNIA NATURAL RESOURCES AGENCY

Electric Program Investment Charge 2026–2030 (EPIC 5) Research Concept Proposal Form

The California Energy Commission (CEC) is currently soliciting research concept ideas and other input for the Electric Program Investment Charge 2026–2030 (EPIC 5) Investment Plan. For those who would like to submit an idea for consideration, please complete this form and submit it to the CEC by **August 8, 2025**. More information about EPIC 5 is available below.

To submit the form, please visit the e-commenting link: https://efiling.energy.ca.gov/EComment/ECommentSelectProceeding.aspx and select the Docket **25-EPIC-01**. Enter your contact information and then use the "choose file" button at the bottom of the page to upload and submit the completed form. Thank you in advance for your input.

1. Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

   Jan Kleissl, jkleissl@ucsd.edu, 619-376-3971

2. Please provide the name of the contact person's organization or affiliation:

   University of California, San Diego

3. Please provide a brief description of the proposed concept that you would like the CEC to consider as part of the EPIC 5 Investment Plan. What is the purpose of the concept, and what would it seek to do? Why are EPIC funds needed to support the concept?

The proposed concept is the development and demonstration of open-source software for interoperable commercial building energy management, leveraging the Brick Schema—a universal standard for modeling and connecting devices and subsystems within buildings.

Interoperability across commercial building systems is fundamental to unlocking advanced load management, optimizing energy usage, and enabling meaningful participation in grid services. Fragmentation and proprietary protocols continue to hinder seamless control and data exchange among HVAC, lighting, and plug

loads, creating persistent barriers to energy efficiency, demand flexibility, and integration with renewable resources.

This proposed energy management software will:

- Integrate and automate diverse building systems through standardized data modeling (Brick Schema).
- Enable dynamic demand management, load shifting, and peak shaving based on forecasted and real-time occupancy—directly supporting the grid's transition to renewable energy.
- Provide a vendor-neutral solution, unlocking innovation, accelerating adoption, and reducing deployment costs across California's commercial building sector.

To derisk deployment and accelerate acceptance, field validation in a leading testbed—such as UCSD's DERConnect, which operates a campus-wide Brick Server—should be conducted. This enables real-world testing across multiple buildings and scenarios, supporting both technology developers and end users with proven applications.

EPIC funds are essential for prototyping, demonstration, and scaling interoperable energy management solutions, building a bridge between laboratory innovation and widespread commercial deployment needed for California's evolving grid and climate goals.

4. In accordance with Senate Bill 96[1], please describe how the proposed concept will "lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals." For example, what technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technology or innovation? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, provide more information on what data and information gaps the proposed concept would help fill, and which specific parties or end users would benefit from the results, and for what purpose(s)?

This concept directly addresses technological and market barriers associated with interoperability, vendor lock-in, and fragmented building systems. Many

[1] See section (a) (1) of Public Resources Code 25711.5 at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PRC&sectionNum=25711.5.

commercial buildings in California use proprietary controls, preventing integration—this project concept leverages the Brick Schema to standardize system representation and interoperability, accelerating adoption of clean energy technologies.

Key barriers addressed:
- Fragmented data and proprietary protocols limiting automation
- High integration and upgrade costs due to lack of standards
- Limited ability to participate in demand response and grid services
- Absence of real-world, scalable testbeds validating efficacy

Cost & Performance Targets:
- Target a reduction in integration and control costs by at least 20%
- Demonstrate peak demand reduction and load shifting with occupancy-based control, aiming for 10–15% total building demand savings
- Validate fast (<5 minutes) automated response for grid events (demand response, VPP)

Data Gaps Filled:
- Demonstrate open, scalable interoperability using Brick Schema
- Empirical data on energy, occupancy, and demand response effectiveness across diverse, real buildings and simulated grid conditions

Beneficiaries:
- Facility managers, building owners, solution providers, and grid operators benefit from reduced integration burdens, increased performance, and expanded market for interoperable solutions

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology or ratepayer costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the innovation at scale? How will the innovation lead to ratepayer benefits in alignment with EPIC's guiding principles to

improve safety,[2] reliability,[3] affordability,[4] environmental sustainability,[5] and equity?[6]

If successful, this research will:

- Reduce costs for building integration and operation through open-source, standards-based controls
- Increase performance with real-time, occupancy-driven energy management for demand flexibility
- Enable scalable deployment across new and retrofit buildings, reducing technical risk and barriers

Ratepayer benefits:

- Improved safety: automated controls reduce manual error and enable fast grid/event response
- Enhanced reliability: building-grid integration prevents overloads and supports grid stability
- Greater affordability: lower integration costs and improved energy efficiency decrease bills
- Environmental sustainability: reduced consumption and peak loads lower emissions and support decarbonization
- Expanded equity: open-source, standards-based systems democratize access and lower barriers, especially for smaller buildings and operators

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[2] EPIC innovations should improve the safety of operation of California's electric system in the face of climate change, wildfire, and emerging challenges.

[3] EPIC innovations should increase the reliability of California's electric system while continuing to decarbonize California's electric power supply.

[4] EPIC innovations should fund electric sector technologies and approaches that lower California electric rates and ratepayer costs and help enable the equitable adoption of clean energy technologies.

[5] EPIC innovations should continue to reduce greenhouse house gas emissions, criteria pollutant emissions, and the overall environmental impacts of California's electric system, including land and water use.

[6] EPIC innovations should increasingly support, benefit, and engage disadvantaged vulnerable California communities (DVC). (D.20-08-046, Ordering Paragraph 1.) DVCs consist of communities in the 25 percent highest scoring census tracts according to the most recent version of the California Communities Environmental Health Screening Tool (CalEnviroScreen), as well as all California tribal lands, census tracts with median household incomes less than 60 percent of state median income, and census tracts that score in the highest 5 percent of Pollution Burden within CalEnviroScreen, but do not receive an overall CalEnviroScreen score due to unreliable public health and socioeconomic data.

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

Quantitative metrics:

- Reduction in peak demand and total energy consumption (kW/kWh)
- Number of buildings successfully integrated via Brick Schema
- Response speed: time to react to occupancy/event/grid signals
- Integration cost reduction ($/square foot or $/device)
- Demand response participation rates and event success rates

Qualitative metrics:

- Stakeholder satisfaction and operator feedback
- Replicability across different building types and vendors
- Policy/market traction for standards-based interoperability

7. Please provide references to any information provided in the form that supports the research concept's merits. This can include references to cost targets, technical potential, market barriers, equity benefits, etc.

- Brick Schema technical documentation ([brickschema.org])—proven interoperability approach

8. The EPIC 5 Investment Plan must support at least one of five Strategic Goals:[7]
    a. Transportation Electrification
    b. Distributed Energy Resource Integration
    c. Building Decarbonization
    d. Achieving 100 Percent Net-Zero Carbon Emissions and the Coordinated Role of Gas
    e. Climate Adaptation

This project most closely supports:

- Distributed Energy Resource Integration: Demonstrates scalable building-to-grid integration for demand response
- Building Decarbonization: Enables deeper energy savings and flexible load shifting for electrification and lower emissions

[7] In 2024 the CPUC adopted five Strategic Goals to guide development of the EPIC 5 Investment Plan. A description of the goals can be seen in Appendix A of CPUC Decision 24-03-007 available at: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M527/K228/527228647.PDF

- Achieving 100 Percent Net-Zero Carbon Emissions: Supports participation in demand response, VPPs, and maximizes clean energy impact via building-level controls

About EPIC

The CEC is one of four EPIC administrators, funding research, development, and demonstrations of clean energy technologies and approaches that will benefit electricity ratepayers of California's three largest investor-owned electric utilities.

EPIC is funded by California utility customers under the auspices of the California Public Utilities Commission.

To learn more about EPIC, visit:
https://www.energy.ca.gov/programs-and-topics/programs/electric-program-investment-charge-epic-program

EPIC 5 documents and event notices will be posted to:
https://www.energy.ca.gov/proceeding/electric-program-investment-charge-2026-2030-investment-plan-epic-5

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