



# 2024 SEPA Snapshots Series

## RESILIENCE



# Introduction

The SEPA Snapshots Program presents a series of focused, stand-alone research chapters (Snapshots) aligned with SEPA's six focus areas: resilience, transportation, emerging technology, energy storage, policy, and energy equity. Each snapshot offers a unique perspective on these critical topics within the energy industry. The series draws on insights from two key surveys—one targeting utilities and the other capturing input from broader energy industry participants—as well as project nominations to the 2024 Power Player Awards. With response rates varying across chapters, each section highlights tailored findings and trends. Whether exploring a single snapshot or engaging with the series as a whole, SEPA Snapshots delivers a versatile and insightful resource built on data-driven perspectives.

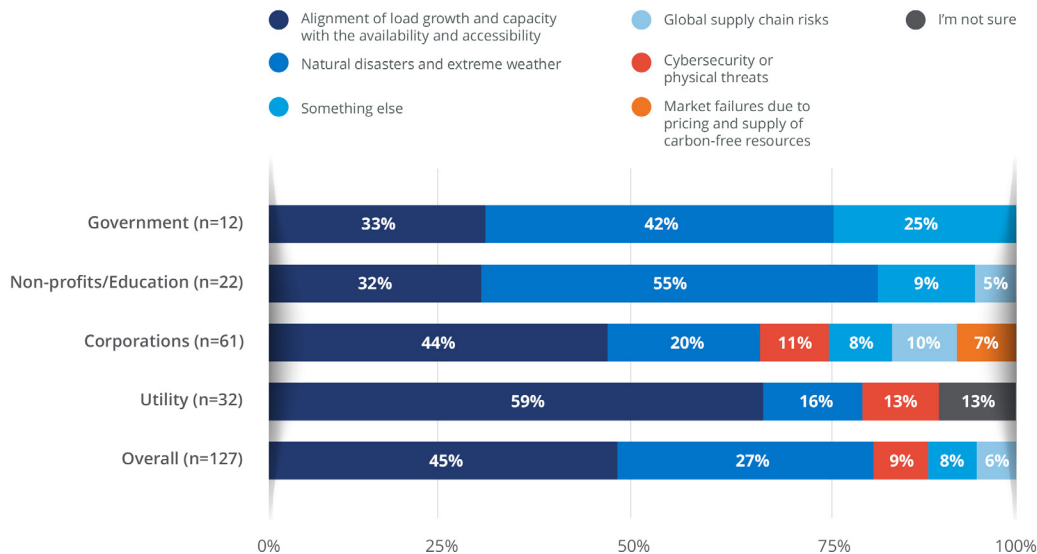
## Importance of Resilience

In recent years, as the energy grid evolves to respond to extreme weather, growing risks of wildfires, and rising demand for electricity – the traditional emphasis on reliability has broadened to include resilience. Resilience is defined as “the ability of the grid, buildings, and communities to withstand and rapidly recover from power outages and continue operating with electricity, heating, cooling, ventilation, and other energy-dependent services.”<sup>1</sup> The growing importance of resilience in the energy transition is why this topic focused on exploring the way that utilities and others in the sector are investing in resilience.

The results for this topic of our annual surveys provide insights related to how we are building a more resilient grid. Drawing on data from 170 respondents across 159 unique organizations,<sup>2</sup> this snapshot highlights some of the strategies, challenges, and regulatory processes shaping resilience efforts. Please see the addendum for more information about the survey respondents and methodology.

Industry and utility respondents perceive natural disasters, extreme weather, and alignment of load growth and capacity as the prevailing challenges to resilience over the next decade (Figure 1). The prevalence of these concerns across various sectors surveyed supports the increased industry focus on resilience planning and investment to mitigate the growing risks posed by severe weather.

**Figure 1. Most significant threats to energy security & resilience over the next decade (n=127\*)**



1 Department of Energy, [www.energy.gov/eere/energy-resilience](http://www.energy.gov/eere/energy-resilience)

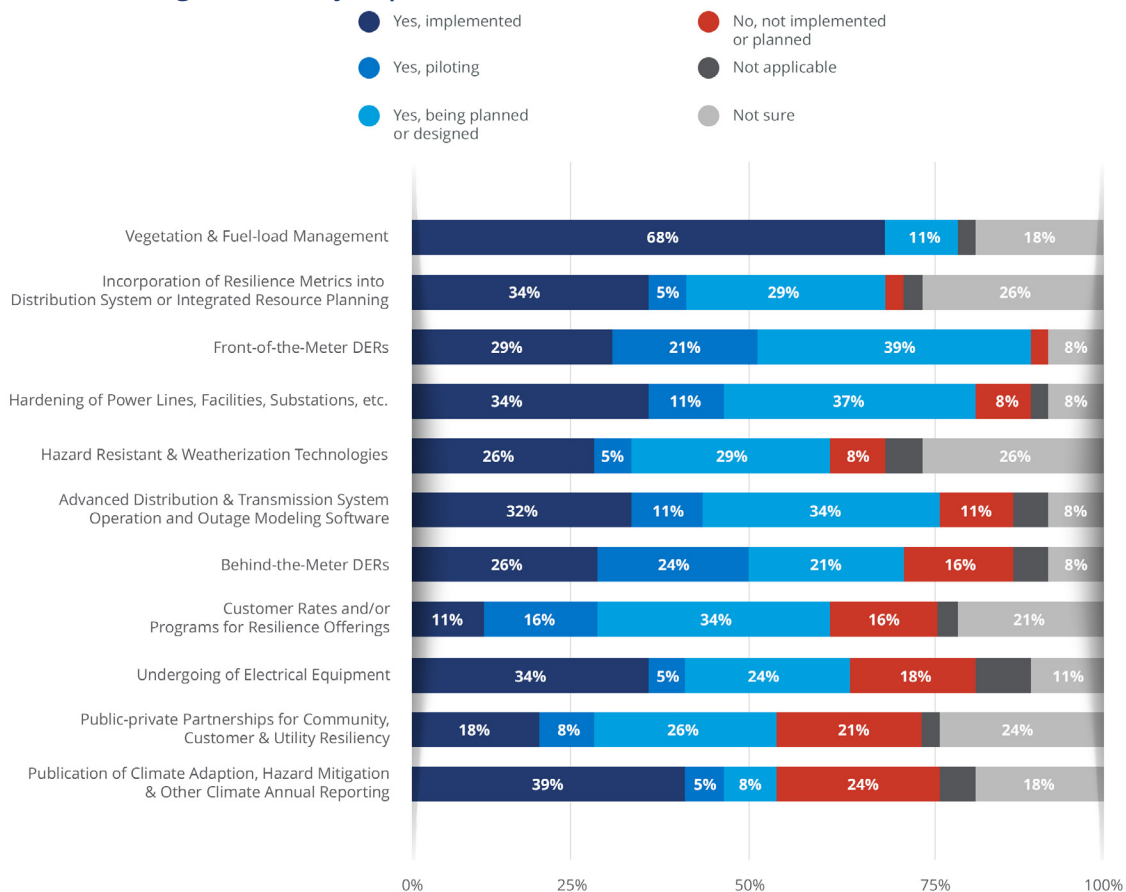
2 Individual sample sizes from the various audiences and data collection activities will vary in the results sections below.

For utilities, the alignment of load growth and capacity with the availability and access to new generation and storage resources emerged as a top concern for respondents. This is consistent with growing concerns, voiced by many in 2024, about whether energy infrastructure expansion can keep pace with growing electricity demand fueled by new data centers and economic growth.

## The Tools Utilities Are Using To Enhance Resilience


Data from the utility survey shows trends in the implementation of practices and tools that enhance the resilience of the grid (Figure 2). Many of these practices and tools are not new and reflect standard industry operations and maintenance efforts. These include vegetation and fuel-load management, front-of-the-meter (FTM) distributed energy resources (DERs), and grid hardening solutions. What is notable is the number of respondents that now view behind-the-meter (BTM) investments and customer-focused programs as key to their resilience plans.

**Figure 2. Utility implementation of resilience measures (n=38\*)**



\*The results presented should be considered directional rather than statistically significant due to the sample size.

Another notable trend is the focus on building resilience and mitigating risks related to wildfires, not just extreme weather events. Survey respondents stated that in areas prone to wildfires and severe weather conditions, particularly the Northeast and West, standard practices, like grid hardening and increased vegetation management, are even more crucial. And, practices designed to address wildfire risks can have broader resilience benefits. As a public power representative from the West describes:



“Grid hardening (tree cable and undergrounding) has been the most impactful in outage reduction and wildfire mitigation because it has reduced the impact of wind, snow, ice, and vegetation on bare conductors.”

Beyond traditional grid hardening and maintenance practices, several survey respondents noted that BTM battery energy storage and other resources can be used to bolster both customer and overall system resilience. This move to incorporate BTM resources into utility resilience plans and projects is an important evolution in how utilities are thinking about the value of these resources.

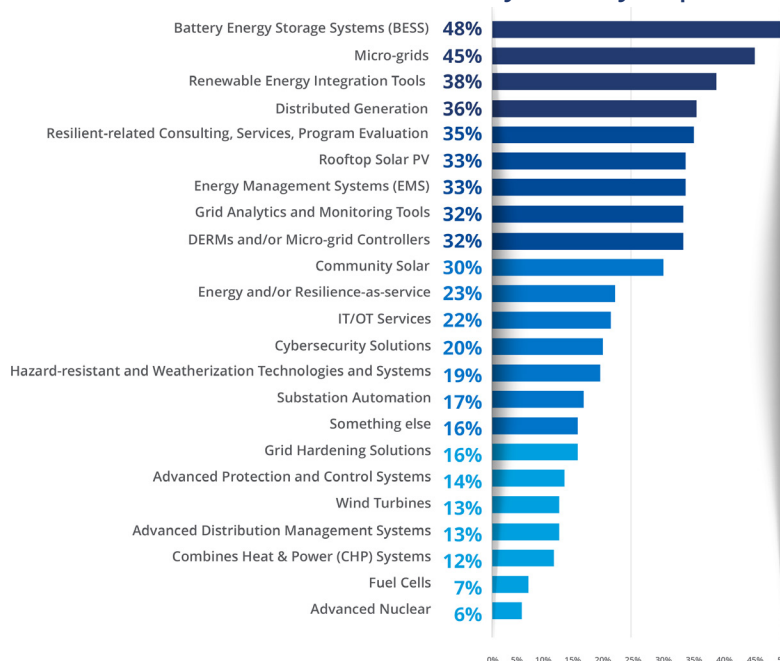
## Innovation in Action: Green Mountain Power

**Green Mountain Power (GMP), SEPA’s 2024 Resilience Power Player award recipient, developed the Zero Outages Initiative (ZOI). This initiative sets a new standard for the utility industry by integrating DERs like home batteries and community microgrids. The integration of these technologies helps decentralize the energy system and offers continuous backup power to GMP customers, regardless of location or income. ZOI combines advanced solutions, such as proactive grid hardening, undergrounding lines, and storm-proofing infrastructure, to create a resilient and adaptable grid for Vermont. By focusing on long-term cost savings and climate resilience, ZOI flips the traditional utility model by transforming the grid into a more flexible and customer-centric system that empowers communities to stay connected during extreme weather events.**

Of utility respondents, more than half have deployed or are exploring or planning behind-the-meter DERs, including rooftop solar photovoltaics (PV). Utilities in the Northeast and Southeast specifically noted that these technologies present opportunities to enhance customer resilience.

Industry responses show a heavy focus on BTM DER integration, microgrids, and renewable energy integration tools to enhance resilience (Figure 3).<sup>3</sup> The majority of survey participants are fortifying the grid through physical infrastructure improvements and advanced energy management technologies.

**Figure 3. Resilience-related solutions offered by industry respondents (n=69\*)**



<sup>3</sup> Businesses refer to professional services, hardware and software providers, developers, aggregators, and other solution providers.

## Microgrids To Enhance Resilience

The survey data indicated that microgrids, though recognized for their significant potential in enhancing energy resilience, are a tool that increasingly is being deployed to bolster resilience. Microgrids are a group of interconnected loads and DERs that can act as a single entity and operate in grid-connected or islanded mode.<sup>4</sup> New case studies demonstrate the resilience value of microgrids.

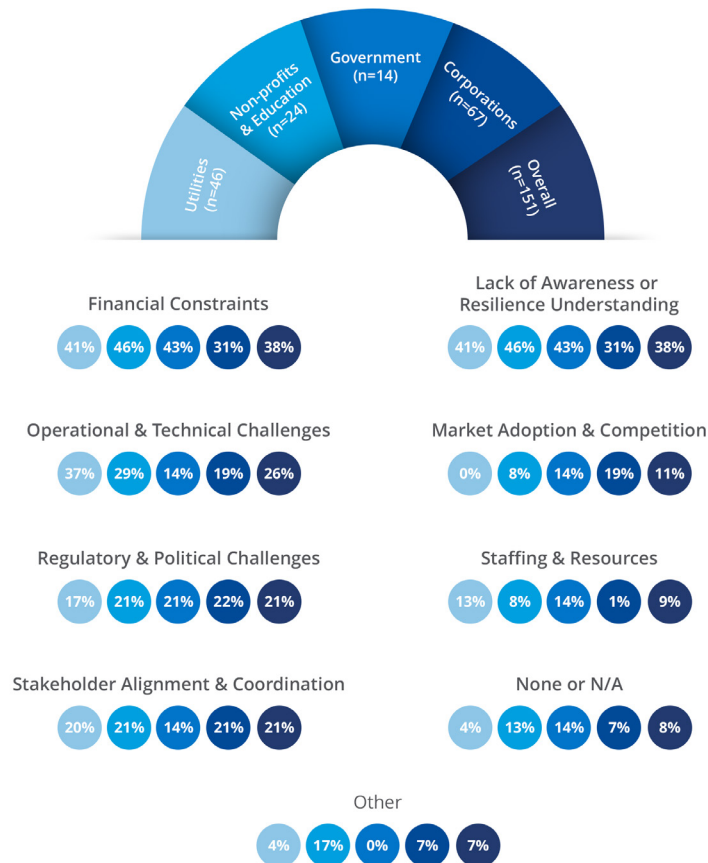
### Innovation in Action: Duke Energy Hot Springs Microgrid

The Hot Springs Microgrid, developed by Duke Energy, is an inverter-only system that provides a reliable backup power supply to Hot Springs, NC. The project, a finalist in SEPA's 2024 Resilience Power Player Awards, combines a 2MW solar facility with a 4.4MW lithium-ion energy storage system and can start without traditional generators, a first in the energy sector. Duke's multidisciplinary team overcame complex technological challenges, including electromagnetic transient analysis and cold load modeling, to ensure the system's success. The microgrid has significantly improved service reliability for hundreds of customers and set a new standard for microgrid innovation.

## Barriers to Enhanced Resilience Efforts

The survey data reveal key organizational challenges and barriers to advancing energy resilience. As Figure 4 shows, financial constraints emerged as a top concern for all participants.

Figure 4. Perceived barriers to advancing resilience  
(sourced from all Snapshots and Power Player data collection activities)



<sup>4</sup> <https://www.nrel.gov/grid/microgrids.html>

Across all respondents, regulatory challenges emerged as a key impediment to resilience investments (Figure 4).

Similarly, nearly 20% of respondents voiced that the lack of standardized definitions and metrics for resilience remains a key challenge, contributing to the overall difficulty in understanding and measuring both resilience challenges and enhancements. Given the industry's focus on managing customer costs, efforts to assess the benefits of these investments (or potential investments) are important to help prioritize those tools or practices that would provide the greatest resilience benefits. Today, states take different approaches to assessing the cost-benefit of utility resilience initiatives.<sup>5</sup>

Despite this, the majority—88%—of surveyed utilities conduct formal cost-benefit analyses to prioritize resilience investments, with 60% incorporating resilience benefits and 27% including societal benefits in their assessments. These assessments can be crucial for making the case to regulators, investors, and customers in support of planned resilience investments.

In addition to improved metrics, many respondents noted the importance of federal funding is critical in enhancing the value and cost-effectiveness of resilience projects by providing essential financial support for utility investments, pilot projects, and research and development.

Notably, 76% of utility respondents have already utilized federal funding for resilience-related efforts or plan to do so. Respondents stated these projects span grid hardening, distributed generation, energy storage, and wildfire and vegetation management initiatives. The availability of government funding significantly reduces the cost of these investments, ultimately lowering the costs for customers. A utility respondent highlights the importance of grant funding opportunities.



“Grant funding is the only way that our utility can afford resilience projects. Without grant funding, we are incorporating grid resilience equipment in its normal 10-year work plan, but these projects will take years to complete.”

## A Resilient Future

This Snapshot highlights the urgent need for innovative solutions and collaborative efforts to strengthen energy resilience in the face of increasing natural disasters and grid challenges. By leveraging novel technologies, behind-the-meter resources, and microgrid innovations, utilities and industry leaders can enhance the grid's adaptability and protect communities. Dive deeper into SEPA's resilience research, including best practices and working groups, to uncover actionable strategies, data-driven insights, and inspiring case studies that can guide your organization in advancing resilience efforts. Together, we can build a grid that not only withstands challenges but also empowers communities to thrive.

<sup>5</sup> <https://pubs.naruc.org/pub/45491EC6-FF05-559F-2B1D-85D1FC8E7042>



For more information on  
Resilience projects, initiatives,  
and partners please visit:

[sepapower.org/our-focus/resilience](https://sepapower.org/our-focus/resilience)