

## THE SERIES

Twenty million Texans lost power in a deadly freeze after state lawmakers brushed aside a decade of warnings about the increasingly vulnerable electric grid.

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“The power market needs to do two things. It needs to provide power today, but it also needs to plan years ahead. And that’s where the Texas market fails,”

### **Can Texas fix its broken power grid?**

By James Osborne STAFF WRITER

Rob Snyder quit the retail power business two years ago, no longer willing to take what he viewed as an increasing and unacceptable risk.

Quite simply, power supply was not keeping up with Texas’ rapidly growing population, a recipe for severe shortages and crazy price swings that could bankrupt a retail power company buying electricity in wholesale markets. In 2019, he sold his firm, Stream Energy, for \$300 million to the Houston power company NRG Energy.

Snyder was mostly worried about broiling summer days when power supplies often are stretched to their limits. But his analysis, borne out over four frigid days in mid-February, pinpoints the underlying problem that led to the massive failure of the state’s power system and an estimated 200 deaths across Texas: a shortage of power when conditions turn extreme.

It’s a problem that will be neither cheap nor easy to fix. At the most fundamental level, experts say, avoiding another grid disaster will require the rethinking of a market-driven system that favors efficiency — and the resulting lower prices — over reliability, which requires backup generation and redundant systems that can add significant costs, even if they are rarely used.

What worries insiders such as Snyder is politicians are looking for simple fixes, a checklist of solutions to protect against a repeat of February’s frigid weather, as opposed to creating a more resilient system capable of handling extreme weather yet to be anticipated.

“I’m getting a lot of calls from legislators, and frankly, the people who are going to be voting on this understand the problem just enough to be really freaking dangerous,” Snyder said in March. “I don’t know how this is going to come out.”

The Texas Legislature is moving to require power generators, natural gas operators and pipeline companies to better weatherize their systems, as well as revamp the organizations that oversee the grid and power system, the Electric Reliability Council of Texas, or ERCOT, and the Public Utility Commission. But these measures do little to induce power companies to have sufficient generation ready for unusual weather that drives electricity demand far beyond what was forecast, experts say.

For the past decade, ERCOT has operated with the smallest amount of backup generation of any grid in the country. In 2019, ERCOT ran a reserve margin of just 9 percent, compared to 19 percent in the Midcontinent Independent System Operator, which runs from Minnesota to

Louisiana, and 32 percent in Southwest Power Pool, which spans an area running from the Texas Panhandle to North Dakota.

That margin is increasing — reaching 15.5 percent this summer — but almost all of it comes from new solar and wind farms, which are weather-dependent and can't be counted on during power shortages.

“The power market needs to do two things. It needs to provide power today, but it also needs to plan years ahead. And that's where the Texas market fails,” said Eric Fell, who studies power and gas markets for the research firm Wood Mackenzie. “ERCOT has skated by for years with several close calls where we avoided blackouts because the weather wasn't quite so crazy.”

### An influx of renewables

Running a grid necessitates a constant balancing of electricity demand and supply. Historically, that meant ramping power plants up and down, depending on whether temperatures were rising or falling, or households were turning on televisions and dishwashers.

But as renewables have expanded in recent years, accounting for as much as 42 percent of the state's electricity generation during some months, the grid has become far more difficult to manage. Grid operators must predict how much power wind turbines and solar panels will generate based on weather forecasts, which is relatively easy for tomorrow, but not three weeks in advance.

To manage this unknown, power grid operators rely on backup generation — a rule of thumb is one megawatt of backup for every megawatt of wind or solar. Grid-scale batteries offer an enticing option, storing solar power in the day and discharging it at night, but the costs remain prohibitive. So, power grid operators rely on natural gas plants, which can ramp up quickly when winds drop or clouds move in.

But renewables complicate this obvious solution by driving down power prices, making investors reluctant to sink hundreds of millions of dollars into building gas-fired plants. Since 2011, only 6,500 megawatts of additional gas capacity — enough to power about 1.3 million homes — has been built, compared to almost 40,000 megawatts of wind and solar.

And as more renewables come online, driving prices down further and discouraging investment in backup power, the problem is only expected to worsen. Some analysts worry that Texas could have insufficient generation to meet summer demand in just a few years.

“The mistake we made is, if you increase prices across the board, you're just going to get more of whatever the cheapest resource is,” said Katie Coleman, an attorney representing large industrial and power consumers. “We have such a high quantity of renewables, if they all show up, we have a ton of power on the system, and prices get really low even though demand is really high. That's sort of good for customers, but when wind or solar doesn't show up, that's where we have an issue.”

One bill by Rep. Phil King, R-Weatherford, sought to charge wind and solar generators for the cost of building additional gas plants or other backup for the grid. But that idea was set aside amid criticism it would make the cost of building wind and solar prohibitive when more clean energy is needed to fight climate change.

Grids across the country are managing the onslaught of renewables. Following the 2014 “polar vortex” that drove record natural gas prices, PJM Interconnection, the nation’s largest power grid covering 13 states in the Northeast and Midwest, imposed a minimum price on power to protect coal and nuclear power plants, which tend to perform better during cold snaps, from competition with cheaper natural gas plants and renew-ables.

PJM, like all deregulated markets in the United States other than ERCOT, operates a capacity market, paying for power generation to be ready for theoretical emergencies years down the line.

Texas has long resisted such a move, with large power consumers such as petrochemical plants and big-box stores lobbying hard against a capacity system they argue provides windfalls for power plants at the expense of customers. When the utility commission took steps in 2013 toward a capacity market — which would have increased electricity bills by 1.4 percent — the Legislature warned the commission that it was overstepping its authority.

Other options are open to the Public Utility Commission. For example, the state could pay natural gas power plants to store fuel on site to avoid supply disruptions, which contributed to February plant outages.

The state also could set performance standards for power plants operating within ERCOT that would minimize the likelihood of going offline in extreme weather, much as the Natural Transportation Safety Board sets standards for commercial airplanes, said Pat Wood, who chaired both the Texas Public Utility Commission and Federal Energy Regulatory Commission under former president and governor George W. Bush.

“If anything comes out of this crisis, it’s that there should be more redundancy throughout the system,” he said. “If it turns out we really can’t depend on our gas infrastructure to be as resilient as we need it to be, then have the backup.”

### Inefficient heating systems

The resiliency of power generation is only half the problem. During the February blackout, power demand spiked to almost 70,000 megawatts — a winter record that exceeded the peak ER-COT forecast for the season by 20 percent. Even as large industrial and commercial customers shut down to avoid sky-high electricity prices, these demand reductions were more than offset by Texas’ hugely inefficient housing stock.

Over the past few decades, the state’s homes have shifted toward electric heating systems, which, while cheaper to install, are far less efficient than fuel oil or natural gas systems. In 2018, more than 60 percent of homes in Texas had electric heating, according to Census data.

Most of the time, that's not a problem — Texas has some of the warmest weather in the nation. But when temperatures fall below freezing for sustained periods, as they did in February, those systems bleed energy to keep homes warm.

Electric heat pumps, common in Texas apartment buildings, operate like reverse air conditioners, extracting warmth from the air outside to increase the temperature inside. But once temperatures fall below freezing, there is little heat to extract. The systems fall back on electrical coils that require four times the electrical load of a heat pump operating under normal conditions, said Jeff Haberl, an engineering professor at Texas A&M University.

“Over time, municipalities and government entities have allowed for a large number of all-electric buildings, and unfortunately, that means heat pumps,” he said. “It's economics. It's much more expensive for these developers to be running gas lines.”

To fix the problem, experts say, Texas needs to increase energy efficiency standards.

Like many states, Texas requires utilities to invest in energy efficiency, promoting fixes such as sealing gaps in window frames and installing double-paned glass. But the efficiency standards are low, and politicians are reluctant to raise them out of concern of increasing housing costs, said Dana Harmon, executive director of the Texas Energy Poverty Research Institute.

In 2015, Texas utilities spent \$6.50 per customer on energy efficiency, far below the national average of \$16, according to a study by the nonprofit South-central Partnership for Energy Efficiency as a Resource.

### Sorting out circuits

The other fundamental failing during the February winter storm was utilities' limited ability to rotate outages.

Power grids are built around circuits, with tens of thousands of customers connected by a crisscrossing network of distribution lines and transformers. During past events, utilities would cut power to one circuit for a couple of hours, then turn them back on while turning off another circuit, so no one was without power for too long.

But in February, so much generation was knocked offline that utilities had only enough power to manage critical circuits, which service facilities such as hospitals and water treatment plants, as well as homes and businesses that surround them. Most everyone else was left in the dark.

Typically, utilities rely on automated systems to rotate outages, but because of the scale of power cuts — roughly one-third of the grid's total load — utilities had to shut circuits manually, a painstaking task requiring the delicate shifting of power to avoid shorting out the grid, said Eric Easton, a vice president for CenterPoint Energy.

“We had to go out into the field and isolate that circuit behind the hospital so we could leave the hospital in service, and then we could drop customers,” he said. “That's how desperate we were.”

The problem is traditional circuits are too big, serving far too many customers and limiting utilities' ability to rotate electricity with more precision, said Alison Silverstein, a consultant and former senior adviser at the Federal Energy Regulatory Commission.

"It's like splitting a pizza into four slices for 12 people," she said. "Four people are going to eat, but the other eight are going to go hungry."

After suffering through a series of poorly executed rotating outages, California utilities upgraded the equipment on their circuits so, in the event of a wildfire, they can shut down relatively small groups of customers instead of the entire circuit.

But that work is not easy. Utilities' customer records are old and often erroneous to the point they cannot map which customers are on which circuits, Silverstein said.

"Pacific Gas & Electric has moved heaven and earth in order to do more granular outages," she said. "It took a year to do the design and installations. They have worked like maniacs to reach out to every customer and done extraordinary data analysis to tell which customer is on which circuit."

The Texas Public Utility Commission is considering tougher rules for how utilities operate their distribution systems. A spokesman declined to discuss the measures under consideration, but like most everything involved in building a more resilient grid, it costs money. California's three largest utilities report they spent more than \$340 million modernizing their grids in fiscal year 2020 alone.

In the end, no power grid is designed to withstand every weather event. Grid planners try to reduce the risk to a manageable level — typically one blackout per 100 years — while keeping in mind what politicians deem is an acceptable price for electricity.

"You're hearing a lot about market design. You're hearing a lot about renewables," said Snyder, the former power executive. "But what it really comes down to is this: Are you going to pay, say, 20 percent more in cost in respect to protect against what you thought was a 1-in-100-year event?" [james.osborne@chron.com](mailto:james.osborne@chron.com) [twitter.com/@osborneja](https://twitter.com/@osborneja)

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