

Building community resilience from prevention through recovery

INITIATIVE DESCRIPTION

Page(s) 46

- Advances a prevention-to-recovery strategy that develops the technologies, operational capabilities, and decision frameworks needed to reduce climate-driven risk and harden the grid more cost-effectively.
- Combines innovations in risk prevention, outage mitigation, and post-event recovery to improve reliability and resilience while lowering the long-term cost of managing climate impacts.
- Improves grid-hardening investment decisions through lower-cost mitigation approaches, enhanced operational practices, and recovery strategies that reduce future system vulnerability.
- Together, the RTAs develop the tools, technologies, and frameworks needed to reduce outage risk, strengthen community resilience, and lower the social and economic burdens of climate-driven disruptions.

PROPOSED INITIATIVE BUDGET	\$22,830,000
% OF TOTAL BUDGET (excl. admin & overhead)	25.25%
# OF RESEARCH TOPIC AREAS	3

ALIGNMENT SUMMARY

STRATEGIC OBJECTIVE ALIGNMENT

Page(s) 46

“By 2033, the EPIC program will develop and demonstrate data, tools, technologies, and frameworks that improve long-term planning and achieve more cost-effective operational practices and capital investments for grid hardening to maintain grid resilience and reliability to long-term climate impacts, with a focus on increasing affordability, reducing outage risk, and reducing social burdens of outages.”

Develops and demonstrates cost-effective grid-hardening technologies, operational practices, and recovery frameworks that maintain grid resilience and reliability under long-term climate impacts. Through a coordinated prevention, withstand, and recovery approach, it reduces outage risk, lowers hardening costs, and lessens the social burdens of outages on customers and communities.

CPUC ALIGNMENT

Page(s) 47

- CPUC wildfire mitigation, climate adaptation, and risk-assessment processes require demonstrated solutions that can reduce the cost of grid hardening while maintaining reliability and resilience under worsening climate conditions.
- Develops technologies and operational approaches that can inform future decisions regarding undergrounding, vegetation management, resilience investments, outage mitigation, and climate adaptation planning.
- The initiative produces evidence on how prevention, restoration, microgrids, batteries, and post-event recovery strategies can reduce outage impacts and improve the cost-effectiveness of resilience investments.
- Ratepayer-funded RD&D is appropriate because these capabilities require demonstration within utility operating environments, using utility assets, risk models, and operational processes before broader deployment.

5.1 Prevent: Understanding & mitigating risk to communities & customers

SO 13: Cost-Effective Grid Hardening for Long-Term Climate Impacts

WHAT PROBLEM ARE WE SOLVING? Page(s) #67-69

Building community resilience from prevention through recovery

Climate-driven hazards are increasing faster than current grid-hardening practices can adapt, while the cost of undergrounding, vegetation management, and asset maintenance limits scale. This Topic addresses the need for lower-cost prevention technologies, improved asset diagnostics, and more effective risk-reduction strategies that support cost-effective climate resilience and reduce outage and ignition risk.

START	2027
OUTPUTS	2029-2032
MARKET READY	2030-2035

ALIGNMENT SUMMARY

WHAT IS THE DISTINCT RESEARCH APPROACH?	HOW WILL YOU KNOW YOU ARE SUCCESSFUL?	HOW WILL YOU COORDINATE?
• Novel and lower-cost undergrounding technologies and construction methods. • Developing and testing AI/ML-enabled asset diagnostics, condition monitoring, and remaining-life estimation tools and using available AMI, SCADA, waveform, and monitoring data to proactively identify fault and ignition risks. • Developing forest treatment optimization and valuation methods that prioritize wildfire risk reduction and ecosystem resilience. • Integrating climate-adjusted asset health monitoring, adaptive protection, and wildfire risk reduction into a unified prevention strategy that can help to reduce cost and improve prioritization of major resilience investments. • Gaps addressed, 67.	• Key Outputs: Validated undergrounding technologies and construction approaches that lower deployment costs. • Advanced asset health and failure prediction models and demonstrated adaptive protection and monitoring solutions for wildfire and climate resilience. • Deployment-ready tools, methodologies, and performance data that can inform future Wildfire Mitigation Plans, climate adaptation investments, and grid hardening programs. • Primary outcome: Lower-cost and more effective climate resilience and wildfire prevention strategies. Metrics: Reduction in undergrounding, monitoring, and vegetation management costs, Reduction in climate-driven fault, outage, and ignition events, Increase in HFRA circuit-miles equipped with continuous monitoring or advanced protection. (Metrics, p. 68-69)	• Administrator coordination in project ideation stage will identify potential joint or complementary projects on grid hardening technologies, analytical tools, and climate-driven event mitigation. (Coordination, p.69) • CEC’s EPIC work produces statewide research approaches and data that PG&E can leverage in climate-adjusted asset health monitoring. (See other examples in Coordination, p. 69) • Builds on EPIC 2.34 predictive risk identification, EPIC 3.20 predictive maintenance, EPIC 4.13 fluid-free boring, and EPIC 4.20 secondary fault analysis. (Leveraging Past RD&D, p. 68)

5.2 Withstand: Minimize community & customer impacts

SO 13: Cost-Effective Grid Hardening for Long-Term Climate Impacts

(Secondary) SO 9: Leveraging DERs for Grid and Community Resiliency

WHAT PROBLEM ARE WE SOLVING?

Page(s) 70

Climate-driven events are increasing the frequency and consequences of outages, while existing restoration, resilience, and backup-power solutions are difficult to deploy at scale and often fail to protect the communities most exposed to repeat outages. This Topic addresses the need for more cost-effective outage mitigation, power restoration, and community resilience solutions leveraging DERs (SO9) that reduce outage impacts, directly supports grid hardening and improved reliability (SO13), and lessen the social burdens of climate-driven disruptions.

Building community resilience from prevention through recovery	
START	2027-2028
OUTPUTS	2029-2032
MARKET READY	2030-2035

ALIGNMENT SUMMARY

WHAT IS THE DISTINCT RESEARCH APPROACH?

- Demonstrates automated restoration workflows, temporary infrastructure solutions, and grid-operational capabilities that reduce outage duration following climate-driven events.
- Develops next-generation microgrids, utility-orchestrated batteries, and community resilience solutions that maintain critical load and provide grid value during disruptions.
- Advances real-time ignition detection, notification, suppression, and response technologies that reduce the consequences of climate-driven events and improve restoration outcomes.
- Gaps Addressed p. 70

HOW WILL YOU KNOW YOU ARE SUCCESSFUL?

- **Key outputs:** Demonstrated restoration, resiliency, and outage-response capabilities that reduce outage duration and improve community resilience during climate-driven events.
- Validated next-generation microgrid and battery architectures that maintain critical load and support community resilience at scale.
- **Primary outcome:** Reduced customer and community impacts from climate-driven outages through faster restoration and expanded resilience solutions. **Metrics:** Reduced outage frequency and duration, and increase in critical load maintained during outage events.
- Metrics and Impact Assessment p. 71

HOW WILL YOU COORDINATE?

- Administrators will review projects for overlap, design parallel projects that treat different use-cases or technology, and share implementation learnings to strengthen complementary resilience initiatives. (Coordination p. 72)
- PG&E may incorporate transferrable learnings from CEC’s research on community-informed planning tools in PG&E’s TD&D for grid hardening, outage response, restoration improvement, and solutions for community resilience (Coordination p. 72).
- Builds on EPIC 1.14 SmartMeter functionalities, EPIC 3.11 Redwood Coast Airport Microgrid, EPIC 3.41 drone operations, EPIC 3.45 wildfire camera detection, and EPIC 4.16 automated drone deployment. (Leveraging Past RD&D p. 70)

5.3 Recover: Rebound from catastrophic events

WHAT PROBLEM ARE WE SOLVING? Page(s) #73

Building community resilience from prevention through recovery

START	2028
OUTPUTS	2029-2033
MARKET READY	2030-2035

Current recovery approaches focus on restoring service but do not consistently optimize vegetation management, landscape rehabilitation, and resilience investments to reduce future climate risk. This Topic addresses the need for cost-effective recovery tools and decision frameworks that improve long-term resilience, reduce outage exposure, and lower future recovery and maintenance costs. This adaptive approach to post-event recovery directly advances SO 13: Cost-Effective Grid Hardening for Long-Term Climate Impacts and would connect with PG&E’s EPIC 5 work under SO 8: Increase Predictability of Weather Impact on, Intermittent Resources, Climate Risks, and Load.

ALIGNMENT SUMMARY

WHAT IS THE DISTINCT RESEARCH APPROACH?	HOW WILL YOU KNOW YOU ARE SUCCESSFUL?	HOW WILL YOU COORDINATE?
- Develops post-event recovery frameworks that evaluate rehabilitation strategies based on long-term resilience, wildfire risk reduction, ecosystem impacts, and customer outcomes. - Develops research-based methods for assessing fire-damaged trees and improving post-event vegetation management decisions. - Demonstrates scalable woody biomass collection, densification, and conversion pathways that reduce recovery costs while supporting broader decarbonization goals. - Gaps Addressed, p. 73	- Validated post-event recovery frameworks that improve rehabilitation, vegetation management, and resilience planning decisions. - Demonstrated biomass management approaches that reduce recovery costs and improve utilization of post-event woody material. Primary outcome: More resilient, cost-effective post-event recovery strategies that reduce repeat outage exposure and future climate risk. Metrics: Change in recovery and vegetation-management O&M costs, and changes in outage frequency and duration. - Metrics and Impact Assessment, p. 74	- EPIC administrators will continue coordination on climate adaptation and landscape rehabilitation work through working groups and ongoing meetings. (Coordination p. 75) - CEC may fund statewide evaluation of various climate risk mitigation strategies that could inform or complement PG&E-funded demonstrations of emerging strategies. (Coordination p. 75) - PG&E’s proposed TD&D in efficient biomass collection and conversion would complement and not duplicate efforts under the Gas RD&D program in RNG and biochar pathway and quality evaluation (Coordination p. 75) - This RTA builds on PG&E’s EPIC 3.47 onsite biomass processing and EPIC 4.19 woody supply chain research. (Leveraging Past RD&D p. 74)