

# The Texas Electricity Grid

January 7, 2022

Updated August 22, 2022



## Top Line

The Texas economy and the lives of our citizens depend on reliable electricity. Texas is unique in two respects: First, unlike any other state in the continental US, Texas has its own electricity grid, and second, Texas experienced a catastrophic failure of its grid in February 2021.

This paper covers five important topics about the Texas electricity grid:

1. How electricity is generated and managed in Texas
2. Why the grid failed in February 2021
3. What the Texas legislature has done since then to address the issues
4. Why that isn't enough
5. What needs to be done to ensure Texas has a reliable supply of electricity for the future. This includes:
  - a. Ensure that the grid is effectively weatherized – for both extreme cold in winter and extreme heat in summer.
  - b. Encourage efficiency, to remove strain on the system especially during peak demand periods.
  - c. Look at ways to reduce risk, such as by interconnecting the Texas grid to one or both major U. S. grids.

**Reliable electricity is essential to our state's future success. The legislature has not done enough to fix the problems that we experienced in early 2021. We need leaders who will do the hard work necessary to ensure our electricity grid is reliable.**

## **Backup**

### **1. How electricity is generated and managed in Texas**

- a. Texas is the only one of the contiguous 48 states with its own stand-alone electricity grid (1)
  - i. There are five electricity interconnections, or grids, in the US: The Eastern Interconnection extends East of the Rocky Mountains to the Atlantic Coast, excluding Texas and Quebec. The Western Interconnection extends from the Rockies to the Pacific Coast and from the Southern United States border to the top of British Columbia and Alberta. There are also three minor interconnections, which are Alaska, Quebec, and the **Texas Interconnection**. (2)
  - ii. The historic reason Texas has its own grid is to avoid dealing with Federal rules and regulations, such as those that establish reliability standards for generation and transmission. (3)
  - iii. While this may have helped to keep costs down, it increases risk because:
    1. Variations in load can't be evened out across a large geographic area as is the case with the two large interconnections.
    2. It has excluded the Texas grid from Federal rules that are designed to ensure reliability.
- b. Most of the electricity in Texas is managed by ERCOT
  - i. The Texas Interconnection, which covers 213 of the 254 Texas counties, is managed by the Electric Reliability Council of Texas, or ERCOT (see map below). Portions of Texas near the state's borders are covered by the eastern and western grids. (4)
  - ii. As the independent system operator for the Texas grid, ERCOT connects more than 46,500 miles of transmission lines and more than 650 power generation facilities, providing electricity to more than 26 million customers. (4)
  - iii. ERCOT's primary responsibilities include maintaining power reliability, ensuring open access to transmission lines, and facilitating competitive electricity markets. (4)
  - iv. The Electric Reliability Council of Texas (ERCOT) manages the flow of electric power to more than 26 million Texas customers -- representing about 90 percent of the state's electric load. (5)

**ERCOT Service Area:**



Source: Texas Comptroller, "Texas' Electricity Resources",  
<https://comptroller.texas.gov/economy/fiscal-notes/2020/august/ercot.php>

- c. **ERCOT** is managed by its Board and overseen by the Public Utility Commission of Texas and the Texas Legislature. (5)
  - i. ERCOT is a membership-based 501(c)(4) nonprofit corporation, governed by a board of directors and subject to oversight by the Public Utility Commission of Texas and the Texas Legislature.
  - ii. ERCOT's members include consumers, cooperatives, generators, power marketers, retail electric providers, investor-owned electric utilities, transmission and distribution providers, and municipally owned electric utilities.
  - iii. ERCOT's Board of Directors consists of 11 members: (6)
    - 1. Three are non-voting members who are members of the Board because of their other affiliations. These are the Chair of the Public Utility Commission of Texas, The Public Counsel of the Office of Public Utility Council, and the CEO of ERCOT.
    - 2. Eight voting members are selected by the "ERCOT Board Selection Committee". (7, Section 39.151 g-1)

3. The Selection Committee consists of three members, one appointed by the Governor, one by the Lieutenant Governor, and one by the Speaker of the House of Representatives. (7, section 39.1513)
  4. Board members cannot have “a fiduciary duty or assets in the electricity market” in the region, and must reside in Texas (7, section 39.151 g-3 and section 39.1513). The first requirement helps to prevent conflicts of interest. The requirement that ERCOT board members reside in Texas was implemented in 2021, because of concern that several board members were not Texas residents at the time of the February 2021 grid failure.
- iv. The **Public Utility Commission of Texas**, or PUC, regulates the state’s electric and telecommunication utilities, implements respective legislation, and offers customer assistance in resolving consumer complaints. It works to protect customers, foster competition, and promote high quality infrastructure among the electric and telecommunication’s wholesale market. (8)
1. In 1975, the Texas Legislature enacted the Public Utility Regulatory Act (PURA) and created the Public Utility Commission of Texas (PUCT) to provide statewide regulation of rates and services of electric and telecommunications utilities.
  2. Texas was the **last state** to enact this kind of law.
- d. How electricity is generated and distributed in Texas
- i. In Texas, several types of entities are involved in providing electricity to end users. (9)
    1. The current structure dates from 1999, when the Texas Legislature introduced retail competition in much of ERCOT’s service area. According to ERCOT, about 75 percent of its total power load represents customers in these “competitive” areas.
    2. In competitive areas, **power generators** produce electricity from fuel and sell it on the wholesale market, where it’s purchased by private companies called **investor-owned utilities or retail electricity providers (REPs)**. Texas has about 300 REPs; customers can choose among them based on pricing and various options such as an emphasis on renewable power.

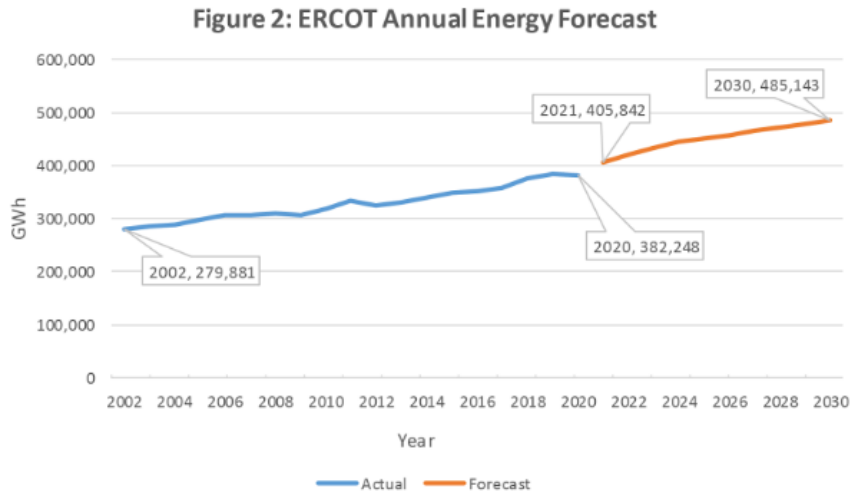
3. Electricity purchased from REPs is distributed to homes, businesses and other facilities by **transmission and distribution utilities**, which own the actual poles, power lines and meters.
  4. Texans living in areas outside the ERCOT grid or in areas served by municipally owned utilities (such as Austin Energy), electricity co-ops and river authorities rely on a single service provider. According to the Legislative Budget Board, as of September 2019, six of Texas' 20 largest cities maintained their own utilities, the largest being San Antonio.
- ii. Natural gas is the largest fuel source for electricity generation in Texas, followed by Coal and Wind.

### Electricity Generation in Texas by Source

	Percent of Total
Natural Gas	47.40%
Coal	20.30%
Wind	20.00%
Nuclear	10.80%
Solar	1.10%
Hydro	0.20%
Biomass	0.10%
Other	less than .1%

Source: Texas Comptroller, "Texas' Electricity Resources", <https://comptroller.texas.gov/economy/fiscal-notes/2020/august/ercot.php>

- e. Electricity demand is expected to grow faster in the next ten years than in the past ten years, so it is critical that we get the grid right. (10)
1. Growth from 2010 to 2020 averaged 1.9% per year, and from 2020 to 2030 is projected to grow at an average of 2.7% per year.
  2. Growth is driven by population growth and growth in the economy.



Source: ERCOT, Long Term Load Forecast,  
<https://www.ercot.com/gridinfo/load/forecast>

## 2. Why the Texas grid failed in February 2021

- a. The Federal Energy Regulatory Commission (FERC) and regional entities involved in the Texas grid completed an in-depth analysis of the February 2021 event in November 2021. (11) The report includes a 20-page summary of what happened, the causes, and recommendations. Key points about the causes of the February 2021 grid failure (the “Event”) are summarized below:
  - i. There have been four events in the last ten years that caused "energy emergencies", but the 2021 Event was by far the largest: "The unplanned generation outages that escalated during the Event were more than four times as large as the previous largest event, in 2011.
  - ii. A confluence of two causes, both triggered by cold weather, led to the Event, part of a recurring pattern for the last ten years.
    - First, generating units unprepared for cold weather failed in large numbers.
    - Second, in the wake of massive declines in natural gas production, and to a lesser extent, declines in natural gas processing, the natural gas fuel supply struggled to meet both residential heating load and electricity generating unit demand for natural gas.
  - iii. Unplanned outages of natural gas wellheads due to the freezing weather, beginning on approximately February 7, as well as unplanned outages of natural gas gathering and processing facilities, resulted in a decline of

natural gas available for supply and transportation to many natural gas-fired generating units in the South-Central U.S.

- iv. Once natural gas supply outages began at the wellhead, they rippled throughout the natural gas and electric infrastructure, causing processing outages and reductions. U.S. natural gas production in February 2021 experienced the largest monthly decline on record.
- v. During the week of February 7, ERCOT and SPP (Southwest Power Pool, including Oklahoma, Kansas, Nebraska, and parts of Texas) experienced rising load, as well as increasing generating unit outages, primarily caused by wind turbine blade freezing as a result of freezing precipitation, and natural gas fuel supply issues. Although ERCOT and SPP issued several alerts, they did not have to take any emergency actions because enough generation remained online to meet load.
- vi. **But the week of February 14 brought far colder weather**, and ERCOT, SPP and MISO (Midcontinent Independent Service Operator, in the upper Midwest) all faced emergency conditions simultaneously.
  - Temperatures dropped as low as six degrees Fahrenheit in Austin, eight degrees in Dallas and ten degrees in Houston.
  - Unplanned generating unit outages and derates (reductions in rated capacity of generating assets) in ERCOT escalated sharply in the late-night hours of February 14 into the early morning hours of February 15, and ERCOT set an all-time winter peak record for system load of 69,871 MW at 8:00 p.m. on February 14.
  - The combination of high load and increasing unplanned generating unit outages caused ERCOT's Physical Responsive Capability to drop below acceptable levels, and at 12:15 a.m., it issued the first stage of an Energy Emergency Alert (EEA).
- vii. Beginning in the early hours of February 15 at approximately 12:18 a.m., the ERCOT Interconnection frequency, which measures the balance of supply and demand on the BES (bulk electric system) and is thus a critical indicator of BES reliability status, began to fall below the normal band level.
  - At first ERCOT was able to recover its frequency to normal levels through deployment of load management measures, but it continued to suffer generating unit outages and needed to order its first 1,000 MW of "load shed" (where electricity is cut off to some consumers to reduce demand) at 1:20 a.m.

- As system frequency continued to fall, ERCOT operators ordered an additional 1,000 MW of load shed, but generating units continued to fail and frequency declined to the point that ERCOT operators had only nine minutes to prevent approximately 17,000 MW of generating units from tripping due to underfrequency relays, which could potentially cause a complete blackout of the ERCOT Interconnection.
  - ERCOT system frequency eventually bottomed out, and finally rose above the generator trip level after remaining below for over four minutes.
  - However, unplanned generating outages continued, and ERCOT system operators continued to shed load to balance demand against the massive generating unit losses.
  - For over two days, including generating units already on planned or unplanned outages when the Event began as well as unplanned outages that began during the Event, ERCOT averaged 34,000 MW of generation outages (based on expected capacity).
  - To balance ERCOT’s load against those staggering generation losses, ERCOT operators continued to order firm load shed, lasting nearly three consecutive days, and peaking at 20,000 MW by 7 p.m. on February 15.
- viii. From February 8 through 20 a total of 1,045 individual generating units—58 percent natural gas-fired, 27 percent wind, six percent coal, two percent solar, seven percent other fuels, and less than one percent nuclear—experienced 4,124 outages, derates or failures to start. Of those outages, derates, and failures to start, 75 percent were caused by either freezing issues (44.2 percent) or fuel issues (31.4 percent)
- b. The February 2021 grid failure caused loss of life, disruption for Texas families, and economic damage. (11)
- i. **More than 4.5 million people in Texas lost power** during the Event, and some went without power for as long as four days, while exposed to below-freezing temperatures.
  - ii. **At least 210 people died during the Event**, with most of the deaths connected to the power outages, of causes including hypothermia, carbon monoxide poisoning, and medical conditions exacerbated by below freezing temperatures.



- iii. **The Event caused over \$195 billion property damage**, including broken pipes which resulted in extensive water damage. (22)
  - iv. Analysts with the Federal Reserve Bank of Dallas estimated that the outages caused **direct and indirect losses to the Texas economy of between \$80 to \$130 billion**
- c. **Meanwhile, other states that endured freezing temperatures managed to keep electricity flowing, in part because their systems, in one form or another, put an emphasis on reliability. (12)**

### **3. What the Texas legislature has done since then to address the issues**

- a. In response to the February 2021 grid failure, the Texas Legislature developed and passed SB 2 and SB 3, which were signed into law by Governor Abbott in June 2021. (13)
- b. Texas Senate Bill 2 reduces the number of seats on the ERCOT board from 16 to 11 and the governor, lieutenant governor and speaker of the House now play key roles in appointing board members. (14)
  - i. Each of these officials appoint a member of a newly formed selection committee, which is responsible for appointing eight of the 11 ERCOT board members.
  - ii. The bill also requires that all members of the board reside in Texas.
- c. Texas Senate Bill 3 establishes a better alert system for potential outages, strengthens disaster preparedness, and calls on agencies to develop guidelines to ensure that key grid components are weatherized. (15)
- d. However, only some gas facilities will be required to "weatherize," just those deemed critical infrastructure necessary to maintain service. (13)

### **4. Why actions so far aren't enough**

- a. Although the Texas legislature acted in 2021 to pass SB 2 and SB 3, many experts say this is not enough to protect Texans from future outages.

- i. **Major issues are that the new rules are being implemented too slowly and allow for too many exceptions.**
  - ii. The Public Utility Commission followed the Legislature’s actions with a rule enacting the weatherization requirements. But the rule allows power plants to request an exception if they document their efforts to comply, explain why they couldn’t, and submit a plan to do so later. (16)
- b. The Texas Railroad Commission, which regulates the natural gas industry, has proposed a timeline that would identify, map, and impose weatherization mandates by early 2023 for gas producers that supply power plants. But the proposed rule allows gas companies to opt out of the “critical infrastructure” classification and avoid having to weatherize their equipment. (16)
  - i. In November 2021 the Railroad Commission approved a rule outlining which Texas natural gas suppliers need to be ready to operate during energy emergencies. (21)
  - ii. The rule creates a process to designate certain parts of that supply chain as “critical infrastructure.” The designation means the gas wells, compressor stations, pipelines and other components that produce and move gas to power plants should not have their power cut by utilities in an effort to conserve.
  - iii. Infrastructure deemed “critical” must also weatherize to be able to run even in extreme conditions.
  - iv. The new rule makes it harder for utilities to opt out of the “critical infrastructure” category. However, it is unclear what deadlines will be applied for compliance. In addition, none of the new rules will take place before mid-2022.
- c. As a result of these gaps, Texas has done “next to nothing” to weatherize its natural gas supply according to Doug Lewin, an Austin-based energy consultant. “We don’t have a regulatory system in place that holds the industry accountable. That is the problem,” Lewin said. “It’s not a technology or engineering problem. It’s a regulatory problem.”
- d. This becomes clear when you consider that many parts of the US regularly experience much colder temperatures than Texas experienced in February 2021, without causing grid failures.

- e. The Texas grid also experienced **significant outages in the summer of 2021** due to extreme heat. The provisions of SB 3, which focuses on protecting power plants against extreme cold, does not address summer shortages. (17)
  - i. The grid was again placed at risk by extreme heat waves in the summer of 2022 (23), which drove record demand levels.
  - ii. ERCOT asked residential and commercial customers to voluntarily cut back on usage, which narrowly avoided rolling involuntary blackouts.
  - iii. These challenges will become more common as climate change continues to increase the severity and likelihood of extreme heat waves.
  
- f. Texas residents recognize that the Legislature has not done enough to ensure grid integrity. **An October 2021 survey found that only 18% of Texans approve of how lawmakers have handled electric grid reliability. 60% disapprove** (22% said they had no opinion or didn't know). Of the Texans expressing an opinion on the Legislature's actions, they disapprove by a margin of more than 3 to 1.
  
- g. **The bottom line is that Texas' electricity grid is still at risk from extreme weather - winter and summer.**

## **5. What needs to be done to ensure Texas has a reliable supply of electricity for the future.**

- a. Experts in Texas have pointed out that while SB 2 and SB 3 are steps in the right direction, they do not go far enough. For example:
  - i. They allow electricity producers to opt out of the "Critical Infrastructure" category and avoid having to fully winterize
  - ii. They only focus on cold weather, and not summer extremes.
  
- b. To identify policy initiatives to improve Texas grid reliability, we looked at recommendations from the Federal Energy Regulatory Commission (FERC) (11), the Houston Advanced Research Center (19) and others. Commonly mentioned recommendations include:
  - i. **Ensure that the grid is effectively weatherized**
    - This needs to address both extreme cold in winter and extreme heat in summer.

- The Texas Legislature needs to ensure that the provisions of SB2 and SB3 are implemented, and that loopholes and exceptions don't undermine the objective of grid reliability.
  - Recommendations contained in the in-depth review by FERC can help to ensure this objective is met. (11)
- ii. **Increase the use of "Demand Response" to better manage the demand side of the equation (20)**
- "Demand Response" tactics enable the grid operators to reduce demand in non-critical areas when grid reliability is threatened.
    - a. For example, companies can agree that certain activities be turned off if needed, so that critical activities are less affected.
    - b. Households can agree that their thermostats are turned up a little when demand peaks
  - Electricity consumers are provided with financial incentives to participate in demand response programs.
- iii. **Encourage conservation and energy efficiency**
- As the Texas population grows, and as climate change pushes up summer extreme temperatures, the strain on the grid will grow.
  - The American Council for an Energy Efficient Economy has proposed measures that could reduce demand, and thereby reduce the risk of grid failure in extreme heat events. (25)
- iv. **Look at ways to reduce risk by interconnecting the Texas grid to one or both of the major U.S. grids.**
- By covering a large and diverse geographic area, a larger grid helps to spread out demand spikes.
  - Connection with the larger grids could also improve Texas' ability to sell excess capacity (e.g from our abundant wind resources) to areas that need the power.
- v. **Call for a long-range risk and capacity analysis by ERCOT**
- There are many risks to grid reliability beyond extreme temperatures, including severe weather events such as hurricanes.

- Demand for electricity is projected by ERCOT to grow faster in the next 10 years than in the past 10 years. We need to ensure that plans are in place to meet this demand while ensuring reliability.

## More Information

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