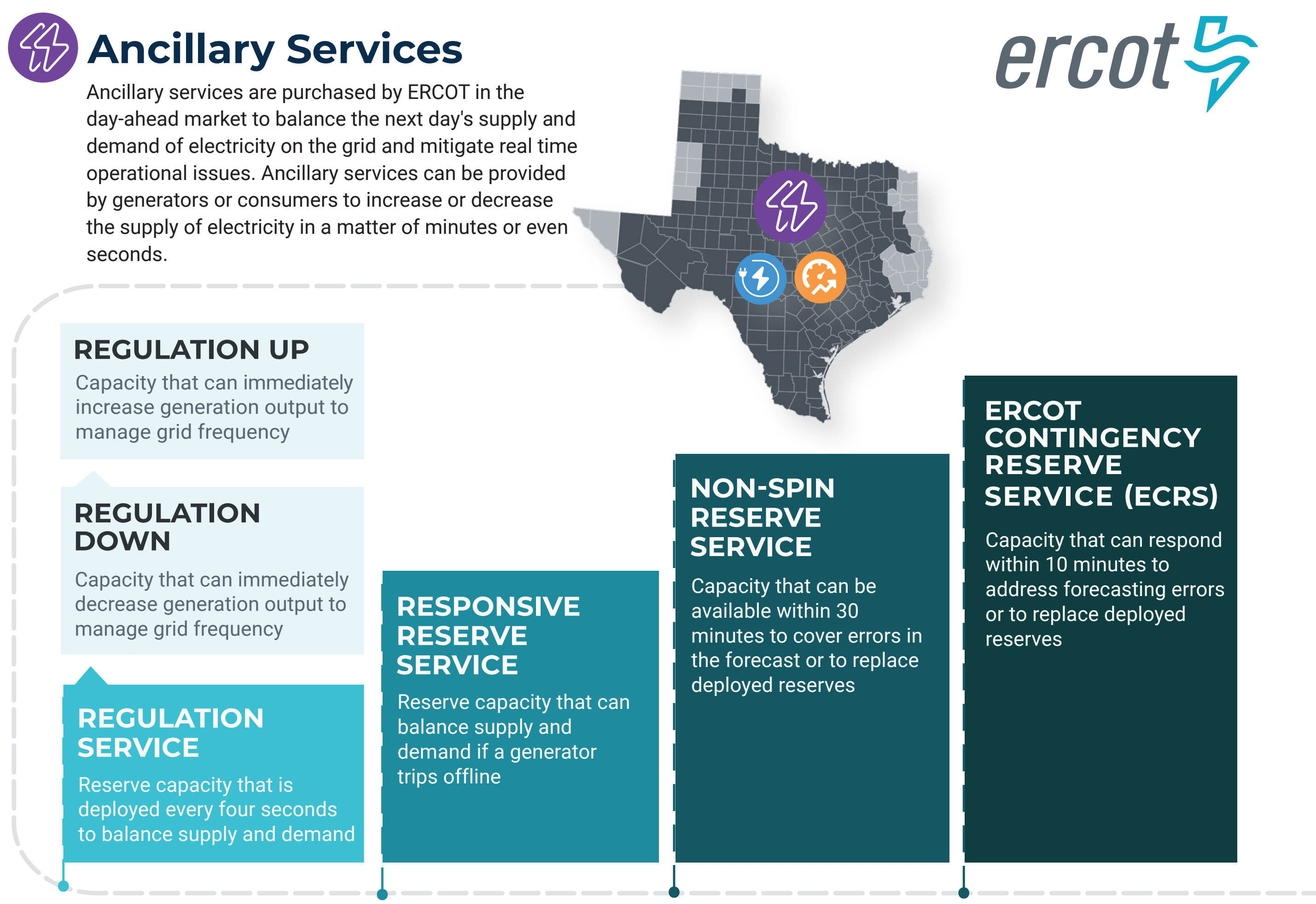
Battery Energy Storage Systems

Battery Energy Storage Systems (BESS, also known as batteries or battery storage) store electricity generated at one time so that it can be used at a later time, when that power is more valuable or could be used for reliability. Until recently, most battery storage in the electric industry was used as backup power for critical infrastructure — often called Universal Power Supply Battery Backup — as protection during power outages or equipment failure. As bulk electric systems rely more on intermittent resources for power, utility-scale battery storage can provide many services to support reliability. They can also shift when energy is available to meet demand. Because of those services, the capacity of utility-scale battery storage has been growing quickly in many areas of the U.S., including the ERCOT market in Texas, which boasts more renewable generation capacity than any other state.

How Batteries Can Be Used in the ERCOT Market

In ERCOT, battery storage charges and stores energy during periods of oversupply when prices are lower and discharges later when prices are higher. This "buy low, sell high" strategy is often referred to as energy arbitrage. Battery storage can charge and discharge very quickly, allowing them to provide certain reliability products in the ERCOT market called Ancillary Services. ERCOT's infographic below explains Ancillary Services, and the table describes which battery storage capabilities make them suitable to provide Ancillary Services.



Ancillary Service Product	Battery Storage Capabilities
Regulation Up and Regulation Down	Battery storage can provide this product through short duration charges and discharges. Regulation Service is short duration but requires flexibility in power output.
Responsive Reserve Services	The electronics in a battery storage system provide the ability to respond quickly and provide Responsive Reserve Services for durations that match their energy capacity.
Non-Spinning Reserves	Even if they are offline for a long period, batteries do not need to "warm up" like some more traditional generators do. They can meet the requirement to provide power within 30 minutes. However, ERCOT rules limit Non-Spinning Reserves offered from a battery to the capacity they are capable of sustaining for four consecutive hours.
ERCOT Contingency Reserve Service (ECRS)	Batteries can also provide power within 10 minutes. ERCOT rules limit ECRS offered from a battery to the capacity they are capable of sustaining for two consecutive hours.

Benefits in Pairing Batteries with Renewables

As renewable resource capacity grows in particular regions across ERCOT, curtailments of these resources are increasing in frequency and amount during periods of higher supply and lower demand. Curtailment means reducing the output of a generation source, often through ERCOT price signals — very low or negative prices that do not offset the cost to run the generator causing the owner to turn off the generation source. Battery storage is one option available to renewable asset owners looking to store energy that would otherwise be curtailed or "wasted."

Growing Uncertainty for Batteries in ERCOT

There has been significant growth in utility-scale battery storage in ERCOT over the past three years, with many more projects in line to potentially connect to the grid. Most of the capacity is near areas with congested renewable resources, but the trend of building battery storage near areas of high demand is rising. These battery storage projects are in various stages of financing and development, and they are most likely to be constructed only when the developer signs a power purchase agreement (PPA) for a guaranteed revenue stream or if they believe they can make sufficient revenue in the ERCOT market.

Historically, many of these projects earned that revenue by a combination of energy arbitrage and Ancillary Services sales. However, recent rule changes require the battery storage operator to constantly provide ERCOT the state of charge — whether the battery is fully charged, fully discharged, or somewhere in between — so ERCOT can monitor and assess the battery's capability to provide Ancillary Services. This provides for more reliability, but it also limits revenue opportunities for batteries. Battery storage economics are further reduced by declining Ancillary Service prices due to growing supply. The diminishing economics will likely lead to delays or cancellations of many of the battery projects in the ERCOT interconnection queue.

Austin Energy's Battery Experience

Austin Energy has been involved in several battery storage projects, providing us a wide range of experiences and opportunities. We closely monitor and evaluate economic opportunities for battery storage in our power portfolio to benefit customers. Here's a summary of our battery storage experience to date:

- From 2016 to 2020, Austin Energy completed a distribution level solar-plus-battery project through a Department of Energy grant. The purpose of the project was to pilot ways to achieve "Sustainable and Holistic Integration of Energy Storage and Solar PV (SHINES)" that could lower the cost of electricity. In this project, Austin Energy studied how to maximize the value of battery storage by deploying it for market (economic) and reliability benefit. The project used varied solar and battery storage installations including several at residential, commercial, and utility-scale locations. While Austin Energy identified many use-cases for potential value, the project results demonstrated that actual benefit does not yet outweigh cost. This is due to several reasons including ERCOT market rules, the complexity of system integrations, changing technologies, and standards that are struggling to keep pace.

  The SHINES project resulted in two distribution-level battery storage systems, which are still in place today. Each one is approximately 1.5 MW with a two-hour duration. These systems provide Austin Energy personnel hands-on experience in owning and operating battery storage. While gaining this experience, there have been notable ongoing challenges, including fire safety, software integration, vendor relationships and insurance premiums.

- Austin Energy has a PPA with a solar farm that often experiences curtailment. We evaluated signing an additional PPA to operate utility-scale battery storage co-located with that solar farm but elected not to because the outcome would have been a net cost, rather than a benefit, to customers. Instead, Austin Energy negotiated an arrangement where it sells curtailed energy to the battery storage, adding value for our customers. This is an innovative solution that finds benefits in battery storage even though Austin Energy does not own or have a PPA tied to that system.

- Austin Energy has analyzed utility-scale battery storage proposals through Requests for Proposals (RFPs) since 2016, including a 2022 RFP that looked for battery options at the Decker Creek Power Plant site. That project idea was put on hold to get better guidance around safety concerns, Austin Energy's next Resource Generation Plan and rising project costs like labor, tariffs, engineering, procurement and construction.
- Austin Energy has conducted multiple interconnection studies for developers who wish to connect renewable-plus-battery projects to our transmission lines. We participate fully in the ERCOT interconnection process and do our part to enable the construction of these projects. One example is the Big Star project in Bastrop County, Texas, which includes 200 MW of solar and 80 MW of battery storage with 1.5 hour duration.
- Austin Energy has additional experience with commercial-scale and residential-scale battery storage not addressed here. For the purposes of the Resource Generation Plan process, these behind-the-meter systems are considered in the Demand Response category.

Current Battery Opportunities

As we look at batteries as an energy option, it is important to identify how we would use them to determine the best technology, type and duration. Long-term investment decisions should be made after considering the lifetime potential of the project and the state of evolving market rules. We should also consider recent tariff increases, fire safety, insurance concerns and overall life-cycle impacts — like mineral mining and end-of-life recycling uncertainties — when assessing the timing and placement of utility-scale battery storage in our portfolio.

While Austin Energy does not have the same economic incentives as renewable project owners experiencing high levels of curtailment and congestion, we continue to explore opportunities to incorporate utility-scale battery storage into our power portfolio. The two biggest drawbacks are cost and limited duration. However, we continue to assess whether we can use batteries to reduce renewable intermittency or to mitigate shorter duration load zone price separation events.

Austin Energy's Kingsbery Energy Storage System is located in a substation and interconnected next to the La Loma Community Solar array.

Notes:

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