Lessons from the Texas Energy Crisis

Issue Brief

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INTRODUCTION

The existing crisis in Texas highlights the complexities of maintaining a reliable energy system under ever increasing extreme weather stress.

Bottom Line

In this case, both the physical grid structure and the market design contributed to ongoing rolling blackouts. What is highlighted most in this instance is the need for a wide portfolio of energy resources in a market that can offset each other's shortcomings in the case of unusual weather and market events.

Background

As unprecedented winter weather swept across Texas, starting Saturday February 13th and continued into the following week, the Texas grid and market monitor — the Electric Reliability Council of Texas (ERCOT) — was forced into extreme circumstances including planned, rolling blackouts for consumers. These blackouts are both a physical grid issue and market design issue.

Due to the weather, the physical grid faced a multitude of challenges.

Loss of Thermal Capacity

Over 27 GW of thermal load (mostly natural gas) was not available for electricity production due to the lack of pipeline capacity to import natural gas for electricity purposes to the generating units. Since much of the available natural gas pipeline capacity in Texas is dedicated to heating, available natural gas was used not for electricity generation but instead to provide heat as temperatures dropped. This lost thermal electric capacity represents over 30% of ERCOT's total capacity , and half of natural gas capacity.

Loss of Renewable Capacity

4-5 GW of renewable capacity was lost due to problems with ice/snow on wind and solar generation units. De-icing technology exists and is utilitized on wind generation units in other climates, but has never been seen as necessary in markets this far south.

Loss of Localized Transmission and Distribution Lines

Prolonged outages are being caused by ice storm impacts on the transmission and distribution network itself, which is not hardened for these types of events.

Lack of Interregional Transmission Access

ERCOT's grid remains largely disconnected from other energy markets and grid systems. There is very little transmission interconnection between the impacted Texas region and the rest of the country. This essentially makes Texas its own electricity island. As Midcontinent Independent System Operator (MISO) and Southwest Power Pool (SPP) announce their own rolling blackouts, this electricity island concept applies to those markets as well. The inability to plan and cite interregional transmission remains a key issue to address to ensure adequate reliability nationally.

Lack of Continuously Producing Electricity Generation Units

All generation types have experienced difficulties during this crisis and have faced varied outage lengths. Each of these generation types has unique attributes that contribute to grid security and reliability but because all faced issues at the same time, the amount of energy available was not enough to meet demand.

MARKET STRUCTURE CHALLENGES

In addition, the ERCOT market structure contributed to this situation.

Unexpected Peak Demand

The ERCOT market is designed around the expectation that electricity demand will peak in the summer during the high heat months. Therefore, more generation capacity is available in these months due to the previously modeled and experienced demand. While cold weather similarly sees electricity demand peaks, in southern climates these peaks are often not as large as the expected summer peak. In this case, due to the extreme weather, this winter peak has far exceeded expected demand and additional needed capacity is not available.

Low Reserve Margins

Reserve margin refers to the buffer between available capacity and expected peak load. ERCOT maintains the lowest reserve margin in the country at only 15.5% above expected peak load. In comparison, PJM's minimum reserve is 16% but averages around 25-28% reserve margin. Since power demand in ERCOT has exceeded the available reserve margin, ERCOT is being forced to utilize rolling blackouts to lower electricity demand.

Two other ERCOT-specific attributes are also mentioned in relation to the rolling blackouts.

However, they have a *limited impact* on causing the blackouts.

Lack of a Capacity Market

ERCOT is the only wholesale market in the United States that lacks a capacity market. A capacity market aims to ensure reliability by pre-committing energy generators to certain amounts of capacity years in the future. Instead, ERCOT only has an energy market. An energy market only pays for needed energy on a day-to-day basis. A capacity market would have helped prevent the $9,000/MWh energy prices experienced during the extreme weather, but is more expensive to maintain. A capacity market would not have prevented the rolling blackouts as the reserve capacity of the market was exceeded.

$9,000 Energy Market Pricing

Occasional instances of $9,000/MWh pricing events is much less expensive to consumers than a capacity market, but extended $9,000/MWh pricing tests the overall affordability. The $9,000/MWh cap was created based on expected peak load equations. In general, these high prices incent flexible generation resources as providing energy during peak price periods provides high levels of profit for flexible technologies. Because ERCOT is optimized for high summer peak load rather than a winter peak, it is less efficient at sending the right price signals for winter storms.

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