

2024 SEPA Snapshots Series

ENERGY STORAGE



Introduction

The 2024 SEPA Snapshots Series presents a series of focused, stand-alone chapters (Snapshots) aligned with SEPA’s six focus areas: resilience, transportation, energy storage, emerging technology, 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 for the 2024 Power Player Awards. With response rates varying across chapters, each section highlights 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 about how a diverse group of stakeholders is thinking about and acting on issues at the heart of the clean energy transition in 2024.

Energy Storage

Energy storage is essential to the clean energy transition as it can help balance supply and demand, stabilize grids, and maximize the benefits of renewable energy. By enabling flexible, reliable energy management, energy storage provides a wide variety of services to the electric grid, making it a cornerstone of modern energy systems.¹

This Snapshot overviews energy storage technology adoption and program implementation across the electric industry. It spotlights key advancements, regulatory drivers, and industry challenges and explores how utilities leverage storage solutions to enhance grid reliability and stability.

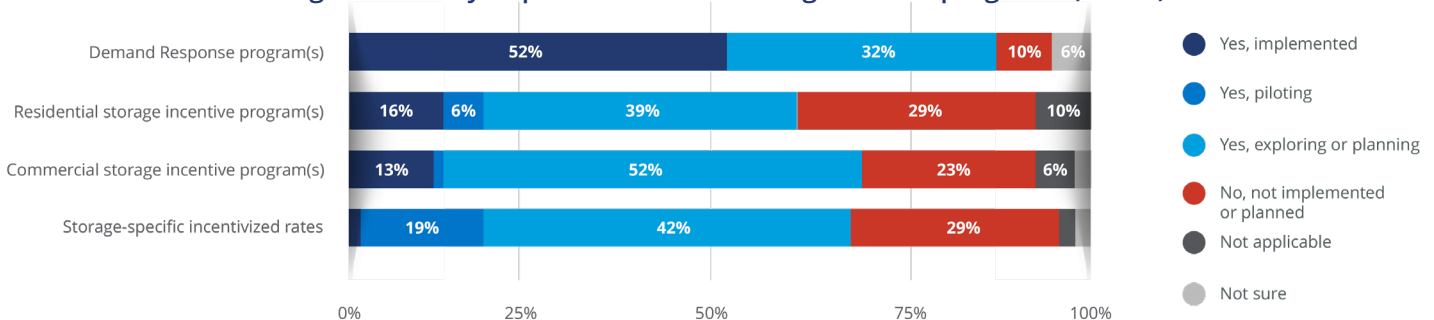
One hundred sixty-three respondents from across the clean energy industry, including utilities, corporations, and nonprofits, representing 151 unique organizations,² provided their perspectives on a range of energy storage issues. Please refer to the Snapshots addendum for an explanation of the survey methods.

Customer-Focused Storage Options and Programs

Deployed U.S. battery storage capacity has been increasing since 2021 and could reach 30 GW by the end of 2024.³ However, most surveyed utilities are still in the early stages of energy storage implementation.

Many offer programs such as demand response (DR), residential and commercial incentives, and storage-specific rates to encourage customers to adopt storage solutions to serve their own needs and to improve grid reliability and resiliency. Surveyed utilities have broadly adopted DR programs, while storage-related initiatives like residential and commercial incentives and storage rates are still largely in the exploratory or pilot stages (Figure 1). DR programs were the most widely cited, with most (84%) of surveyed utilities reporting full adoption or planning for implementation.

Figure 1. Utility implementation of storage-related programs (n=31*)



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

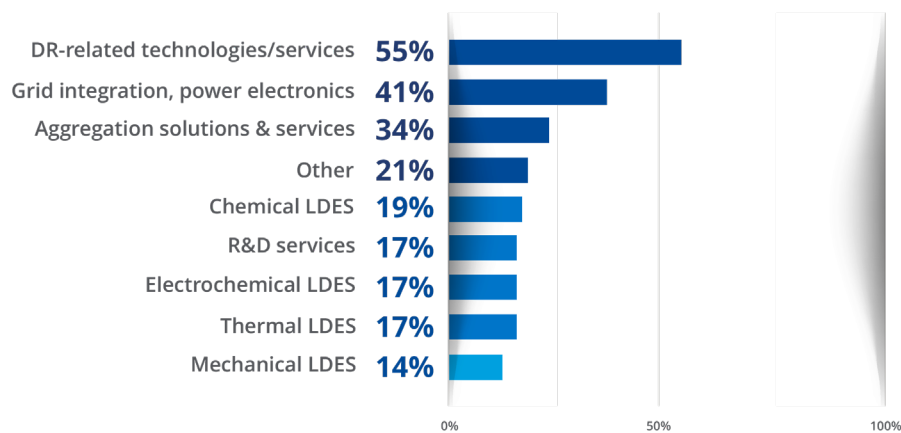
1 https://sepapower.org/wp-content/uploads/2024/08/SEPA-Energy-Storage-Primer-2024_print.pdf

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

3 U.S. Energy Information Administration, [U.S. Battery Storage Capacity Expected to Nearly Double in 2024](https://www.eia.gov/analysis/studies/battery-storage/) (Jan. 4, 2024).

On the industry side, there is also a strong focus on DR technologies and services, with 55% of surveyed businesses reporting that they offer these solutions (Figure 2), reflecting the same DR trend heard from utilities.

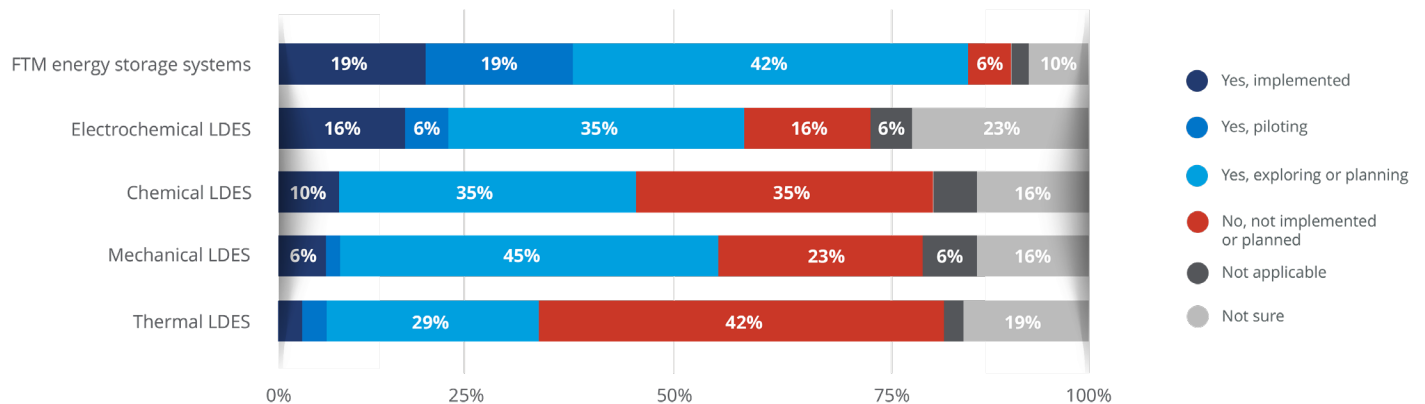
Figure 2. Industry (corporate) energy storage solutions (n=58)



Long-Duration Energy Storage: Emerging Trends

In addition to customer-focused energy storage programs, the surveys showed that utilities are piloting and exploring a range of storage technologies for system deployment (Figure 3). In particular, utility interest in the various long-duration energy storage (LDES) options is nascent, but growing, consistent with the technological development and current costs of these technologies.

Figure 3. Utility adoption of storage technologies (n=31*)



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

Innovation in Action: Iron-Based Batteries, Xcel Energy

Xcel Energy, which partnered with Form Energy, is planning to deploy two 1,000-MWh-iron-air battery systems at retiring coal plants in Minnesota and Colorado, making it the first large-scale utility implementation of this type of battery. The project was a finalist for SEPA's 2024 Energy Storage Power Player Awards. These multi-day systems can store renewable energy and then deliver energy for up to 100 hours, addressing the variability of wind and solar power and strengthening the grid against extreme weather. The project showcases iron-air batteries' cost-effectiveness and scale potential, demonstrating the opportunity for broader adoption across utilities.

Energy Storage Adoption Challenges

Despite growing deployment of battery electric storage and growing interest in emerging LDES options, survey respondents still face challenges when implementing or developing energy storage technologies, services, and solutions.

Cost Barriers

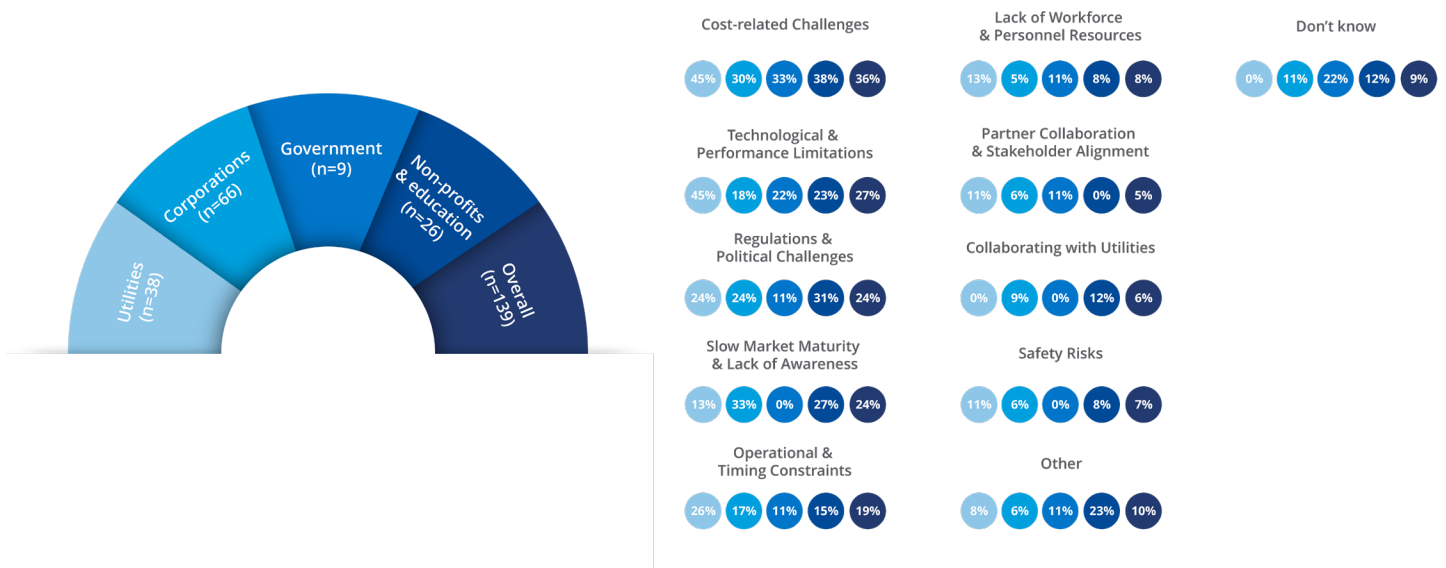
Across all sectors, cost-related challenges emerge as the most significant barrier (Figure 4). Nearly half of the utilities expressed concerns about the upfront costs and a general lack of external or other funding options to reduce the required investment. One respondent got right to the point:

“Upfront cost. The lag from regulatory policy and the historical ‘least cost / least risk’ framework compared to what we need to do to meet decarbonization goals. But really this just boils down to cost.”

A corporate respondent also noted that the deployment of novel technologies tends to be more uncertain, causing timelines and processes to be lengthier and more expensive:

“First-of-a-kind deployment always has a number of unknowns that need to be discovered and resolved during the startup and commissioning phase. This process can be very time consuming and expensive if not properly staged and planned for.”

Figure 4. Organizational barriers to advancing energy storage adoption
(sourced from all Snapshots data collection activities; n=139)



Amongst all of the challenges identified, 45% of utility respondents said that technological performance limitations present challenges to advancing energy storage adoption. Many cite inadequate infrastructure, unproven technologies, and long lead times for development and testing as key barriers. Additionally, utilities face challenges related to seasonal performance and ensuring storage technologies are reliable and located optimally.

Lack of Market Maturity and Regulatory Alignment

Another prominent challenge expressed by corporations, governments, and nonprofits and education respondents is slow energy storage market maturity and a lack of awareness or education. Key challenges include a lack of industry-wide understanding and buy-in and public misconceptions around lithium-ion battery safety. Many potential customers are unaware of the benefits of energy storage and misinformation and complex programs make adoption difficult.



“Energy storage has unfortunately often been considered late, or not at all, when compared to PV, when various standards are created. This has left some of the nuances of energy storage unconsidered and unhandled in the various standards.”

Partnered Progress Salt River Project & CMBlu Energy

Salt River Project (SRP) and CMBlu Energy, SEPA’s 2024 Energy Storage Power Player winner, developed an LDES pilot called Desert Blume. This partnership deployed a cutting-edge 5 MW, 10-hour energy storage system, marking the largest utility-scale installation of this kind in the world. The project offers a “plug and play” setup, facilitating the potential future adoption of this innovative storage solution. This effort highlights the importance of selecting experienced, trusted, and supporting collaborators to accelerate the commercialization of LDES technologies.

The findings in this report emphasize the vital role energy storage plays in advancing the clean energy transition. By addressing barriers like costs, technological performance, and market maturity, stakeholders can unlock the full potential of storage solutions to enhance grid reliability, support renewable integration, and drive decarbonization. Explore SEPA’s research, insights and actionable strategies to drive innovation, resilience, and sustainability in the energy industry. Together, we can power the future.

SEPA snapshots

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

sepapower.org/our-focus/storage