

Causes and Costs of ERCOT Load Sheds in February 2021

Preliminary (February 24)

Causes: Thomas Popik, Chairman and President

Costs: Richard Humphreys, Director

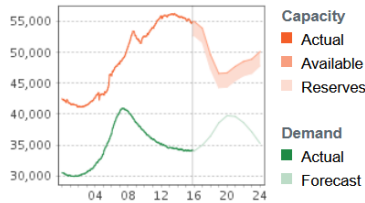
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Agenda

- ❑ ERCOT Background
- ❑ Sequence of Events for ERCOT Load Sheds
- ❑ Causes of ERCOT Load Sheds
- ❑ Costs for ERCOT Electricity
- ❑ Key Points for Texans
- ❑ Summary

ERCOT Background

TODAY'S OUTLOOK



Current Demand: 34,176 MW

Last Updated: Feb 22, 2021 - 15:49

GRID CONDITIONS

Normal Conditions

Operating Reserves: 7,569 MW

Last Updated: Feb 22, 2021 - 15:49

<http://www.ercot.com/>

MARKET CONDITIONS

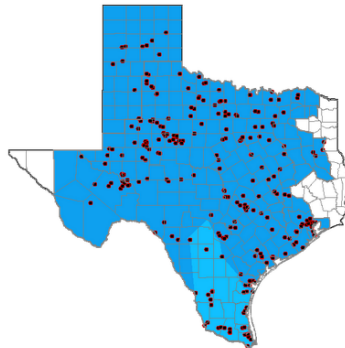
View Real-Time Market

View Day-Ahead Market (DAM)


View CRR Information

WHOLESALE PRICES

View Real-Time resource node prices across the region.



http://www.ercot.com/content/wcm/lists/219736/ERCOT_Fact_Sheet_2.12.21.pdf



Fact Sheet

February 2021

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.

90 percent

of Texas Load

More than **26 million** customers in the ERCOT region

15 percent

of load is competitive-choice customers — nearly 8 million electric-service IDs (premissas)

- 1,800+ active market participants that generate, move, buy, sell or use wholesale electricity
- 86,000+ megawatts (MW) of expected capacity for summer 2021 peak demand
- 710+ generating units, excluding PUNs
- Transmission projects endorsed in 2020 total \$1,071 million
- 46,500+ miles of high-voltage transmission

- Wind Generation record: 22,893 MW (Jan. 14, 2021)
- Wind Penetration record: 60.4 percent (Jan. 30, 2021)
- 25,121 MW of installed wind capacity as of Jan. 2021, the most of any state in the nation
- 3,854 MW of utility-scale installed solar capacity as of Jan. 2021
- 225 MW of installed battery storage as of Jan. 2021

74,820 MW

Record peak demand (Aug. 12, 2019)

73,821 MW

Weekend peak demand record (Aug. 15, 2020)

1 MW of electricity can power about 200 Texas homes during periods of peak demand.

2021 Generating Capacity

Reflects operational installed capacity based on the December 2020 CDR report

51.0% Natural Gas	24.8% Wind	13.4% Coal	4.9% Nuclear	3.8% Solar	1.9% Other*	0.2% Storage
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*Other includes hydro, biomass-fired units and DC tie capacity

2020 Energy Use

45.5% Natural Gas	22.8% Wind	17.9% Coal	10.9% Nuclear	2.9% Other*
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*Other includes solar, hydro, petroleum coke, biomass, landfill gas, distillate fuel oil, net DC tie and Black Load Transfer import/exports and an adjustment for wholesale electric load.

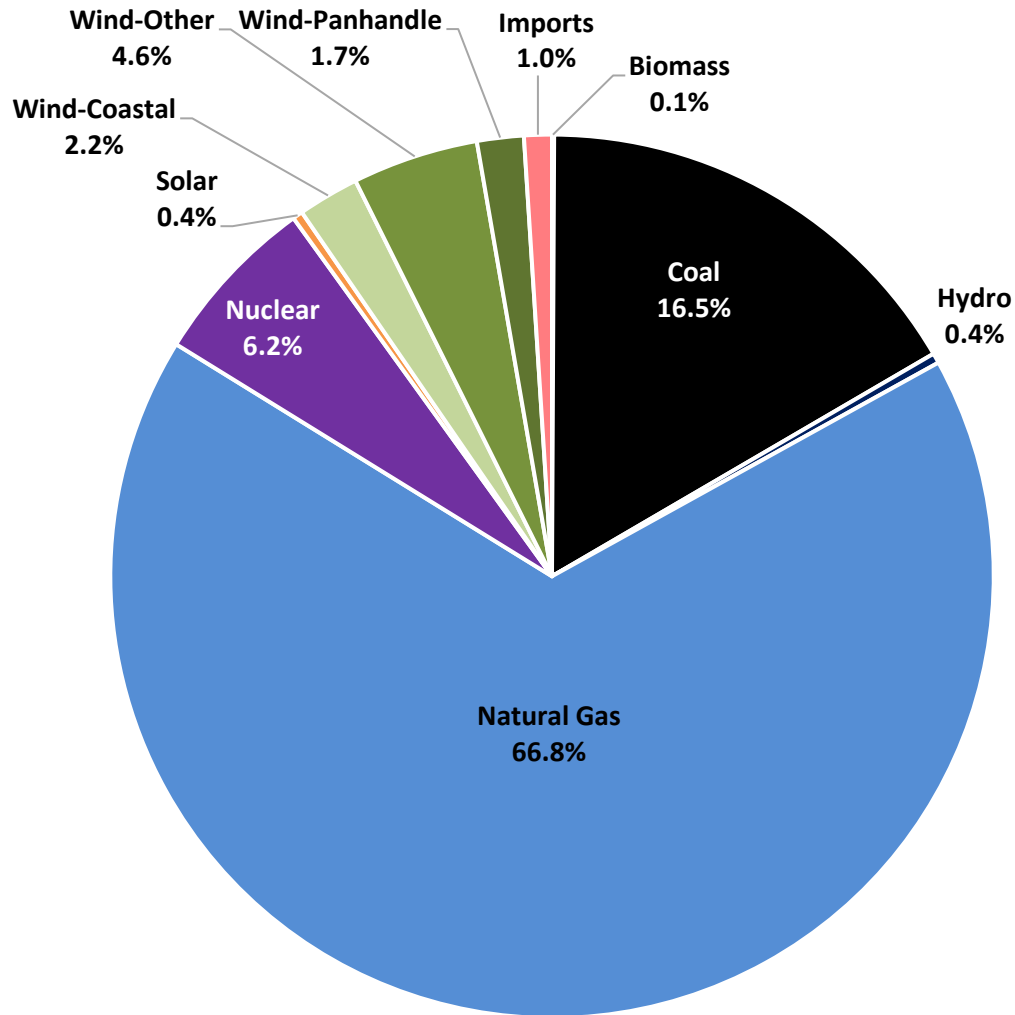
381 billion kilowatt-hours of energy were used in 2020, a 0.5 percent decrease compared to 2019.

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

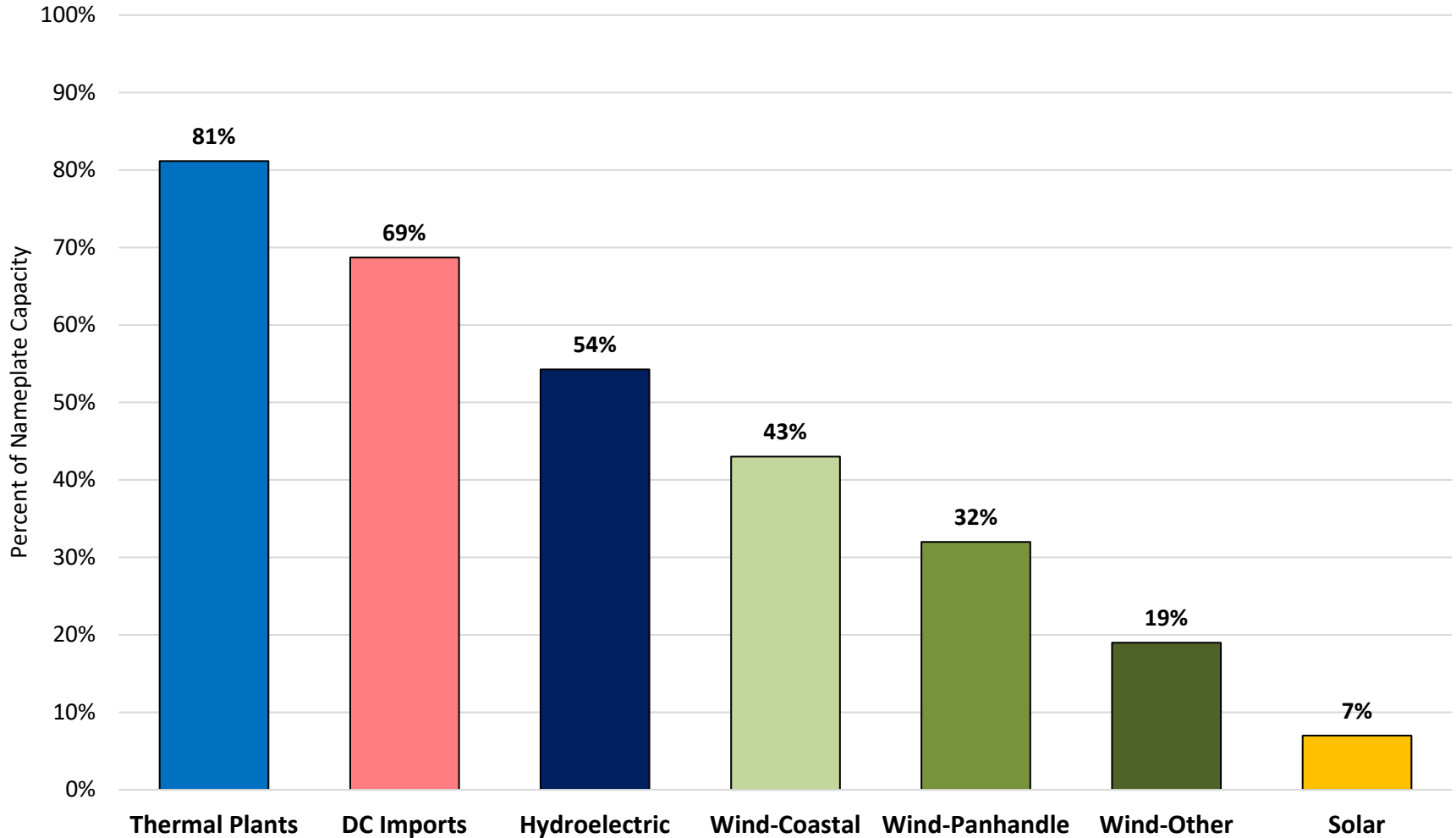
Causes of ERCOT Load Sheds

Winter 2020-2021 Seasonal Resources in ERCOT—83 GW



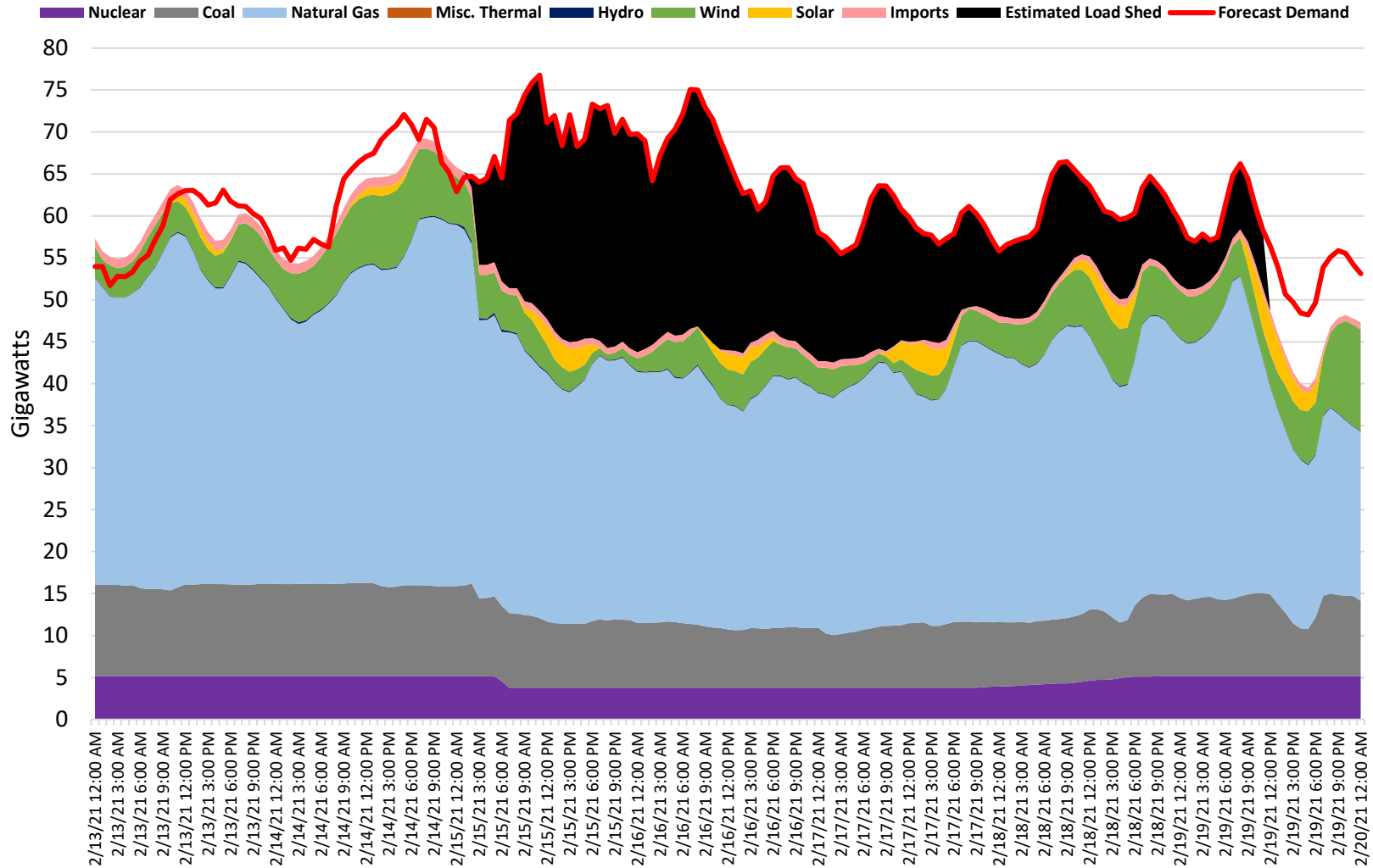
Source: ERCOT Winter 2020-2021 SARA; Resilient Societies analysis. *Note: Thermal plant capacity not derated in 83 GW total.*

Extreme Weather Derating Factors for ERCOT Winter Resource Planning



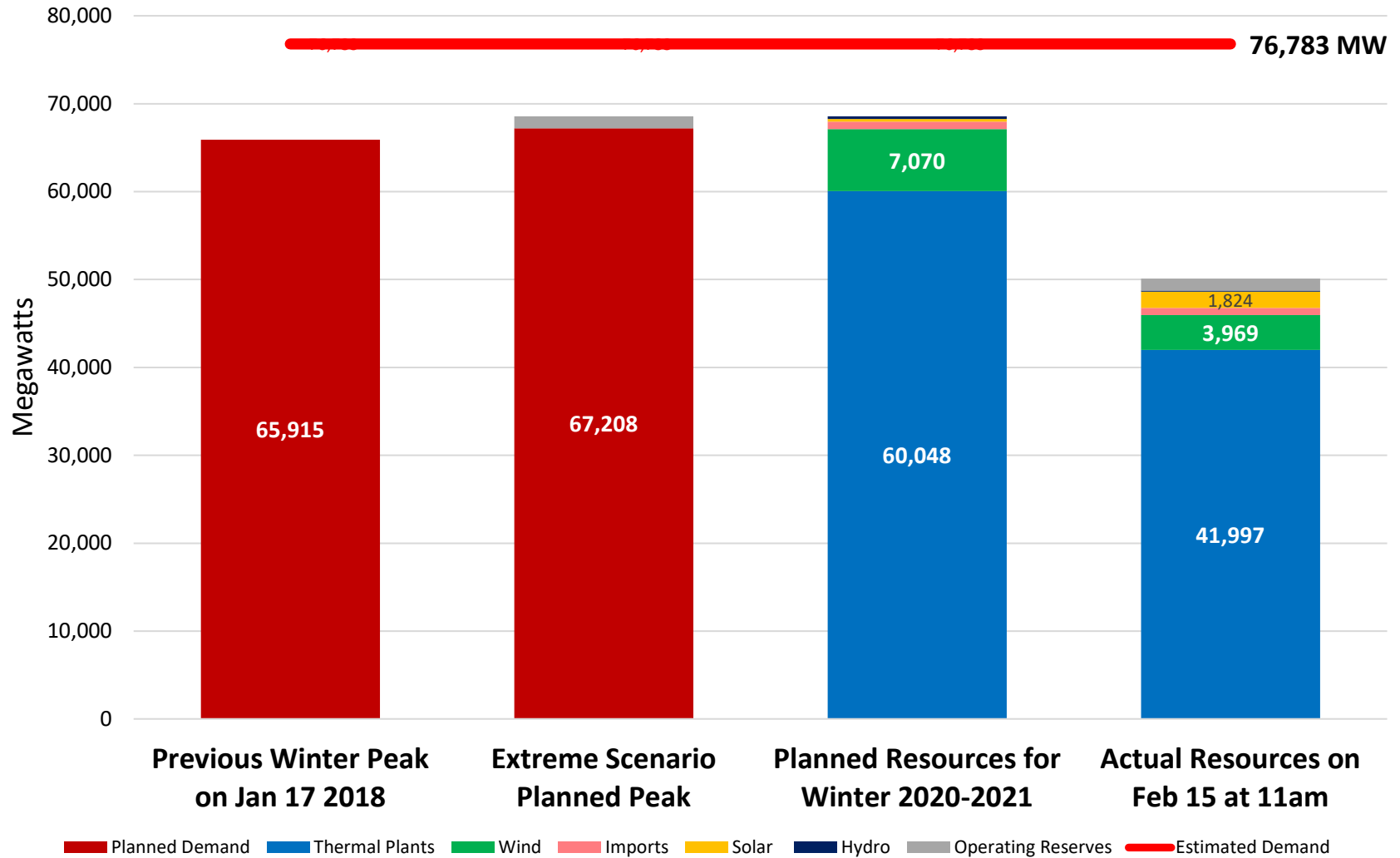
Source: Winter 2020-2021 Seasonal Assessment of Resource Adequacy for ERCOT, Resilient Societies analysis

Estimated Demand vs. Resources Available During February Load Sheds



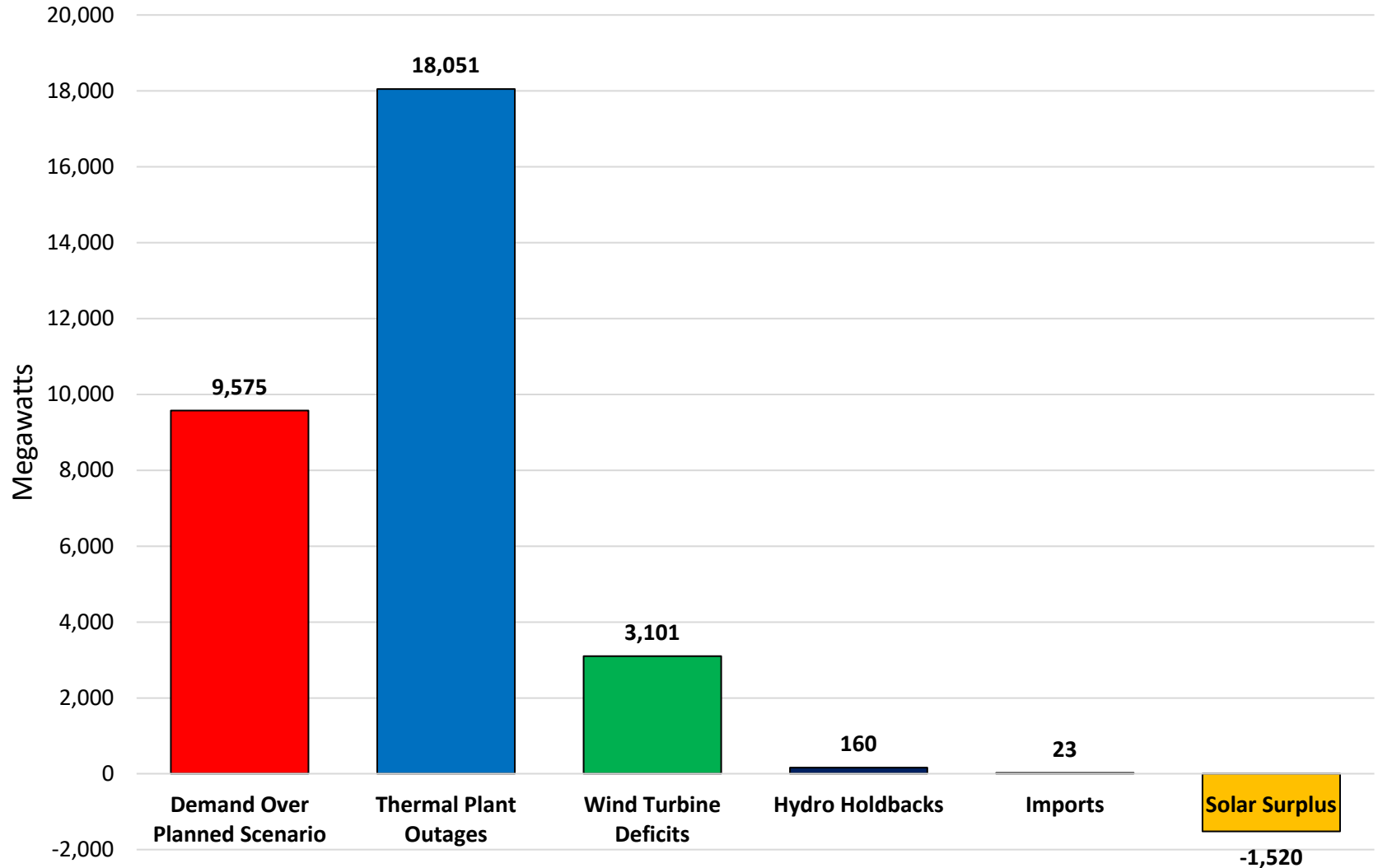
Source: EIA Hourly Electric Grid Monitor data, Resilient Societies analysis

Estimated Peak Demand on Feb 15 at 11am vs. Resources



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

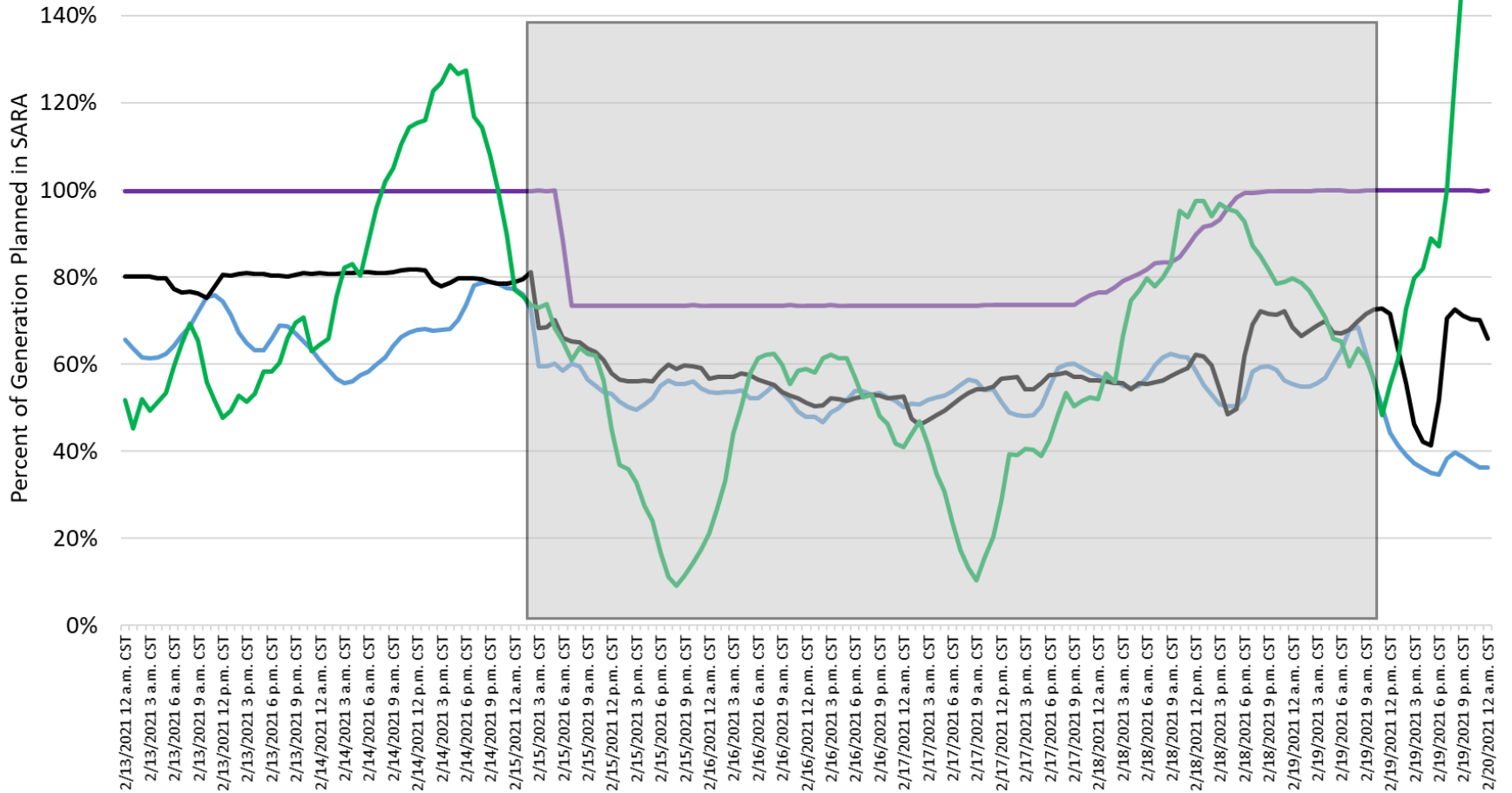
Contributions to Load Sheds at Estimated Peak Demand on Feb 11 at 11am



Source: EIA Hourly Electric Grid Monitor data, ERCOT Winter 2020-2021 SARA, Resilient Societies analysis

Actual Generation as a Percent of Planned Extreme Weather Capacity

— Natural Gas — Coal — Nuclear — Wind — Load Shed Period



Source: EIA Hourly Electric Grid Monitor Data, ERCOT Winter 2020-2021 SARA, Resilient Societies analysis

Costs for ERCOT Electricity

How Much Did the February 2021 Cold Snap Cost?

\$50bn

Texas wholesale power sales this week

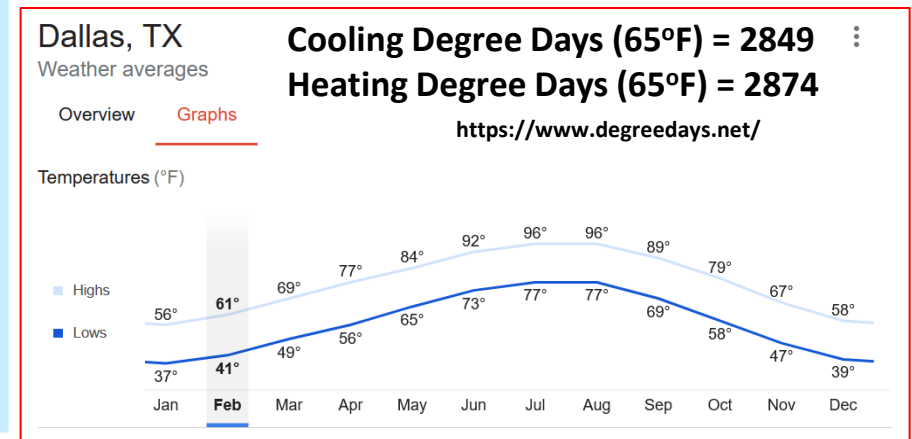
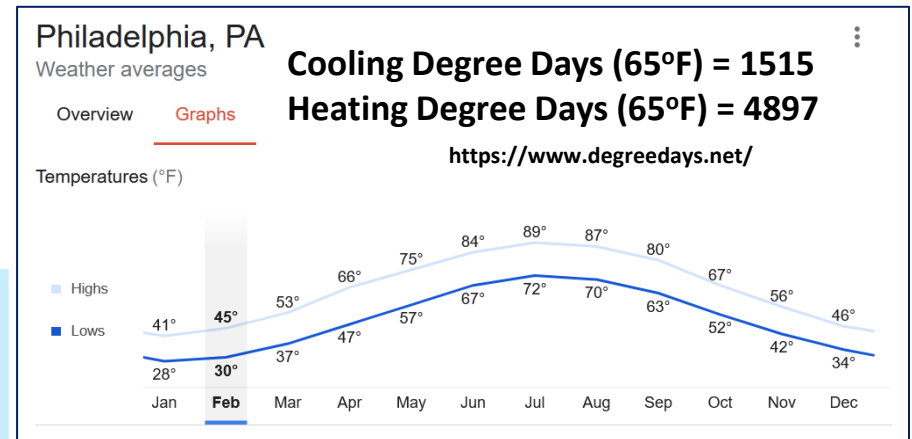
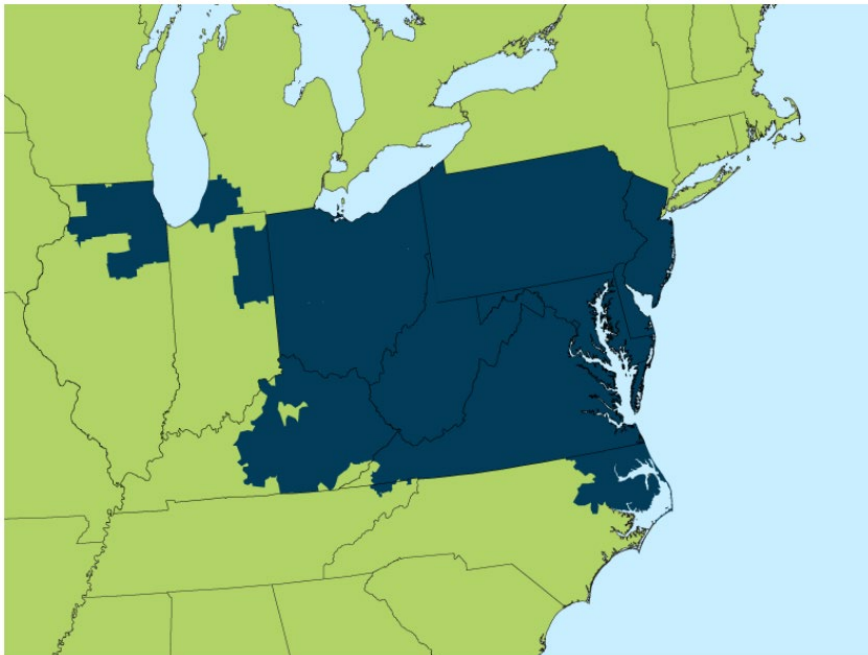
Ercot declined to provide more recent data, but the value was likely to have grown sharply over the week, since it is based on a formula that encompasses average prices over the preceding several days, traders said. Ercot hosted a record \$50bn in sales during the week, said BloombergNEF, a research group.

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)*

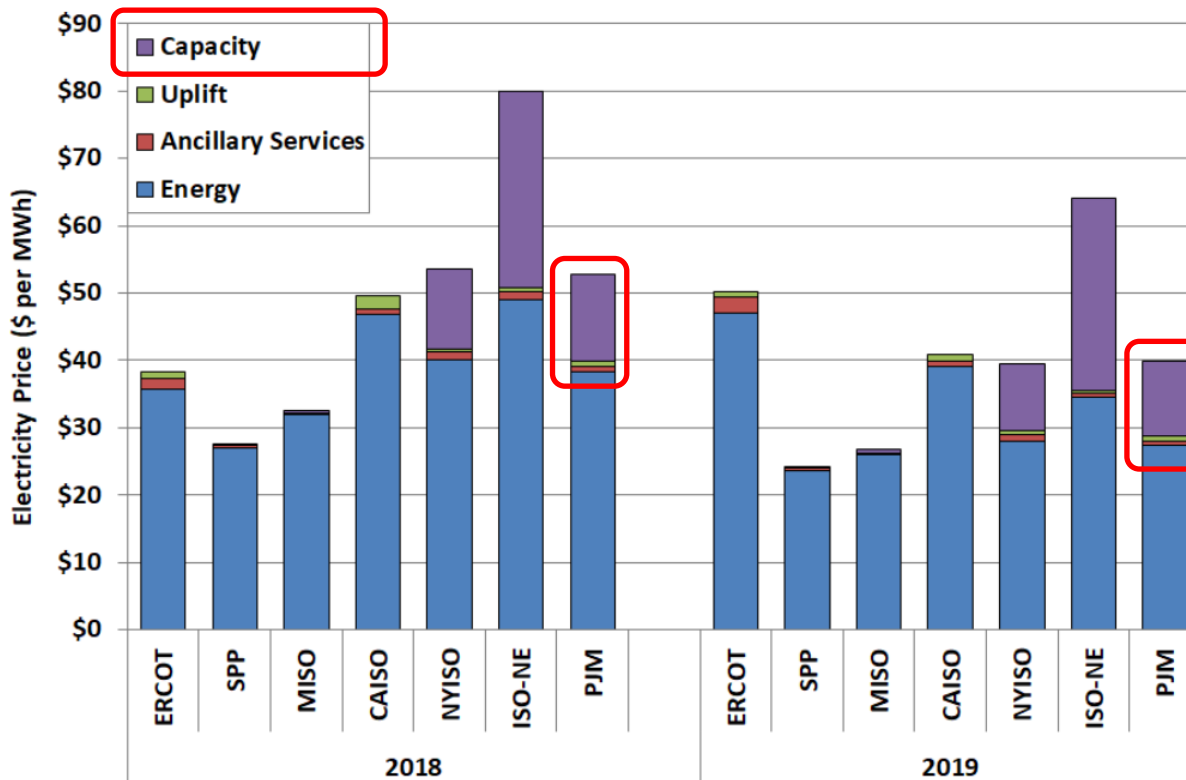
PJM Is Colder Than Texas



ERCOT “Energy Only” vs. PJM Capacity Market

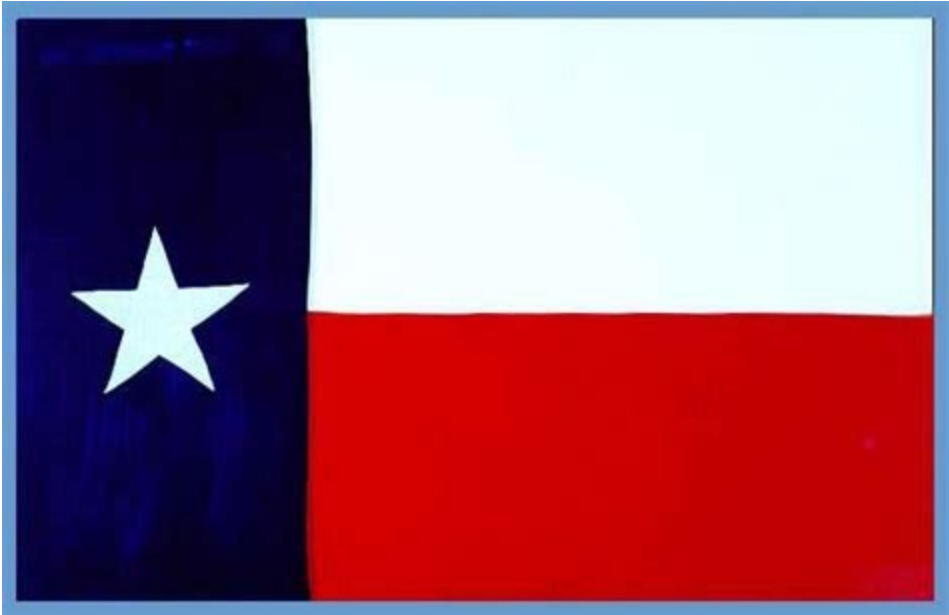
Review of Real-Time Market Outcomes

Figure 2: Comparison of All-in Prices Across Markets



Source: p. 4 of <https://www.potomaceconomics.com/wp-content/uploads/2020/06/2019-State-of-the-Market-Report.pdf>

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

Source: <https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2021-2022/2021-2022-base-residual-auction-report.ashx>

- ❑ ERCOT Estimated Cost for 2011-2020 at PJM Capacity Rate:

$3,530 \text{ TW-Hour} \times \$93.7 / \text{MW-day} \times 1,000,000 \text{ MW/TW} \times \text{day} / 24 \text{ hours} = \14B

- ❑ ERCOT Estimated Cost for February 2021 Cold Snap:

$\sim \$7,500 / \text{MW-Hour} \times 47,000 \text{ MW} \times 5 \text{ days} \times 24 \text{ hours} / \text{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?