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Enhancing T&D grid resilience with 2-in-1 long-duration storage solutions

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:

   Name: Ben Kaun, Chief Commercial Officer
   Email: ben.kaun@inlyteenergy.com
   Phone: +1 (650) 272-8804

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

   Inlyte Energy ("Inlyte")
   Chief Commercial Officer

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 to demonstrate a novel "2-in-1" long-duration energy storage solution to enhance transmission and distribution (T&D) grid resilience. The purpose is to prove the viability of a new class of energy storage that can

provide both daily grid services, e.g., energy shifting and peak load management, *and* multi-day backup power during grid outages.

The core technology is Inlyte's inherently fire-safe, cost-effective iron-sodium battery energy storage system. While Inlyte has raised private capital and secured federal grants to support commercialization, EPIC funds are needed to de-risk this novel application of the iron-sodium chemistry at the utility-scale and accelerate commercial deployment. This project will generate publicly-accessible data on the performance, safety, and economic benefits of this technology in a real-world utility environment, paving the way for broader adoption to meet California's grid resilience and decarbonization 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 addresses several technological, market, and customer barriers preventing the achievement of California's energy goals.

   - Grid resilience in high wildfire-risk areas: California's IOUs face immense challenges from wildfire risk, leading to disruptive PSPS and EPSS events. While there are alternatives, they have their own shortcomings. Residential-scale batteries are difficult to scale equitably across communities, and existing energy storage options cannot serve both daily cycling and long-duration resilience. We believe solutions should be able to serve critical loads for at least 24 hours (without co-located solar) in a resilience event.

[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.

- Cost and performance of long-duration storage: The high cost and performance trade-offs of existing LDES options are significant barriers to their widespread adoption. Inlyte's iron-sodium battery combines high round-trip efficiency for daily use (85% at DC-scale) with the low-cost materials needed for long-duration (24+ hours) energy reserves. We believe LDES solutions at <$100/kWh with >80% RTE are crucial for commercial adoption.
- Safety of energy storage: Fire risk associated with the lithium-ion and similar chemistries is a major concern for utility deployments, especially in fire-prone regions. California residents are uniquely worried after the 2025 Moss Landing fire. Grid-scale solutions in fire-prone areas should be non-flammable, removing a critical barrier to siting and public acceptance.

A successful demonstration would provide critical data on the operational and economic viability of using a single asset for both daily value stacking (energy arbitrage, T&D deferral) and multi-day resilience. This would fill a crucial information gap for utilities, regulators, and planners. The primary end-users of this data would be California's IOUs, the CPUC, and CAISO, who could use the results to develop new procurement programs and operational models for scalable, cost-effective grid resilience.

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]

[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

A successful project would demonstrate a new model for grid infrastructure investment that will both reduce ratepayer costs & increase system performance. We estimate a single 1MW / 24MWh system can provide an estimated $1.8M annually across:

- $1.4M annually in outage hours saved (across 5 PSPS events) by VoLL (assumes $12/kWh VoLL and 24 hour long events)
    - Alternatively, we can use a benchmark of $100-200/kW-year for standby generation if that's available at the substation-level. Investing in new standby generation can exceed $1,000/kW over asset lifetime given market constraints for new generation and fuel cost volatility.
- $0.34M annually in energy arbitrage to lower electricity prices
- $0.07M annually in T&D infrastructure deferral value, limiting pass-through of IOU investment costs to ratepayers

This solution is innately more cost-effective and scalable than deploying individual behind-the-meter systems, which can exceed $400/kWh at the C&I-scale or $1,000/kWh at the residential-scale. A successful demonstration can create a replicable roadmap for deployments of the "2-in-1" solution at 100s of at-risk substations across the state, improving resilience to wildfires and other threats.

Further, the system is well-aligned with EPIC's guiding principles:

- **Safety:** Deploys an inherently non-flammable battery chemistry, reducing fire risk compared to alternatives.
- **Reliability:** Dramatically improves reliability for entire communities by providing backup power during planned and unplanned outages.
- **Affordability:** Lowers the overall cost of resilience through a scalable FTM model and value-stacking capabilities that generate revenue and defer costly T&D upgrades.
- **Environmental Sustainability:** Reduces the need for fossil-fueled backup generators, lowering local air pollution and GHG emissions.

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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.

- **Equity:** Provides resilience benefits to all customers connected to the substation, including low-income customers and those in Disadvantaged Communities (DACs) who are often most impacted by outages and least able to afford individual solutions.

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.
   Quantitative metrics to evaluate project success include:
   - System round-trip efficiency (%)
   - Delivered energy capacity (MWh) and duration (hours) during simulated or actual outages
   - Value of T&D upgrade deferral ($)
   - Revenue generated from energy arbitrage and ancillary services ($)
   - Value of Lost Load (VoLL) avoided during outages ($)
   - System uptime, cycle life, and degradation rate

   The following qualitative and/or indirectly quantifiable metrics can further support the project's value:
   - Improved customer satisfaction scores (via surveys)
   - Reduction in inbound call center volume during outages
   - Formal risk-assessment reports comparing the fire safety of the technology to alternatives
   - Analysis of outage hours avoided in DACs and for low-income populations
   - Avoided emergency support costs for vulnerable populations during outages

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.

   References to cost targets are based on the following sources:
   - Inlyte's system-level targets are based on internal technoeconomic modeling.
   - Comparison prices for lithium-ion can be found across multiple sources, including Anza Renewables' Storage Pricing Insights Report, Wood Mackenzie's Energy Storage Monitor, and Bloomberg NEF's battery storage cost reporting.

Technical potential for Inlyte's solution is supported by internal testing and the cell- and module-level, as reported in the following:

- Canary Media, reporting on Inlyte's utility-scale pilot with Southern Company
- The DOE's Office of Electricity, which selected Inlyte as a $4.1M grant recipient under the CIFeR program.

The wildfire risks in Northern California are well-reported, but in particular, the battery fire risks and desire for fire-resistant battery solutions is reported by pv magazine. Inlyte's inherent fire-resistant chemistry is intrinsic to the chemical reactions and has been tested internally at the cell-level. We are planning to conduct appropriate UL certifications in 2026. Further, PSPS event frequency is shared annually by CPUC here and the disproportionate impact of climate change on DACs has been studied by CARB here.

Finally, on the value side, the VoLL in California has been studied by Gorman and Callaway (2024). Estimates of energy prices (in $/MWh) are based on historical rates published by CAISO, and the cost of substation upgrades is based on publicly available benchmarks in the 1MW-range.

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

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

The proposed concept directly supports the three of the EPIC 5 Strategic Goals:

- **Distributed Energy Resource Integration:** The proposed battery system is a grid-scale DER that provides essential services for managing grid

[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

congestion, absorbing excess renewable generation, and providing capacity. This demonstration would provide a blueprint for how to integrate large-scale, long-duration storage to support a more distributed and resilient grid.

- **Achieving 100 Percent Net-Zero Carbon Emissions and the Coordinated Role of Gas:** Long-duration energy storage is a critical enabling technology for achieving 100% clean energy. By providing day(s) of power, this technology can help bridge long periods of low renewable generation (e.g., multiple cloudy days), reducing the need for fossil-fuel peaker plants and backup generators. This enhances grid reliability without compromising California's decarbonization commitments.
- **Climate Adaptation:** The primary driver for this concept is to build a grid that is more resilient to the impacts of climate change, particularly the increasing frequency and intensity of wildfires. By providing reliable backup power at the community level during PSPS events, this solution is a direct and highly effective climate adaptation strategy that protects communities and critical infrastructure from climate-driven threats.