

# Leading Innovation in Electricity Sector Resilience and Adaptation

COST-EFFECTIVE GRID  
HARDENING FOR LONG-TERM  
CLIMATE IMPACTS

INITIATIVE DESCRIPTION

Pages 177-180

- Provides climate-informed research, tools, and innovations that strengthen long-term electricity system resilience by reducing outage impacts, mitigating wildfire risks, and improving the cost-effectiveness of grid-hardening under evolving climate conditions.
- Directly addresses SO 13’s call for “data, tools, technologies, and frameworks” supporting long-term planning, grid hardening, and operational improvements through gap-filling advances in climate analytics, wildfire risk mitigation, and community-scale resilience.
- Provides complementary approaches through climate impacts modeling and tools (9.1), wildfire risk assessment and mitigation (9.2), and community-scale resilience solutions (9.3), addressing both system-level risks and the impacts of outages on communities.

|                                            |         |
|--------------------------------------------|---------|
| PROPOSED INITIATIVE BUDGET                 | \$46.4M |
| % OF TOTAL BUDGET (excl. admin & overhead) | 6.2%    |
| # OF RESEARCH TOPIC AREAS                  | 3       |

ALIGNMENT SUMMARY

STRATEGIC OBJECTIVE ALIGNMENT

Pages 178-179

**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.**

The initiative addresses this objective by advancing climate-informed planning, risk assessment, mitigation, and integrated resilience approaches that would improve the operational effectiveness and cost-effectiveness of grid investments and reduce the frequency, duration, and impacts of outages under long-term climate conditions.

*[Also addresses SO 8, SO 9]*

CPUC ALIGNMENT

Page 179

- As CPUC refines adaptation requirements and evaluates resilience and grid-hardening investments (via e.g., Climate Adaptation Vulnerability Assessments, GRC), it needs improved climate risk data, methods, and tools to assess vulnerabilities, alternatives, costs, and potential impacts.
- Research would produce climate risk data, analytics, and demonstrated resilience and wildfire mitigation approaches to inform CPUC adaptation guidance, GRCs, and decisions on cost-effective measures.
- Climate adaptation is a complex research problem involving interacting systems, long time horizons, climate science, societal change, and high uncertainty.
- Research spans utility boundaries, technologies, communities, and resources, integrating emerging analytical approaches to support more cost-effective decisions than would be possible without EPIC.

# Advancing Energy System Resilience Under Climate Change and Extreme Weather

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WHAT PROBLEM ARE WE SOLVING?

Page 182

Leading Innovation in Electricity  
Sector Resilience and Adaptation

Without sufficient data, tools, technology, and frameworks for addressing the risks of long-term climate impacts, utilities and communities are left more vulnerable to grid disruptions and escalating costs. This RTA addresses the underlying data and analytical gaps by developing California-specific climate risk data, models, and decision-support tools that connect climate hazards and system vulnerabilities to energy system planning, adaptation, and investment decisions. This enables more informed evaluation and prioritization of cost-effective and resilient grid investments.

|                 |             |
|-----------------|-------------|
| START           | 2028        |
| OUTPUTS         | 2029 - 2032 |
| MARKET<br>READY | 2030 - 2034 |

ALIGNMENT SUMMARY

WHAT IS THE DISTINCT RESEARCH APPROACH?

- Develop empirically grounded data, modeling, and analytics linking projected climate to grid impacts and energy system planning and adaptation needs. (p. 188)
- Modeling to understand impact of grid stressors alongside compounding climate risks. (p.188)
- Decision-support tools and technical capacity to embed climate adaptation into regulatory processes and utility investment. (p. 188)
- Open, transparent, California-specific innovation to ensure resilience and adaptation investments are cost-effective, equitable, and aligned with statewide goals. (p. 189)

HOW WILL YOU KNOW YOU ARE SUCCESSFUL?

- Improvements to planning, regulatory frameworks, and utility filings via integration of advanced data, projections, and analytical insights. (p.184)
- Investments aligned with emerging climate risks and opportunities for improved coordination. (p. 184)
- More cost-effective adaptation investments, reduced exposure to climate impacts, and improved affordability. (p. 184)
- Metrics: change in costs from baseline for adaptation-related investments, improved resilience outcomes, reduced outage risk, use of research in key processes. (p. 184)

HOW WILL YOU COORDINATE?

- Working group meetings with EPIC administrators on complementary research and with IOU SMEs on use of research outputs. (p. 184)
- Research proposed by IOUs would leverage the CEC-funded data and research to generate insights and robust decisions specific to their infrastructure, systems, and customers. (p. 184)
- Builds directly on successes and gaps identified in earlier EPIC- and Gas-funded research, e.g., development of historical and projected climate datasets (PIR-19-006, EPC-20-006), the Cal-Adapt Analytics Engine (EPC-23-024), and climate-informed energy modeling studies (EPC-21-037, EPC-21-041). (p. 183)

# Supporting Wildfire Mitigation that Manages Risk and Advances Affordability

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WHAT PROBLEM ARE WE SOLVING? Page 186

SO 13 identifies the need for improved approaches to managing the cost and outage risks associated with long-term climate impacts. Wildfire is an increasingly significant climate-driven risk to California’s electricity system, and mitigation and liability costs are major contributors to electricity rate increases. This RTA addresses gaps in wildfire risk data, modeling, evaluation of mitigation tradeoffs, and development of novel technology, approaches, and partnerships to support cost-effective risk mitigation while maintaining safety and reliability.

Leading Innovation in Electricity  
Sector Resilience and Adaptation

|                 |             |
|-----------------|-------------|
| START           | 2028        |
| OUTPUTS         | 2029 - 2032 |
| MARKET<br>READY | 2030 - 2034 |

ALIGNMENT SUMMARY

| WHAT IS THE DISTINCT RESEARCH APPROACH?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | HOW WILL YOU KNOW YOU ARE SUCCESSFUL?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | HOW WILL YOU COORDINATE?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <ul style="list-style-type: none"><li>• Novel modeling and analysis of wildfire behavior and risk and integration with utility planning. (p. 186)</li><li>• Evaluation of risk mitigation strategies for their cost, effectiveness, and additional impacts to ratepayers, leveraging advances in landscape and community resilience. (p. 186)</li><li>• Development of new technology, tools, and operational approaches for ignition prevention, detection, and reduction in the impacts of utility-caused wildfire. (p. 186)</li><li>• Centering of ratepayer affordability and use for both planning and regulatory oversight. (p. 187)</li></ul> | <ul style="list-style-type: none"><li>• Provision of evidence and tools on wildfire mitigation to strengthen planning and oversight. (p. 188)</li><li>• Improved transparency and rigor in evaluation of risk, understanding of mitigation tradeoffs, and regulatory review. (p. 188)</li><li>• Coordinated, comprehensive risk reduction achieved through partnerships (e.g., with CalFire, tribes, and local communities). (p. 188)</li><li>• Metrics: reduction in wildfire mitigation costs or rate impacts from baseline, reduced utility wildfire ignitions and damage from baseline, reduced reliance on strategies that impact reliability. (p. 188)</li></ul> | <ul style="list-style-type: none"><li>• Ensure complementary perspective to that of EPIC administrators with established working group meetings to confirm projects are non-duplicative. (p. 188)</li><li>• Scope projects to provide data and modeling needs for ongoing IOU wildfire mitigation efforts, OEIS and CPUC review, and Wildfire Resilience Partnerships. (p. 189)</li><li>• Build on prior CEC EPIC investments in modeling fire behavior, near- and long-term climate-driven fire hazard (e.g., EPC-18-026, EPC-25-024, EPC-25-025, EPC-25-032) and early stage technology development in CalSEED and CalTestBed programs. (p. 187)</li></ul> |

# Building Community Energy Resilience and Reliability

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CLIMATE IMPACTS

WHAT PROBLEM ARE WE SOLVING? Pages 189-192

LEADING INNOVATION IN  
ELECTRICITY SECTOR RESILIENCE  
AND ADAPTATION

Grid-edge communities face outage exposure and consequences not captured in conventional reliability tools, limiting identification of cost-effective resilience investments under climate change. Current approaches often assess resilience options separately rather than integrated portfolios that reduce outage risk and social burdens, improve affordability, and provide grid benefits. This RTA closes that planning and conceptual gap by developing community-level evidence, methods, and resources that connect localized resilience needs with long-term electricity planning and investment.

|                 |             |
|-----------------|-------------|
| START           | 2028        |
| OUTPUTS         | 2028 - 2032 |
| MARKET<br>READY | 2029 - 2033 |

ALIGNMENT SUMMARY

| WHAT IS THE DISTINCT RESEARCH APPROACH?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | HOW WILL YOU KNOW YOU ARE SUCCESSFUL?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | HOW WILL YOU COORDINATE?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| <ul style="list-style-type: none"><li>• Develop community-centered data, models, metrics, analyses, and technologies to characterize outage exposure and consequences and to evaluate portfolios of community and grid-edge resilience resources. (pp. 191 – 192)</li><li>• Evaluate resilience investments in context, linking community benefits with system reliability, operational flexibility, and avoided infrastructure costs rather than seeing technologies in isolation. (p. 182)</li><li>• Test community-specific approaches for maintaining resilience while coordinating with the bulk grid. (p. 190)</li></ul> | <ul style="list-style-type: none"><li>• Validated, empirically grounded tools, metrics, and methods enable tribes and communities to identify resilience needs and lower-cost portfolios that reduce outage burdens and provide grid benefits. (p. 194)</li><li>• Success shown when validated methods inform investment decisions that improve affordability, reduce outage risk and social burdens, and identify cost-effective alternatives to conventional grid hardening. (p. 194)</li><li>• Metrics: geographically refined outage statistics (duration, frequency), critical-load service loss, avoided outage costs, and social burden versus established or modeled baselines. (p. 194)</li></ul> | <ul style="list-style-type: none"><li>• Coordinate with PG&amp;E’s “Building Community Resilience from Prevention to Recovery,” SDG&amp;E’s “Next Generation Resilience and Response” initiatives, Gas RD&amp;D, CPUC, CalOES, and various federal, tribal, and private-sector resilience efforts. (p. 181; pp. 193 – 194)</li><li>• Coordinate with CEC’s OIIP on Tribal Energy Sovereignty to support tribal leadership and sovereignty in resilience research and deployment. (p. 190)</li><li>• Build on successes and gaps identified in EPIC-supported projects on microgrids, mobile power, and resilience (e.g., GFO-20-310, EPC-22-001, EPC-19-050). (pp. 190 – 191; p. 193)</li></ul> |