DOCKETED	
Docket Number:	25-EPIC-01
Project Title:	Electric Program Investment Charge 2026–2030 Investment Plan (EPIC 5)
TN #:	265216
Document Title:	Stephen Harris Comments - OpenBESS Accessible Battery Energy Storage Optimization for California's Grid Modernization
Description:	N/A
Filer:	System
Organization:	Stephen Harris
Submitter Role:	Public
Submission Date:	8/2/2025 1:59:35 PM
Docketed Date:	8/4/2025

Comment Received From: Stephen Harris
Submitted On: 8/2/2025
Docket Number: 25-EPIC-01

OpenBESS Accessible Battery Energy Storage Optimization for California's Grid Modernization

This concept addresses a critical barrier to California's clean energy transition: over 80% of distributed battery energy storage systems (BESS) under 20MW operate with basic controls that ignore battery health economics, significantly underperforming their potential. Sophisticated optimization algorithms require six-figure annual budgets, creating an optimization divide limiting grid modernization.
OpenBESS proposes a low-cost, Prophet-based optimization framework for Lithium Iron Phosphate systems dominating utility-scale installations. The system provides degradation-aware optimization through transparent, auditable algorithms that resource-constrained operatorsâ€”municipal utilities, rural cooperatives, and mid-sized developersâ€”can afford using standard hardware.
EPIC funds are essential to develop this accessible commercial solution bridging expensive proprietary platforms and inadequate basic controls. Success would accelerate California's distributed storage deployment, maximize renewable integration efficiency, and ensure equitable access to advanced battery optimization across diverse operator scales.

Additional submitted attachment is included below.

EPIC 5 Application Responses

Question 1: Contact Information

Name: Stephen Harris
Email: sjharris@lbl.gov
Phone: 248.245.1830

Question 2: Organization/Affiliation

Organization: LBNL, ESDR

Question 3: Brief Description of Proposed Concept

What is the purpose of the concept, and what would it seek to do? Why are EPIC funds needed?

California's distributed battery storage sector faces a critical problem: over 80% of smaller installations operate with basic controls that ignore battery health, significantly underperforming their potential. Advanced optimization platforms cost over $100,000 annually, creating a barrier that prevents municipal utilities, rural cooperatives, and community-based operators from accessing better technology. This gap is particularly significant as the global BESS optimization software market grows from $25-32B in 2024-2025 to $114-172B by 2030-2032.

OpenBESS solves this through a low-cost optimization platform that uses machine learning to track battery health and maximize performance. The system focuses on Lithium Iron Phosphate (LFP) batteries, which capture 87% of market share, and runs on standard computers while providing transparent, auditable decision-making that meets regulatory requirements.

EPIC funds are essential to develop this accessible solution that bridges expensive commercial platforms and basic controls. This would accelerate California's battery storage deployment, improve renewable energy integration, and ensure all communities can access advanced optimization technology, directly supporting the state's clean energy goals while reducing costs for ratepayers.

Question 4: Technological Advancement and Barriers (SB 96 Alignment)

How will the concept lead to technological advancement and breakthroughs to overcome barriers preventing achievement of the state's statutory energy goals? What technical/market barriers would be addressed? What cost and performance targets need to be met? What data gaps would be filled and which parties would benefit?

OpenBESS addresses critical barriers preventing achievement of SB 96's 100% clean electricity goal by making sophisticated battery optimization affordable for all operators.

Market Breakthrough: Current optimization platforms costing $100,000+ annually create a two-tier market where most distributed storage systems operate poorly. OpenBESS bridges this gap through machine learning that automatically learns battery aging patterns from real operational data, solving the challenge of applying laboratory battery research to real-world systems with thousands of individual battery cells.

Performance Targets: The platform targets under $10,000 annual costs—a 90% reduction from current solutions—while delivering 15-25% revenue improvements and completing optimization calculations in under 10 seconds on standard computers. This makes advanced optimization accessible to municipal utilities, rural cooperatives, and mid-sized developers previously shut out of the market.

Data Gaps Addressed: OpenBESS tackles the critical shortage of real-world battery performance data through validated testing methods. Municipal utilities gain affordable optimization tools; rural cooperatives access battery health-aware operation; researchers obtain standardized datasets; regulators receive transparent frameworks for oversight.

This breakthrough enables California's energy goals by accelerating distributed storage deployment essential for renewable integration while ensuring fair access across all community types.

Question 5: Anticipated Outcomes and Ratepayer Benefits

What outcomes are anticipated if successful? How would the research reduce costs/increase performance? What is the potential at scale? How will innovation lead to ratepayer benefits aligned with EPIC's principles (safety, reliability, affordability, environmental sustainability, equity)?

Cost and Performance Improvements: Success would reduce optimization costs by 90% (from $100,000+ to under $10,000 annually) while delivering 15-25% revenue improvements through battery health-conscious operation. This transforms distributed storage economics, making previously unprofitable projects viable while extending battery equipment life.

Impact at Scale: OpenBESS would bring advanced optimization to California's smaller battery installations, targeting a $5-10B addressable market for accessible optimization platforms. Hundreds of distributed storage systems operating intelligently would create combined benefits through better renewable energy coordination and improved grid stability during peak demand. The platform also creates expansion opportunities to markets like ERCOT, which offers immediate potential with 7+ GW operational capacity.

EPIC Principle Benefits:

- **Affordability:** Lower optimization costs enable more storage deployment while reducing grid costs passed to ratepayers
- **Reliability:** Battery health-conscious operation extends battery equipment life and prevents unexpected failures, improving grid reliability during critical periods
- **Environmental Sustainability:** Better asset utilization accelerates renewable energy integration by optimizing storage throughout battery equipment lifecycles
- **Equity:** Affordable optimization ensures all communities benefit from grid improvements rather than bearing costs from poor operations
- **Safety:** Transparent, auditable algorithms ensure compliance with operational safety requirements

The platform creates smart foundations for California's distributed energy transition with comprehensive optimization accessible to all operator types.

Question 6: Evaluation Metrics

What quantitative or qualitative metrics would be used to evaluate the impacts of the proposed research concept?

Quantitative Performance Metrics:

- Revenue improvement: 15-25% increase over basic controls
- Cost reduction: 90% decrease in optimization expenses (target: <$10,000 annually)
- Battery life extension: cycles to 80% capacity remaining
- Time-series forecasting accuracy: prediction errors <5%
- System integration success rates with existing equipment
- Market adoption: 50% of smaller installations within 5 years

Qualitative Assessment Indicators:

- Regulatory approval rates for transparent frameworks
- Operator satisfaction with ease of use and integration
- Compliance success and regulatory acceptance
- Renewable energy integration improvements during peak periods
- Participation rates in disadvantaged communities
- Geographic spread ensuring fair access

Evaluation Methods: Metrics tracked through operator data, regulatory filings, operator surveys, and independent assessments to ensure comprehensive evaluation of technical performance, market

adoption, and community benefits aligned with EPIC principles.

Question 7: Supporting References

Provide references to information that supports the research concept's merits (cost targets, technical potential, market barriers, equity benefits, etc.)

The research addresses documented market barriers where commercial optimization platforms require six-figure annual budgets as primary deployment barriers, while the sub-20MW segment represents a significant underserved market with faster permitting and reduced regulatory requirements. Current platforms rely on simplified degradation models leading to significant prediction errors versus actual performance.[1]

Technical Potential: The project targets 10-15% reduction in Levelized Cost of Storage through battery health-aware optimization. California BESS market shows clear saturation indicators with revenue compression signaling a shift from basic arbitrage strategies to sophisticated optimization requirements. Current CAISO market data shows energy arbitrage constitutes approximately 90% of battery revenue, with average monthly revenues around $2.73/kW-month as of June 2025.[2]

Market Barriers: No existing platform adequately addresses modular battery replacement scenarios, where operators replace 10-20% of modules every 3-5 years. Regulators increasingly demand systematic tracing and validation of optimization decisions, while current black-box systems fail these transparency requirements.[3]

Equity Benefits: California's Self-Generation Incentive Program provides $150-300/kWh standard incentives and up to $1,000/kWh for equity resiliency projects, with the 2025 Residential Solar and Storage Equity program adding $280 million in funding.[4] Combined with the federal Investment Tax Credit's 30% base rate, these incentives can eliminate upfront hardware costs, making software optimization costs the dominant operational expense.[5]

Market Integration: The modular design enables integration with existing energy management systems while providing pathways for capability enhancement as operator resources and expertise grow.

References: [1] "Optimal Capacity and Cost Analysis of Battery Energy Storage System in Standalone Microgrid Considering Battery Lifetime," MDPI, https://www.mdpi.com/2313-0105/9/2/76 [2] ERCOT & CAISO BESS: The evolving revenue stack, June 2025, Modo Energy, https://modoenergy.com/research/ercot-caiso-june-2025-revenue-stack-batteries-bess-energy-arbitrage [3] "New battery storage on shaky ground in ancillary service markets," Utility Dive, https://www.utilitydive.com/news/new-battery-storage-on-shaky-ground-in-ancillary-service-markets/567303/ [4] Self-Generation Incentive Program Handbook, California Public Utilities Commission, 2025, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/self-

generation-incentive-program/2025-sgip-handbook-v1.pdf [5] "How the 2025 Battery Storage Tax Credit Boosts Residential and Commercial Adoption," Infolink Group, https://www.infolink-group.com/energy-article/how-the-2025-battery-storage-tax-credit-boosts-residential-and-commercial-adoption

Question 8: EPIC Strategic Goals Alignment

The EPIC 5 Investment Plan must support at least one of five Strategic Goals: (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. Describe how your proposed concept would support these goals.

Primary Goal: Distributed Energy Resource Integration

OpenBESS directly supports California's distributed energy resource integration through several mechanisms:

Enhanced Grid Integration: The platform optimizes distributed battery storage systems to better support renewable energy integration by providing battery health-conscious operation that maximizes asset use while preserving battery equipment life. This enables more effective load shifting and grid stabilization services from distributed storage. With solar+storage systems approaching 50% of deployments by 2030, integrated optimization becomes increasingly critical for grid modernization.

Improved Coordination: By making sophisticated optimization affordable across hundreds of distributed installations, OpenBESS enables coordinated participation in grid services. Municipal utilities, rural cooperatives, and community-based operators can effectively participate in demand response and grid stabilization programs previously accessible only to large-scale operators. The platform also supports Virtual Power Plant aggregation, a market growing from $5B to $16-24B by 2030.

Market Participation Enhancement: The platform's transparent, auditable algorithms meet California grid operator requirements while providing the economic intelligence needed for effective market participation. This increases distributed resource participation in wholesale markets, improving overall grid efficiency and renewable integration.

Supporting Goals:

Achieving 100% Net-Zero Carbon Emissions: Enhanced distributed storage optimization accelerates renewable energy integration by ensuring battery systems operate at peak efficiency throughout their lifecycles, maximizing the value of clean energy generation and storage.

Transportation Electrification: Optimized distributed storage provides the grid infrastructure needed to support widespread electric vehicle adoption, particularly in disadvantaged communities where state incentives make storage projects economically viable with proper optimization. The coordinated

optimization of distributed storage resources creates the flexible grid capacity essential for EV charging infrastructure deployment.

The research directly enables California's clean energy transition by ensuring distributed storage resources—critical for grid modernization—operate optimally across all community scales and geographic regions.