DOCKETED	
Docket Number:	25-EPIC-01
Project Title:	Electric Program Investment Charge 2026–2030 Investment Plan (EPIC 5)
TN #:	265266
Document Title:	Electric Power Research Institute, Inc. (EPRI) Comments - Smart Panels
Description:	N/A
Filer:	System
Organization:	Electric Power Research Institute, Inc. (EPRI)
Submitter Role:	Public
Submission Date:	8/6/2025 2:27:35 PM
Docketed Date:	8/6/2025

Comment Received From: Electric Power Research Institute, Inc. (EPRI)
Submitted On: 8/6/2025
Docket Number: 25-EPIC-01

Smart Panels

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.

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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:

Doug Lindsey, dlindsey@epri.com, 865-314-1955

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

Electric Power Research Institute, Inc. (EPRI)

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?

EPRI estimates that California has between 40-45% of single-family homes with 100 A service size or less. With 7.6 million single family homes in CA and an average project cost of $4,000 to upgrade the service, this could amount to $14 billion in upgrade costs borne by the customer. Additionally, if utilities are subsequently required to upgrade distribution equipment such as transformers and poles, rates may have to increase to accommodate cost recovery of the new infrastructure. As electrification is being promoted throughout the state, smart panels that also enable load control or whole home demand limits should be explored as a measure that helps keep electric rates lower.

EPRI proposes the following research activities to explore the current functionalities of smart panels as well as accelerate the development of new smart panels to meet the needs of CA.

1. R&D to develop lower cost panels/solutions that can accelerate electrification adoption and minimize the cost to the customer. New smart panel offerings with modular form factors are needed to address multi-family and commercial infrastructure.

2. Lab testing and demonstrations exploring the readiness and scale of whole home flexibility through smart panels. Also explore the viability of coordination of multiple homes on the same transformer to prevent transformer failure.

3. Demonstrations of smart panel technology are needed to understand the full cost and time of implementing the various styles and form factors of smart panels. Every house presents unique electrification challenges. Demonstrations will identify edge cases where smart panels may not be feasible or where new solutions are needing to be developed.

4. Surveying of the electrical infrastructure of commercial buildings, specifically in the small business sector. Electrical infrastructure costs are much higher for commercial businesses, and there is currently little to no public data on panel capacity and electrical service utilization. This will be necessary data in order to develop technology to electrify these businesses.

4. In accordance with Senate Bill 96[i], 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)?

Smart panel research and development is in alignment with CEC goals to accelerate electrification, decarbonization, and load flexibility in the state. As homes are converted from natural gas to electricity, many homes are triggering panel upgrades in accordance with the National Electric Code. The NEC is a safety code first, and the load calculation methods are conservative. This means

that the customer that chooses to electrify their home likely has to undertake a large, lengthy permitting process involving the city and the utility, which historically can take several months, or in some cases years, to complete. This is an extra cost and burden to the customer, which can hinder or delay decarbonization projects.

Smart panels have been developed in recent years to mitigate the need to perform the electrical service upgrade process. In addition to service upgrade avoidance, smart panels are uniquely positioned to achieve firm residential load control for customer participation in utility demand response programs. There are unique control schemes being developed by smart panel manufacturers to guarantee load shed while maintaining customer choice and comfort. These features could unlock whole-home flexibility, which to date has been a challenge that the market has not been able to solve.

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,[ii] reliability,[iii] affordability,[iv] environmental sustainability,[v] and equity?[vi]

The successful development and implementation of smart panels to mitigate service upgrades and enabling residential load flexibility is anticipated to reduce ratepayer costs through prevention of unnecessary distribution equipment upgrades and improved reliability of the grid. Unlocking whole-home residential DR through panel-level control has the potential to meet the needs of the electric grid while also maintaining customer comfort and choice over what receives power in their home. Furthermore, the autonomous nature of several of the smart panel technologies enables easy DR program participation for customers that do not want to have to be an "energy manager" for their home.

Advancing equity and serving disadvantaged communities (DVCs)

As the state of California moves towards full decarbonization of the residential sector, many disadvantaged and vulnerable communities will face rising gas prices and will likely be among the last to electrify due to the high cost of new appliances. Furthermore, electrical work and service upgrade projects will pose additional time and financial barriers that many are unaware will be necessary. Smart panels may serve as a faster and more attainable way to provide the necessary electrical infrastructure to achieve decarbonization without requiring

utility involvement in a service size upgrade. Developing lower cost options that remove barriers for low-income households is of utmost importance in the energy transition.

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

Metrics to consider for smart panel development:

i. Smart panel first cost below $2,000

ii. Installation time under 8 hours

iii. Ability to load control all 240V circuits in the home

iv. 30% whole home load reduction throughout a 3-hour window

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.

To our knowledge, the only previous CEC solicitation pertaining to smart panels was GFO-23-303 – A Decision Tool to Electrify Homes with Limited Electrical Panel Capacity. While not specifically focused on smart panel R&D, the solicitation asked for the development of a customer decision tool to help the customer decide what actions to take to electrify their home, be it 120V appliances, circuit splitters, smart panels, or some other alternative. A funding opportunity focused on building out and proving the ability of smart panels to mitigate service upgrades and unlocking whole home flexibility would be worthwhile. Watt/amp dieting may be achievable for some, but many customers will likely not be satisfied with smaller or slower appliances than they were used to. Also, 120V appliances are not necessarily cheaper than 240V options. While smart panels are not inexpensive either, they can provide additional features that customers may find valuable, such as whole home energy management, ability to add more electric appliances, solar and storage optimization, load scheduling to align with TOU rates, and demand response program participation without compromising comfort. One vendor estimates that smart panels could achieve 2-10 times more load shed than the 0.6-1.2 kW per event1 than smart thermostat programs provide, depending on what loads are in the house and what time of day the load shed is needed.

8. The EPIC 5 Investment Plan must support at least one of five Strategic Goals:[vii]
    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

    Please describe in as much detail as possible how your proposed concept would support these goals.

Smart panels support a-c of the strategic goals.

- For transportation electrification, the smart panel enables at-home level II charging without a service upgrade and provides smart charging through flexible schedules and modular charging rates to stay within customer panel requirements.
- For DER integration, smart panels act as a protected loads panel without needing a separate panel. The user can classify which circuits are energized by the battery during a power outage and it is customizable during an outage, meaning that any circuit in the panel can be powered on if desired.
- For building decarbonization, the smart panel can enable full home electrification without a service upgrade, decreasing the time it takes to complete projects since no service upgrade is required.

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

Subscribe to the EPIC mailing list to stay informed about future opportunities to inform the development of EPIC 5: https://public.govdelivery.com/accounts/CNRA/signup/31897

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i 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.

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

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

iv 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.

v 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.

vi 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.

vii 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