

The image features a stylized illustration of an energy storage facility at night. In the foreground, a large rectangular area is filled with numerous white, rectangular energy storage units arranged in neat rows. A network of glowing green lines, representing power distribution or data flow, connects these units to various points across the landscape. Several green battery icons, some fully charged and others partially, are scattered throughout the scene, indicating the status of different storage components. The background shows a dark, silhouetted landscape with trees and distant hills under a night sky with some clouds. The FlexGen logo, consisting of the word 'FLEXGEN' in a white, sans-serif font with a green 'X' that has a diagonal slash through it, is positioned in the upper left corner.

# FLEXGEN

FFRA and ERCOT

## How FlexGen's HybridOS can make any energy storage project ready for Texas

With ERCOT and other ISO's overhauling their energy markets, grid operators require reliable software to provide the rapid response time needed for grid stabilization. FlexGen's HybridOS is one such solution, capable of responding to a rapid response request in less than 200ms.

# Introduction

Whether or not everything is bigger in Texas, one thing certainly is – the energy industry. The state is the country's largest consumer of energy and its largest producer, by some distance. Texas produces the country's most oil and natural gas, and the fuel industry continues to call Greater Houston home. Its energy dominance isn't limited to The Lone Star State's traditional strengths in fossil fuels, either; the state is by far the country's largest source of wind power, accounting for a quarter of all generation, and has the second largest base of solar power.

The preeminence of energy in Texas makes the state an appealing place for companies in the business of making power, but these firms also must navigate peculiarities unique to how the state manages its electrical grid. Most of the state's power supply is overseen by the Electric Reliability Council of Texas (ERCOT), which operates the Texas Interconnection (TI) electrical grid. Compared to the other major grids of the country, ERCOT's is relatively isolated and decentralized, with limited connections to outside grids.

The decentralized nature of the Texas Interconnection has had both positive and negative effects on Texans. On the one hand, it means ERCOT has a freer hand to test out novel ways of generating and delivering power and can adapt the grid to the particular needs of 26 million Texans. Compared to many other grid operators, for example, ERCOT only pays generating companies based on the immediate power they put on the grid – there's no compensation for keeping a large amount of power in reserve, so Texas doesn't have a capacity market. This system is designed to foster competition and keep prices low since power generators don't have to keep a costly reserve of power on tap. Partly as a result, Texans enjoy among the lowest electricity rates in the country.

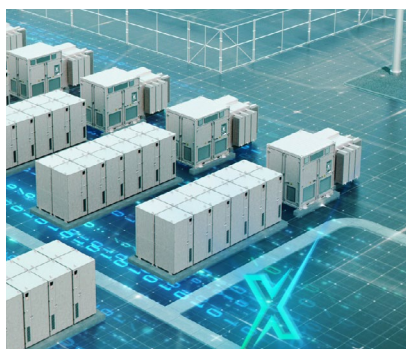
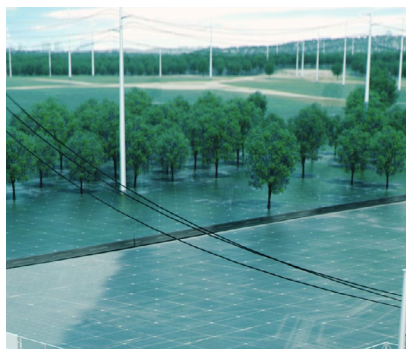
The benefits of a deregulated and energy-only market are most obvious when the grid is operating at normal demand. However, times of increased stress on the grid have exposed the downsides of ERCOT's system. This was evident during the brutal winter storm in 2021 when millions of homes lost power primarily due to the grid's lack of preparation for severe weather events. Though this was the most notable recent example of the pitfalls of a grid focused primarily on immediate power, there's a concern for the grid's reliability essentially anytime Texas experiences unusually high demand or low generation – a pressing matter for a state already dependent on air conditioning that's facing down increasingly brutal summers in the decades to come.

Regardless of how one views the peculiarities of ERCOT's operations, one thing is clear – companies that wish to participate in the state's burgeoning energy market must learn how to adapt to the way things are done in Texas.

Having operated in Texas for several years now, FlexGen has done just that, and the company has become well acquainted with how to best meet the needs of an energy market that prioritizes immediate power. Pairing its expertise in renewable energy with a deep engineering background, FlexGen has embraced ERCOT's unique way of managing power delivery, making the company a one-stop shop for others who are interested in doing business in Texas. As ERCOT looks to find ways to encourage more immediate sources of grid power while preserving its deregulated nature – and ensuring the Texas Interconnection can also support increasing renewables, FlexGen is ensuring its energy management software is matching these changes along the way.

**In essence – FlexGen has done the work of navigating ERCOT so other renewable energy companies don't have to.**

## FFRA: HOW ERCOT WILL MEET THE FUTURE NEEDS OF THE GRID



The February 2021 power crisis revealed that ERCOT would need to make changes to the grid to prepare for similar times of surging demand in the future. As the planet warms and severe weather events become more likely, this is particularly true for Texas, a state that already experiences a high need for power during the summer and lies in the path of Gulf of Mexico-spawned hurricanes, while also having one of the country's fastest growing populations.

The decentralized, deregulated nature of the Texas Interconnection is valued by ERCOT, meaning there isn't much appetite for building a reserve market into the grid. This leaves the primary option as incentivizing power providers to have more immediate power available. ERCOT currently employs an ancillary services market, which creates the conditions for power generators to have standby power available if needed. Electricity may be sold into the ancillary services market, for example, if there's an unexpected gap between supply and demand. A combination of grid isolation, high penetration of renewable energy sources, lack of capacity

reserve market and the risk of future extreme demands on the grid puts ERCOT in the position where it is at risk of lower or higher frequency current on its grid. They have created a specific market to address rapid changes by stabilizing grid frequency. Other interconnections also deploy ancillary services markets, but often place a greater premium on the reserve part of ancillary services than ERCOT.

While being better prepared for periods with unusual gaps between supply and demand is one reason for ERCOT to update its ancillary services market, the grid also needs to be ready to support increased renewables.

The intermittent nature of renewable energy like wind and solar means too much can destabilize an unprepared grid. The ancillary services market currently supports purchasing energy and services that can help keep the grid stable, but it needs to be updated to meet the needs of a growing renewable sector – particularly for an energy market that already generates the country's highest amount of wind energy and its second-most solar.

This is where ERCOT's Fast Frequency Response Advancement (FFRA) project comes into play. Realizing the need to update its ancillary services market, ERCOT has laid out plans to introduce new markets for ancillary services. These include:

With these newly proposed ancillary services, energy operators must meet the stringent needs for quick-responding energy resources to participate in the ancillary markets. Such requirements mean that the ERCOT grid will be better prepared to respond to events like a sudden mismatch in supply and demand, as well as support more renewable resources. With the new ancillary services markets incentivizing operators to have more immediately available power on demand, ERCOT will be able to call on a modern reserve of power without having to rely on traditional, inertia-powered plants supplying a capacity market, as happens in many other grids. Firms will be further incentivized to have resources that support the new ancillary services since, under FFRA, a single power generation site can deliver power to multiple FFRA markets.

The last market, FFR, is of greatest interest to those in the renewable energy industry. Since this is the market that requires the fastest response to a request for power, it is well-suited for resources like energy storage that can supply immediate power. When paired with solar or wind, energy storage that supports the FFR market can effectively give ERCOT the same reserve capacity as a traditional power plant.

However, one additional resource is needed to ensure energy storage supports the demands of the FFR market; an advanced energy management system.



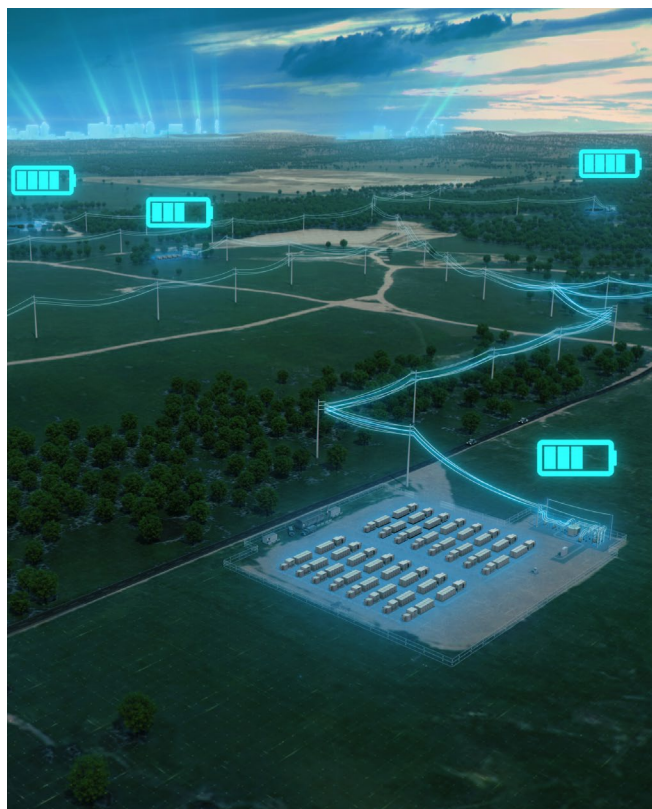
**PRIMARY FREQUENCY RESPONSE (PFR):** THE LEAST SEVERE NEED FOR ENERGY RESOURCES TO RESPOND TO A REQUEST FOR POWER



**FAST FREQUENCY REGULATION SERVICE (FFRS):** RESOURCES THAT CAN RESPOND WITHIN 60 CYCLES OF THE REQUEST FOR POWER



**FAST FREQUENCY RESPONSE (FFR):** THE FASTEST RESPONSE MARKET, RESOURCES THAT CAN RESPOND WITHIN 15 CYCLES OF A REQUEST FOR POWER



## THE NEED FOR SPEED: FLEXGEN'S HYBRIDOS CAN MAKE ANY BESS ERCOT-READY

For most technologies, the case can be made that the hardware is only as good as the software, and this is especially true of energy storage. Energy management software monitors and controls battery storage and is what enables it to connect to generation sources like solar and wind, as well as a home, commercial building, or the grid. It's software that manages when power should be absorbed by a battery and when it should be delivered. Good energy management software will analyze historical trends, the weather, and energy rates to determine when it makes sense to switch to grid energy and when a building, for example, should rely on storage for power. Great management software will meet the strict requirements of advanced energy markets.

FlexGen's HybridOS, which underpins the company's industry-leading utility-scale energy storage systems, has been planned since the beginning of ERCOT's FFRA project to support the new FFR market. The company's engineers have closely tracked the FFRA discussions to ensure HybridOS and the systems it powers will be able to participate in the FFR market, meaning their operators will be ready to sell FFR energy. FlexGen's storage units have been in Texas since before ERCOT began planning for FFRA, so the company has been in a prime position to update the HybridOS behind these units and others to meet the latest changes in the FFR requirements.

FlexGen as an organization has been a critical part of ERCOT's FFRA planning, helping shape the decision that generation resources should be able to qualify for multiple ancillary services within the

market. HybridOS has also already proven itself to be ready to support the future needs of ERCOT; energy storage systems equipped with FlexGen software were the only ones to stay online during the 2021 winter storm. If the FFRA markets were in place at the time, FlexGen-powered storage asset owners could have sold energy to ERCOT. That experience demonstrated the utility of operators installing more renewable energy – when the next power crisis strikes and FFRA is in place, storage that's underpinned by HybridOS will be readily available to sell ancillary power into the grid.

Already advanced energy management software in its own right, HybridOS's readiness for FFRA demonstrates how prepared FlexGen is to operate within the unique confines of ERCOT. The company has projects and people on the ground in Texas closely following FFRA developments, and engineers are updating HybridOS as the requirements for the FFR market evolve. As it stands, HybridOS has already proven itself capable of surpassing the requirements of FFRA. A resource must provide 95% of its power within 250 milliseconds of a triggering event – with HybridOS, battery storage can do this within 200 milliseconds.

Operators that augment their energy storage assets with HybridOS can be certain that their resources are well-equipped for the complexities of operating within ERCOT. HybridOS has already proven itself capable of keeping storage sites operating during severe grid events, and the software surpasses the requirements for selling energy under the stringent FFRA requirements.

## CONCLUSION

Texas is too big an energy market for operators and solutions providers to ignore, but embarking on energy projects within the state can be daunting due to the peculiarities of ERCOT. FlexGen has essentially done the work of navigating how to operate in Texas, so all operators need to do is install HybridOS for their energy storage systems. The coming FFRA markets are designed to prepare the Texas Interconnection for a renewable future.

Energy operators will be able to capitalize on a prime source of revenue in the new ancillary markets with a software solution designed around it.



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