Battery storage systems in texas

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Revolution battery storage project in Crane County, Texas, is a large-scale battery energy storage facility developed, owned and operated by Spearmint Energy, designed to provide grid stability and support the integration of renewable energy sources in the region. It is one of the largest battery storage projects in the state, with a capacity of 150 megawatts and 300 megawatt-hours of storage. Photo courtesy of Spearmint Energy.

Texas leads the nation in both dispatchable natural gas-powered electricity generation and intermittent renewable energy production. But one of the challenges Texas faces is how to align renewable generation with demand, as these intermittent power sources often go offline while demand peaks. This misalignment can lead to extreme price volatility and can make maintaining grid reliability more complex and challenging. Renewable energy also adds more volatility to the grid because the power output from these resources fluctuates.

Another factor is the modular nature of batteries, which makes building new installations relatively fast and allows for a quicker return on investment compared with other energy infrastructure. Joshua Rhodes, a research scientist at The University of Texas at Austin, compares energy storage batteries to Lego bricks that can be transported by truck, assembled on location and connected to the grid. He notes, “It doesn’t require a whole lot of building and bringing fuel to a site. All you need is one connection.”

One solution is to connect inverters with “grid-forming” capabilities, which help mitigate this risk by limiting fluctuations outside of 60 Hz, increasing grid stability. Experts see utility-scale batteries as a prime opportunity to deploy grid-forming inverters to the grid, as grid-forming integration with batteries is cheaper and faster than building new transmission.

The facilities themselves also have some residents concerned about disruptive construction noise and damage to property as well as fire risks, such as what happened in California in May 2024. Experts note, however, that fires and explosions at battery storage facilities are rare due to strict safety precautions. Rhodes argues that battery storage facilities don’t pose a greater risk than facilities in other Texas industries.

Utility-scale batteries primarily provide energy to the ERCOT grid in two ways: ancillary services and energy arbitrage. Ancillary services ensure the grid is stable by providing additional dispatchable capacity when needed. Despite the challenges facing IBRs on the grid, batteries are uniquely suited to these tasks thanks to their controllability, fast response times and ability to provide short durations of electricity.

Energy arbitrage, on the other hand, refers to buying electricity when prices are low and selling electricity when prices are high, with the goal of profiting from price differentials -- not unlike the logic behind stock

trading. This strategy is one that is often employed by battery operators seeking to maximize profits from price fluctuations. A closely linked strategy known as load shifting involves moving consumption from high-demand periods to low-demand periods (Exhibit 4).

With BESS, these strategies can work in tandem. For example, a battery can charge at midday when solar generation is high and electricity prices are low, then discharge that stored energy in the evening when solar output declines, demand increases and prices rise. In this scenario, batteries are engaged in energy arbitrage and peak-load shifting. The strategy of peak-load shifting not only smooths out peak demand periods and lowers grid strain, it also reduces energy costs.

The growth of variable renewable energy sources in ERCOT’s portfolio and the rapid rise in both residential and industrial demand have led to increasingly volatile prices, allowing battery storage to take advantage of tight conditions on the grid, employing both ancillary services and energy arbitrage.

Grid strain can be particularly lucrative for battery storage operators. During Winter Storm Heather, battery storage earned 74 percent of its January and February revenue in just three days, with 85 percent of the revenue for those months coming from ancillary services. Similarly, 51 percent of battery storage revenue from January to August 2023 came from 10 days during record-setting heat and high demand. Between 2021 and 2023, the majority of battery storage revenue in ERCOT came from ancillary services versus energy arbitrage.

But batteries engaged in ancillary services can reduce real-time energy market prices. For example, in August 2023, during record-setting heat and high demand, power prices surged to the maximum amount permitted of $5,000 per kilowatt-hour. Batteries were quickly deployed and released 1.8 GW of power on the grid, reducing energy prices by almost 50 percent.

As the buildout of grid-scale storage continues in Texas, prices for ancillary services will continue to decline, and energy arbitrage will likely become the primary revenue stream, according to Brandt Vermillion, ERCOT Market Lead at Modo Energy. He argues that energy arbitrage and the design of the ERCOT market are “tailored to the flexibility of battery energy storage.” This change is already taking place as revenue from ancillary services has decreased in 2024 compared with last year, due to a milder summer and more competition in ancillary services.

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