Causes and Costs of ERCOT Load Sheds in February 2021

Preliminary (February 24)

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Agenda

- ERCOT Background
- Sequence of Events for ERCOT Load Sheds
- Causes of ERCOT Load Sheds
- Costs for ERCOT Electricity
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ERCOT Background

The Electric Reliability Council of Texas (ERCOT) is a nonprofit organization that ensures reliable electric service for 90 percent of the state of Texas. The grid operator is regulated by the Public Utility Commission of Texas and the Texas Legislature.

ERCOT has four primary responsibilities:
- Maintain system reliability.
- Facilitate a competitive wholesale market.
- Facilitate a competitive retail market.
- Ensure open access to transmission.

ERCOT has more than 26 million customers in the ERCOT region. More than 26 million customers in the ERCOT region.

The peak demand in 2021 was 74,820 MW, which is higher than the previous peak demand of 73,821 MW recorded in 2020. 1 MW of electricity can power about 200 Texas homes during periods of peak demand.

381 billion kilowatt-hours of energy were used in 2020, a 0.5 percent decrease compared to 2019.
Sequence of Events for ERCOT Load Sheds

- February 14 – ERCOT requests energy conservation during forecasted cold snap

- February 15
  - ERCOT initiates load sheds at 1:25 am after steep declines in gas, coal, and wind generation
  - Unit 1 at South Texas Project nuclear plant trips at 5:37 am
  - Estimated demand (based on forecast) hits 77 GW at 11:00 am, compared to extreme winter planning of 67 GW
  - Wind generation falls to 0.6 GW out of 7.1 GW planned capacity at 8:00 pm
  - Estimated load shed peaks at 29 GW at 11:00 am
  - Texas state outages impact over 35% (4,395,193 out of 12,448,564) of customers at 10:11 pm

- February 16-18 – Continued significant load sheds

- February 19 – Resumed normal operations at 10:35 am
Causes of ERCOT Load Sheds
Winter 2020-2021 Seasonal Resources in ERCOT—83 GW

- Natural Gas: 66.8%
- Coal: 16.5%
- Nuclear: 6.2%
- Solar: 0.4%
- Wind-Coastal: 2.2%
- Wind-Other: 4.6%
- Wind-Panhandle: 1.7%
- Imports: 1.0%
- Biomass: 0.1%
- Hydro: 0.4%

Source: ERCOT Winter 2020-2021 SARA; Resilient Societies analysis. Note: Thermal plant capacity not derated in 83 GW total.
Extreme Weather Derating Factors for ERCOT Winter Resource Planning

- Thermal Plants: 81%
- DC Imports: 69%
- Hydroelectric: 54%
- Wind-Coastal: 43%
- Wind-Panhandle: 32%
- Wind-Other: 19%
- Solar: 7%

Source: Winter 2020-2021 Seasonal Assessment of Resource Adequacy for ERCOT, Resilient Societies analysis
Estimated Demand vs. Resources Available During February Load Sheds

Source: EIA Hourly Electric Grid Monitor data, Resilient Societies analysis
Estimated Peak Demand on Feb 15 at 11am vs. Resources

Previous Winter Peak on Jan 17 2018
- Planned Demand: 65,915 MW

Extreme Scenario Planned Peak
- Planned Demand: 67,208 MW

Planned Resources for Winter 2020-2021
- Planned Demand: 60,048 MW
  - Thermal Plants: 41,997 MW
  - Wind: 7,070 MW
  - Imports: 3,969 MW
  - Solar: 1,824 MW
  - Hydro
  - Operating Reserves

Actual Resources on Feb 15 at 11am
- Planned Demand: 76,783 MW
  - Thermal Plants: 1,824 MW
  - Wind: 3,969 MW
  - Imports: 1,824 MW
  - Solar
  - Hydro
  - Operating Reserves

Source: EIA Hourly Electric Grid Monitor data, ERCOT Winter 2020-2021 SARA, Resilient Societies analysis. Note: Extreme Scenario Planned Peak = 57,699 MW forecast plus 9,509 Seasonal Load Adjustment plus 1,352 Operating Reserves
Contributions to Load Sheds at Estimated Peak Demand on Feb 11 at 11am

- Demand Over Planned Scenario: 9,575 MW
- Thermal Plant Outages: 18,051 MW
- Wind Turbine Deficits: 3,101 MW
- Hydro Holdbacks: 160 MW
- Imports: 23 MW
- Solar Surplus: -1,520 MW

Source: EIA Hourly Electric Grid Monitor data, ERCOT Winter 2020-2021 SARA, Resilient Societies analysis
Costs for ERCOT Electricity
ERCOT Wholesale Prices During Cold Snap

DAM Prices Feb 14-20

Source: ERCOT MIS
How Much Did the February 2021 Cold Snap Cost?

Excerpt from Financial Times on February 19, 2021
https://www.ft.com/content/0e746280-e72c-4087-9c0d-df2a7af82b77

- Sanity check Using Day Ahead Market Settlement Price Point (DAM SPP):
  - ~$7,500 / MW-Hour x 47,000 MW x 5 days x 24 hours / day= $42B
- Typical wholesale cost of electricity ~ $40 / MW-Hour
- *Ongoing debate on whether price charged should be adjusted (upward)*
PJM Is Colder Than Texas

Cooling Degree Days (65°F) = 1515
Heating Degree Days (65°F) = 4897

https://www.degreedays.net/

Cooling Degree Days (65°F) = 2849
Heating Degree Days (65°F) = 2874

https://www.degreedays.net/
ERCOT “Energy Only” vs. PJM Capacity Market

Figure 2: Comparison of All-in Prices Across Markets

Key Points for Texans
Cost Comparison: “Energy Only” vs. Capacity Contracts

- ERCOT Suffered a “Deep Freeze” in 2011; FERC-NERC Staffs identified winterizing protections in August 2011, but with energy-only pricing, financial incentives for winter resilience were largely absent.

- ERCOT Usage 2011 – 2020 = 3,530 Terawatt-Hour (TW)
  Source: ERCOT Factsheets (e.g., p. 3)

- PJM Average Capacity Cost 2011 – 2020 = $93.7 / MW-day

- ERCOT Estimated Cost for 2011-2020 at PJM Capacity Rate:
  3,530 TW-Hour x $93.7 / MW-day X 1,000,000 MW/TW x day / 24 hours = $14B

- ERCOT Estimated Cost for February 2021 Cold Snap:
  ~$7,500 / MW-Hour x 47,000 MW x 5 days x 24 hours / day = $42B

Would Texas consumers rather pay $14B for 10 years of weatherization under capacity contracts or $42B for five days of exorbitant prices that might incent generators to weatherize?
Future of Texas “Energy Only” Market

- Texas suffered prolonged extreme cold which resulted in great loss, but these temperatures should have been expected
  - ~10 degrees colder than 2011 Cold Snap (Dallas, Houston)
  - But ~10 degrees above all-time record lows (Dallas, Houston)
- Extreme cold led to record high electricity prices
  - Financial losses – and gains – of approximately $40B-$50B
  - Load sheds might have been avoided by investing ~$14B for protections in decade after 2011 Cold Snap (assuming same rates as PJM Capacity Market)
- “Energy Only” Market behaved as might be expected
  - Extremely high prices send “signals” to generators, transmission and fuel suppliers, but will they invest to protect against infrequent events?
- Do Texans want to keep the “Energy Only” Market going forward?
Summary

- **Causes of ERCOT Load Sheds**
  - Demand far above ERCOT planning scenario
  - Underperformance of thermal generation plants (natural gas, coal, and nuclear) and wind generation plants

- **Costs to Incent Reliable Electricity**
  - $42+B for five days in ERCOT
  - $14B for ten years in PJM

- **ERCOT “Energy Only” Market has resulted in exorbitant costs but inadequate protections**

- **When Texas repeatedly raises price caps for the electricity market and still has multi-sector reliability issues, are resilience contracts and associated penalties needed?**