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Storage Now Vital Part Of Grid Architecture

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It has become, in electric terms, the elephant in the room. That metaphor dates back to 1814, but serves well today when looking at the constrained future of the U.S. electricity supply: the emergence of storage as an essential part of the grid infrastructure.

Storage, largely pump storage, has been around since the 19th century. Now with batteries, storage has become an essential player in supporting the grid during normal operations and in times of stress.

Notably both the CEO of ERCOT, Pablo Vegas, and the CEO of CAISO, Elliot Mainzer, have said their systems got through the winter of 2022-2023 because of the amount of storage in both systems.

Storage Is The New Essentiality

The growing importance of storage, indeed its essentiality, is covered in a major article — more of a white paper, really -- authored by three energy attorneys at the world's largest law firm, Dentons: Clinton Vince, Jennifer Morrisey and Andrew Mina. It appears in the August issue of Financier Worldwide, a monthly publication for executives.

The article traces the history of battery storage from its acceptance as a potential contributor to a low-carbon grid, playing a role in firming up intermittent resources, to its growing importance in grid stability.

Historically, pump storage was the most cost-effective and reliable storage system with long drawdown times. But, as the Dentons attorneys point out in their article, it is difficult to build and new sites are limited. Ninety percent of new storage is from batteries, they say.

You might say that utility scale battery storage has come of age. The article states: “The essential role of storage and the variety of benefits it offers to the grid are quickly becoming more broadly appreciated.”

The authors portray the grid as becoming more stressed, suffering from years of under investment, increasingly turbulent weather, and a rapidly increasing demand for power.

“Last year the U.S. electric grid saw additions of new generation capacity of more than 70 percent over the previous year, a trend that is expected to repeat this year.

“This is a significant increase, but it pales in comparison to the expected threefold increase in demand over the next few years, driven by artificial intelligence and data center growth, and the electrification of transportation and industrial operations,” they write.

The workhorse in batteries is lithium ion which has done so much to support the changing face of the modern world, from cellphones to electric vehicles, drones to toys, personal computers to spacecraft.

But for utilities, the future may have other strong players, including iron-air and flow batteries. Even old-fashioned and proven lead-acid devices may have a future in the utility space.

While iron-air batteries, as offered by Form Energy based in Somerville, Massachusetts, have the advantage of drawdown times of several days, they are less adept at load following.

John Howes, principal at Redland Energy Group and an aficionado of batteries of all kinds, points out that energy-hungry data centers aren't waiting. They are deploying batteries in their data centers now.

Howes told me, "Energy storage systems, which have been part of the nation's power infrastructure for more than 150 years, now must assume a role of greater importance to ensure that the physical infrastructure will perform seamlessly.

"Batteries already are deployed in every data center."

He added that batteries serve the nation's growing artificial intelligence capability.

Howes said batteries not only back up other power generators in emergencies but can also achieve "black starts" in a complete blackout situation.

Their day-to-day work is to store low-cost energy for discharge in peak demand times.

To accomplish these functions in a cost-effective manner, Howes said, batteries will have to use better performance materials and advanced designs, and be made with state-of-the-art processes.

Complexity Of Valuing Battery Resource

The Dentons article explains these challenges this way:

"Valuing a battery resource is a more complex exercise than for other resources. The cost of a battery resource is deeply intertwined with the engineering operations of the grid, and the arbitrage functions of battery storage complicates the determination of the market value of the resource.

"Moreover, battery storage provides a variety of values to the electric system. The cost will vary depending on which service is needed at any given time to optimize which market, and will affect how battery storage is bid into the market and at

what level of charge. This sets battery storage apart from other distributed resources."

In 2024, according to the Energy Information Administration, utility-scale battery storage exceeded 26 gigawatts, with operators adding 10.4 GW of new battery storage capacity, making it the second-largest generating capacity addition after solar. The EIA expects a record-breaking increase in 2025, with 19.6 GW of utility-scale battery storage planned to be added to the grid.

The elephant is stirring, maybe getting to its feet.