

Enhancing Clean Energy Technology Safety, Supply Chains, and Life-Cycle Benefits

LEVERAGING DISTRIBUTED ENERGY RESOURCES FOR GRID AND COMMUNITY RESILIENCY

INITIATIVE DESCRIPTION	Pages 130-132
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- Address fire safety, environmental risk, and health impact concerns for batteries and other clean energy technologies.
- Accelerate the deployment of safer, more reliable next-generation storage and generation technologies through strategies such as improving monitoring, enhancing diagnostics, reducing and preventing failures, and developing and expanding circular-economy pathways for critical materials.
- Advance critical materials recovery and reuse to make distributed energy systems more affordable, reliable, safe, equitable, and rapidly deployable to support resiliency and provide additional ratepayer benefits.

PROPOSED INITIATIVE BUDGET	\$62M
% OF TOTAL BUDGET (excl. admin & overhead)	8%
# OF RESEARCH TOPIC AREAS	3

ALIGNMENT SUMMARY

STRATEGIC OBJECTIVE ALIGNMENT	Page 131
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“Support technology development, innovative deployment models, and real-world testing and evaluation for the demonstration of the use of clean distributed energy resources to reduce the impact of outage events, through strategies that allow critical and/or essential loads and services to remain powered through such events and that reduce power restoration time for vulnerable populations, with a specific focus on solving challenges related to critical loads and services identified by Disadvantaged and Vulnerable Communities as critical community resilience needs.”

This initiative strengthens and expands the ability of clean DERs to provide essential services and serve critical loads by addressing safety, performance, materials, and supply chain challenges that currently delay clean energy deployment, particularly to Disadvantaged and Vulnerable Communities.

CPUC ALIGNMENT	Pages 131-132
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- CPUC proceedings on Integrated Resource Planning and Resource Adequacy programs support acquisition of safe, reliable, cost-effective, and environmentally responsible energy resources.
- Research outputs can inform policy and planning by providing validated safety and performance data for new and existing grid resources, in addition to permitting frameworks and standards guidance for Authorities Having Jurisdiction (AHJs), as well as supply chain insights that shape long-term resource planning.
- Benefits of safer deployments, avoided grid upgrade costs, reduced outages, and improved material security reduce systemwide costs and improve grid reliability for all customers.

Advancing the Safety of Next-Generation Storage Solutions

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ENHANCING CLEAN ENERGY
TECHNOLOGY SAFETY, SUPPLY
CHAINS, AND LIFE-CYCLE
BENEFITS

WHAT PROBLEM ARE WE SOLVING? Pages 134-139

Access to the resilience, affordability, and other benefits of clean distributed energy resources (DERs) can only be realized if communities can accept — and local AHJs can permit — DERs. Emerging non-lithium storage currently lacks consistent safety standards, test methods, and installation codes to evaluate the unique hazards of non-lithium batteries. Moreover, representative data on battery fire emissions is lacking. As a result, custom AHJ review and multiyear permitting can delay storage and endanger critical loads.

START	2027
OUTPUTS	2029
MARKET READY	2030 - 2032

ALIGNMENT SUMMARY

WHAT IS THE DISTINCT RESEARCH APPROACH?	HOW WILL YOU KNOW YOU ARE SUCCESSFUL?	HOW WILL YOU COORDINATE?
- Develop chemistry-specific hazard analyses and safety testing, addressing gaps in existing standards and protocols. (p. 136) - Validate storage safety under deployment-relevant conditions to inform practical safety and permitting guidance for AHJs and other decision makers. (p. 138) - Characterize fire and off-gas emissions from li-ion and emerging chemistries and innovations to address siting and community safety concerns. (p. 135) - Explore approaches to streamline testing and certification, reducing cost and time barriers for emerging storage technologies and deployment. (p. 136)	- Improved understanding of the hazards, failure modes, and effective mitigation strategies for various energy storage technologies, reducing key uncertainties that can impede deployments. (p. 138) - Actionable safety information, tools, and research findings inform policies such as codes and standards, permitting and siting, emergency response guidance, and industry safety practices. (p. 138) - Reductions in testing, certification, siting, and permitting timelines and costs. (p. 137-138)	- Build on EPIC certification lessons from Eos, ReJoule, and Sepion (EPC-18-023, EPC-19-055, EPC-20-015) and on safety data from Form Energy and Salient Energy (EPC-19-041, EPC-19-040). (p. 136 – 137) - Coordinate with IOU administrators to integrate operational data, failure mode insight, and permitting experiences when available (p. 137). - Engage through the State Battery Storage Collaborative with CPUC, CAL FIRE, GO-Biz, and others (p. 137). - Leverage complementary LDES Program efforts: Collaboration with Sandia on energy storage safety research and Indian Energy's first-responder safety planning (LDS-22-001, LDS-23-002) (p. 137).

Enhancing Energy Storage Performance and Longevity through Advanced Battery Analytics

WHAT PROBLEM ARE WE SOLVING?

Pages 139-142

Current battery systems lack predictive analytics to model degradation across diverse, next-generation mobility and storage chemistries during dynamic grid cycling. This prevents manufacturers from unlocking these assets for load-shifting. Resolving this transforms advanced batteries into resilient grid resources, saving ratepayers up to \$18 billion in distribution upgrades.

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ENHANCING CLEAN ENERGY TECHNOLOGY SAFETY, SUPPLY CHAINS, AND LIFE-CYCLE BENEFITS

START	2027
OUTPUTS	2029
MARKET READY	2030 -- 2032

ALIGNMENT SUMMARY

WHAT IS THE DISTINCT RESEARCH APPROACH?

- Focus upstream on core battery management system intelligence (p. 140).
- Develop hardware-agnostic, open data protocols that interface with proprietary automotive telemetry (p. 142).
- Develop and implement predictive algorithms that detect electrochemical microfaults to optimize performance, extend battery life, reduce costs, and prevent thermal runaway failures (p. 141).

HOW WILL YOU KNOW YOU ARE SUCCESSFUL?

- Deliver field-tested, intelligent charging that extends battery life and reduces charging times (pp. 141 – 142).
- Improve cost-effective load management and grid reliability (p. 141).
- Establish hardware-agnostic open protocols that improve safety, reduce warranty claims, and incentivize adoption (p. 142).
- Improve the value proposition, accelerate DER uptake, and balance out load on the grid (p. 142).

HOW WILL YOU COORDINATE?

- Build on bidirectional degradation control strategies from heavy-duty vehicle electrification (EPC-22-002) and V2X cost reductions (EPC-25-021) (pp. 140 – 141).
- Complement next-generation storage safety, diagnostics, and fire impact mitigation research (EPC-20-016) (p. 141).
- Partner with EPIC Administrators, industry collaboratives, like Charging Interface Initiative and Vehicle-Grid Integration Council, via working groups to validate algorithms using utility storage datasets and public charging fleets (p. 141).

Strengthening Critical Materials Supply Chains for Clean Energy Technologies

WHAT PROBLEM ARE WE SOLVING?

Pages 142-147

Material bottlenecks slow or limit deployment of distributed energy systems needed to support critical loads. To address this research and market gap, development of California-specific sourcing, recycling, and substitute materials pathways are needed. These pathways must lower costs, build local quality control and workforce expertise, and ensure availability of critical materials needed for DER deployment. Strengthening supply chains enables DERs to be deployed rapidly and reliably, particularly in vulnerable and remote communities.

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START Q2, 2028

OUTPUTS Q4, 2030

MARKET READY 2031 – 2033

ALIGNMENT SUMMARY

WHAT IS THE DISTINCT RESEARCH APPROACH?

- Advance domestic sourcing and processing technologies to reduce reliance on concentrated and geopolitically vulnerable materials and improve local availability, quality, and pricing. (pp. 142 – 143)
- Scale circular economy solutions to recover key materials, such as lithium, cobalt, rare earth elements, and platinum group metals from domestic waste streams for sustainable reuse. (pp. 142 – 143)
- Develop novel or substitute materials that can alleviate or minimize supply chain risks. (pp. 142 – 143)

HOW WILL YOU KNOW YOU ARE SUCCESSFUL?

- Validate California-based sourcing, processing, and recycling pathways that reduce DER deployment delays and costs. (p. 145)
- Generate performance and cost data that helps to derisk capital-intensive manufacturing and recycling processes at pilot scale and inform utility planning and procurement. (p. 145)
- Reduce the levelized cost of clean energy manufacturing. (p. 145)
- Reduce sourcing lead times and improve availability and costs of key materials. (p. 145)

HOW WILL YOU COORDINATE?

- Coordinate with public agencies, like the DOE and ARPA-E, including through working groups and advisory committees, to exchange project learnings and reduce supply chain bottlenecks that hinder utility resource procurement. (pp. 144 – 145)
- Build on prior EPIC efforts in battery recycling (GFO-21-901), advanced Li-ion materials (EPC-24-003, EPC-24-004), upstream manufacturing (EPC-24-007, EPC-25-011), and lithium recovery at the Salton Sea (GFO-23-304). (pp. 144 – 145)