

Decision Support for Microgrid Hardening

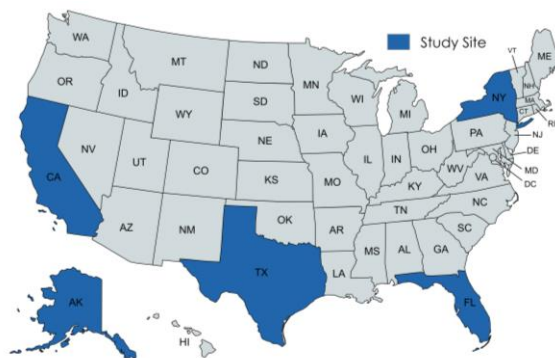
State & Regional Insights on Hazards, Information, and Microgrid Systems



Integrating Stakeholder Requirements for Decision-Support Tool Development

Through a series of stakeholder interviews, the Sandia Sociotechnical Systems team identified key decision-making needs and translated them into requirements for a new tool to support microgrid planning and hardening against environmental hazards. Insights revealed: (1) the roles stakeholders play and how they make microgrid decisions, (2) strengths and gaps in their data access and technical capacity, and (3) use cases for a decision-support tool assessing hazard risk and mitigation options.

This fact sheet summarizes findings from semi-structured interviews with 64 stakeholders, including staff members from: Federal and state agencies; utilities; microgrid hosts (e.g., municipalities, critical facility operators, and retailers); nonprofit organizations and industry associations; research and consulting firms; and project and technology developers, across five U.S. states (Alaska, California, Florida, New York, and Texas) and nationally.



Stakeholder Roles and Relationships

Our research indicated that stakeholders play varying roles in the microgrid development process, and these roles are not dictated by their sector. Instead, stakeholder relationships are shaped by environmental, regulatory, economic, and political factors. Different configurations of relationships emerge depending on stakeholders' unique capabilities and project development pathways.

Microgrid Project Roles	
Project Champion	Overall Project Development
Financing	Technical Advising
Permitting	Technology Development
Regulation	Microgrid Hosting or End Use
Utility Interconnection	Community

Information and Tool Needs

Stakeholders shared five core needs that national laboratories, research organizations, and others can address to guide microgrid hardening decisions:



Granular, community-scale **hazard data** that capture both historical impacts and future projections across multiple, potentially compounding events.



A comprehensive **catalogue of existing microgrid installations and hardening options**, accompanied by real-world performance metrics and cost data.



Standardized **economic analysis tools** that offer clear capital, operations, and maintenance cost ranges, outage-cost calculators, and benefit quantification methods.



Regulatory context data, including information on permitting jurisdictions and protected areas, to streamline site selection and compliance.



Capacity-building resources, such as intuitive primers on microgrid fundamentals, clear definitions of stakeholder roles, and step-by-step planning workflows to empower under-resourced teams.

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Summary Findings

The term “microgrid” lacks a clear, agreed-upon definition. Stakeholder opinions differ on the scales, sizes, and configurations (standalone vs. grid interconnected) of systems that can constitute microgrids. Conceptual and operational variability in microgrid definitions can impact the development of regulatory structures and the types of decisions stakeholders may seek support for.

Cost is a critical factor in decisions about microgrids, hazard mitigation, and resilience. Resources for cost-benefit analysis, including for different hazard mitigation strategies, are needed. Stakeholders weigh a range of factors in decisions about microgrid deployment and design: a) costs of meeting current and projected loads with existing systems, relative to those of microgrid generation; b) operational costs and losses from main grid outages, alongside costs saved through reliability and operational continuity afforded by the microgrid; c) capital expenses of microgrid interconnection and installation, including upgrades or accommodations for existing infrastructure; d) capital expenses related to hardening measures, as

well as the additional resilience provided by those options; and e) microgrid operating expenses, including maintenance and workforce development.

Stakeholders acknowledge both the impacts of environmental hazards on microgrids and the impacts of microgrids on the surrounding natural and built environment. These dynamics impact decisions about microgrid siting and design, with implications for overall project costs, impacts, and timelines.

Some stakeholders question whether microgrids require unique hardening measures, as existing infrastructure may already address these concerns. Hazard mitigations may be incorporated systemically through internal and external capital standards, building codes, or certification requirements, even if these can be inconsistent across jurisdictions. Particularly in regions with a history of hazard impacts and response, stakeholders may perceive stringent municipal building codes or existing investments in hardening the main grid as sufficient resilience measures.

Recommended Actions

1. National laboratories and others providing decision support for microgrid hardening should clearly communicate tools' intended purposes and scopes and accommodate a range of system types and configurations to address a broad set of stakeholders.
2. Tools and resources that help stakeholders across sectors quantify and compare costs and benefits would make a strong contribution to stakeholder needs and support more informed decision-making.
3. Incorporating data on both environmental hazards and environmental sensitivities or protections into microgrid hardening decision-support tools would allow for robust impact analyses and risk assessments.
4. Helping stakeholders identify and interpret applicable local codes, standards, and regulatory requirements could support microgrid hardening decisions by clarifying which measures may already be required and where additional hardening options could add value.

Contact

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