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Deploying battery-buffered ultra-fast EV charging stations that use stationary energy storage to deliver high-power charging

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:

   Dr. Yongchun Tang, tang@peeri.org, 626-695-4539

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

   Power Environmental Energy Research Institute (PEERI)

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?

   This concept proposes deploying **battery-buffered ultra-fast EV charging stations** that use stationary energy storage to deliver high-power charging (150–350 kW) while drawing low-power input from constrained grid connections or renewables. This approach enables rapid EV charger deployment in areas where grid upgrades are costly or delayed, supporting transportation electrification across underserved communities. EPIC funding is needed to demonstrate technical and economic viability, reduce deployment risk, and ensure benefits to California ratepayers by improving grid flexibility, resilience, and access to clean mobility infrastructure.

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)?

   This concept addresses a major technical and market barrier to widespread EV adoption: the lack of high-power charging infrastructure in areas with limited grid capacity and long utility upgrade timelines. By integrating stationary battery energy storage with fast chargers, the system enables high-rate EV charging without requiring expensive, time-consuming distribution system upgrades. This breakthrough allows for rapid, flexible deployment of charging infrastructure, especially in rural, disadvantaged, and grid-constrained communities. Key performance targets include delivering ≥150 kW charging with ≤100 kW grid input, reducing installed cost by ≥30% compared to traditional grid-tied chargers, and achieving ≥90% round-trip efficiency. The project will also generate valuable data on energy usage, load management, and battery cycling to inform utility planning, rate design, and resilience strategies. Utilities, municipalities, EV infrastructure providers, and CEC policymakers will benefit from the results to support equitable, cost-effective transportation electrification aligned with California's statutory energy and climate goals.

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]

   If successful, this concept would demonstrate that battery-buffered ultra-fast EV charging can be deployed rapidly and cost-effectively without requiring major grid upgrades. This would reduce infrastructure and interconnection costs by 30–50%, lower utility upgrade delays, and improve charger availability in underserved and grid-constrained areas, accelerating

EV adoption. At scale, this approach could enable widespread, equitable access to fast charging, especially in rural or disadvantaged communities, supporting California's transportation electrification goals. The innovation improves grid reliability by smoothing peak loads, enhances environmental sustainability through renewable integration and load shifting, and promotes affordability by avoiding expensive upgrades that are ultimately paid for by ratepayers. It directly aligns with EPIC's principles by advancing clean mobility infrastructure that is safe, resilient, inclusive, and cost-effective.

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

Quantitative metrics:

- Round-trip efficiency (%), battery cycle life, specific energy (Wh/kg)
- Cost reduction ($/kWh, $/cycle)
- Emissions/waste reduction (GHG, solvent, water use)
- Technology scale-up rate (kg/day or m^2/day)
- Market adoption potential (% market share increase)

Qualitative indicators:

- Technology Readiness Level (TRL) advancement (e.g., from 3 to 6)
- Stakeholder feedback (industry, utilities)
- Alignment with California energy goals (SB 100, SB 96)
- Innovation recognition (IP, publications)
- Workforce training impact

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.

(1) **Cost target:** Lithium-ion Battery Energy Storage System (BESS) costs are projected to fall to $245–$326/kWh by 2030 (NREL, Cost Projections for Utility-Scale Battery Storage, 2023). Long-duration storage targets $0.05/kWh Levelized Cost of Storage (LCOS) by 2030 (DOE Long-Duration Storage Shot).
(2) **Technical potential:** Cost optimization models show significant cost savings with proper sizing and forecasting strategies in PV-BESS systems (~29% reduction) (Journal of Energy Storage, 2025).
(3) **Scalability:** U.S. BESS deployment surged from ~2 GW in 2020 to nearly 30 GW in 2025, showing rapid scalability potential (Reuters, 2025).
(4) **Market barriers:** Key barriers include high system costs, limited cycle life, long permitting timelines, grid interconnection delays, and insufficient infrastructure for widespread EV charging and long-duration storage (DOE, 2020).

(5) **Equity benefits:** Equity benefits include improved access to clean energy and EV charging in underserved communities, reduced energy burdens, and local job creation through targeted infrastructure investments (DOE Justice40 Initiative, CEC EPIC Program).

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.

    The proposed concept directly supports **transportation electrification** by enabling safer, lower-cost, and higher-performance BESS that are critical for both EVs and EV charging infrastructure. The innovation addresses key performance bottlenecks in current battery technologies by improving energy density, cycle life, thermal safety, and charging speed, while simultaneously reducing the cost per kWh and system-level degradation. These advances lower the total cost of ownership and enhance the reliability of EVs across passenger, commercial, and heavy-duty transit fleets, supporting broader market adoption.

    Furthermore, the concept strengthens the grid-EV interface by supporting bidirectional power flow, smart charging, and vehicle-to-grid (V2G) capabilities, which enable EVs to serve as distributed energy resources. This can reduce peak demand, enhance grid flexibility, and provide backup power in vulnerable communities. By supporting faster, safer, and more efficient EV charging, the technology enables high-throughput charging hubs in both urban and rural settings, directly supporting infrastructure expansion in disadvantaged and underserved communities.

    This work aligns with **EPIC 5 Strategic Goals** by:

- **Supporting widespread EV deployment** and charging access across income and geographic lines
- **Reducing transportation-related emissions** and improving air quality
- **Enhancing grid reliability and flexibility** through storage-enabled electrification

- **Stimulating local clean energy job creation** through domestic manufacturing and deployment

  Ultimately, the innovation contributes to building a resilient, equitable, and decarbonized transportation system in California, accelerating progress toward the state's zero-emission vehicle (ZEV) mandates and climate neutrality goals.

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

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