



Review of February 2021 Extreme Cold Weather Event – ERCOT Presentation

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ERCOT

Urgent Board of Directors Meeting

ERCOT Public
February 24, 2021

Disclaimer

Information in this presentation is preliminary and represents the best available data at the time it was created.

ERCOT Corporate Governance

- **Founded in 1970**
- **Texas non-profit corporation with members from seven market segments:**
 - Consumers (Commercial, Industrial, Residential)
 - Cooperatives
 - Independent Generators
 - Independent Power Marketers
 - Independent Retail Electric Providers
 - Investor-Owned Utilities
 - Municipals
- **The Texas Legislature enacted laws which govern all activities of ERCOT – See Public Utility Regulatory Act (PURA) Section 39.151.**
- **The Public Utility Commission of Texas (PUC) has complete authority over ERCOT’s finances, budget and operations, with oversight by the Texas Legislature.**
 - Approves ERCOT Bylaws
- **16-member ERCOT Board composition is established by law:**
 - 5 Unaffiliated Directors (independent from ERCOT Market Participants); all must be approved by the PUC for three-year terms with a maximum of two renewals
 - 8 Directors each elected annually by different Market Segments
 - Office of Public Utility Counsel (represents Residential Consumer Market Segment)
 - ERCOT Chief Executive Officer
 - PUC Chairman (non-voting)



ERCOT's Role

- **Fulfills four responsibilities required by law as the independent organization certified by the PUC (PURA Section 39.151):**
 - Maintain electric system reliability
 - Facilitate a competitive wholesale market
 - Ensure open access to transmission
 - Facilitate a competitive retail market
- **Manages the flow of electric power over the bulk power system to approximately 26 million Texas end-use customers.**
 - About 90% of the state's electric load
 - Over 680 generation units
 - Over 46,500 miles of transmission lines
- **Must, at all times (24/7/365), balance all consumer demand in the ERCOT region (load) and the power supplied by companies who generate electricity (generation) while maintaining system frequency of 60 Hz.**
- **Performs financial settlement for the competitive wholesale bulk power market and administers retail switching for nearly 8 million premises in competitive choice areas.**

ERCOT's Role (continued)

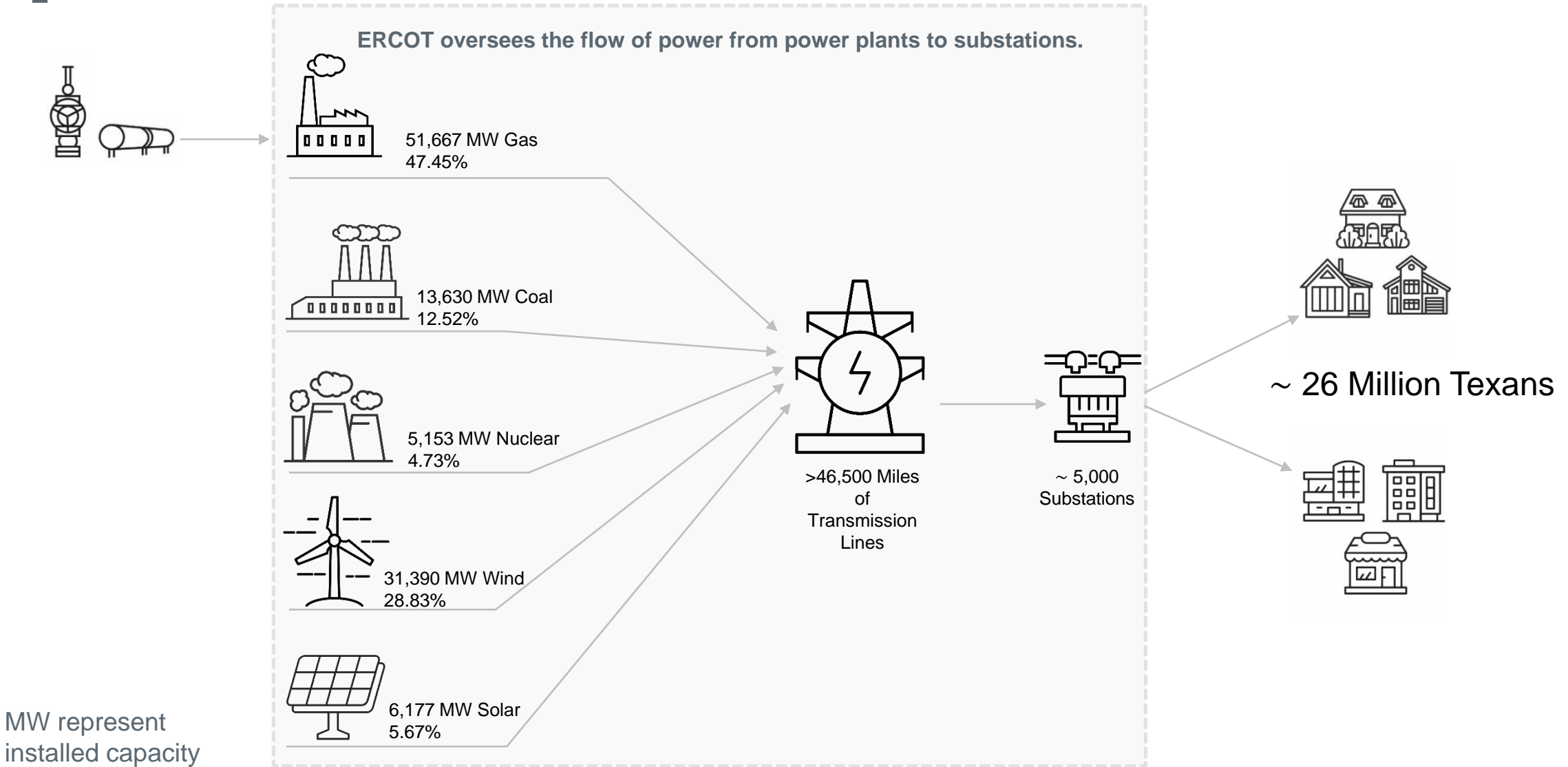
ERCOT does not:

- Own, operate or have any enforcement authority over any electric generation facilities or any electric transmission or distribution lines or substations.
- Sell or send bills for retail electricity to residences or businesses.
- Control or operate electric service to local areas, neighborhoods or individual premises.
- Establish pricing or rates for retail electric customers.
- Have any direct customer relationships with the public.

ERCOT Budget & Funding

- **Budget is approved by the Board and the PUC biennially.**
- **Funded by a System Administration Fee to cover its system costs.**
 - Current fee is 55.5 cents per megawatt hour (MWh).
 - One megawatt of electricity can power about 200 Texas homes during periods of peak demand.
 - Average cost of \$7/year (50-60 cents/month) for residential households.
- **ERCOT does not set consumer electric rates.**
 - Rates are either set by the PUC or companies that sell electricity at retail to end-use customers.
 - Additional transmission costs are proportionally passed on to customers.

Electric Generation, Transmission & Distribution Overview



Pre-Event Operational Preparation

- Canceled transmission maintenance outages affecting over 1,600 transmission devices and delayed other outages.
- Reviewed planned generation outages for potential early return to service.
- Noted potential for 11,100 MW of forced outages due to gas restrictions based on gas company communications – more units affected during this event compared to previous cold weather events.
- Began using maximum icing potential for wind forecasts.
- Waived COVID restrictions and brought additional support staff on-site.
- Prepared facilities for extended on-site staffing, activated additional remote engineering/support staff.
- Began regular calls with Chief System Operators (18 over 8 days).
- Requested TCEQ/DOE enforcement discretion for power plant emissions during anticipated event.
- Supported Railroad Commission of Texas review of natural gas priority.

All available generation was online on February 14.

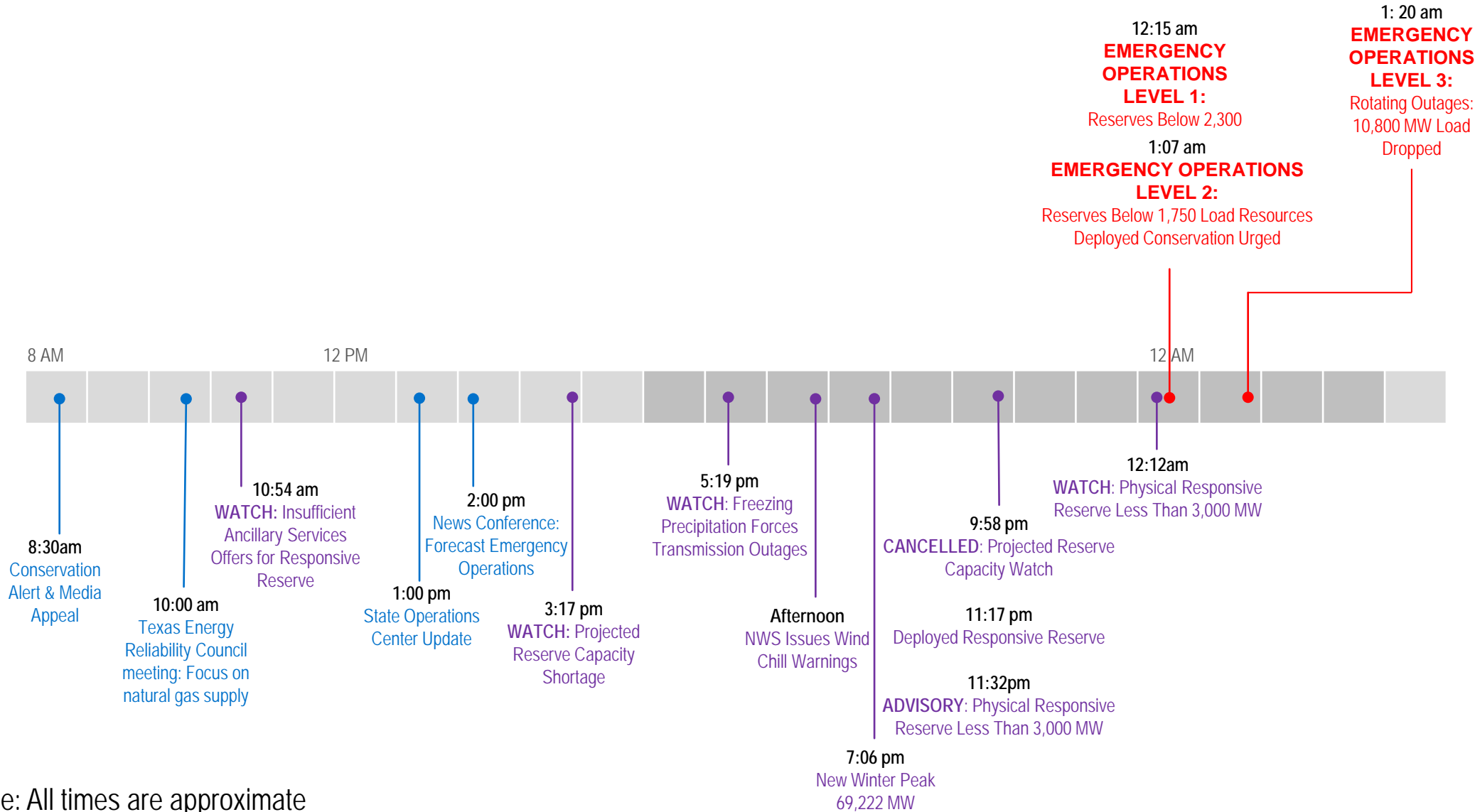
Pre-Event Communications

- November 5 ERCOT meteorologist issues winter outlook for Market Participants and public noting the “very good” chance for an extreme cold weather event during winter 2020/2021.
- February 3 ERCOT meteorologist warns Market Participants and the public of coldest weather of the year. Weather updates continue.
- February 8 Operating Condition Notice issued for extreme cold weather event, posted on public website.
- February 10 Advisory issued for extreme cold weather event posted on public website. Issued grid conditions update for market media representatives.
- February 11 Watch issued for cold weather event (hotline calls made, notice to Market Participants, posted on public website). News release on extreme weather expected, social media outreach.
- February 12 Texas Energy Reliability Council meeting.
- February 13 State Operations Center news conference: forecast Conservation Alert.
Emergency notice issued for extreme cold weather event, posted on public website.
Texas Energy Reliability Council meeting.
- February 14 Issued conservation appeal by news release, performed social media outreach, held media briefing.

Overview of Cold Weather Event

- Record-setting, sub-freezing temperatures and wind chills across the state.
- Approximately 48.6% of generation was forced out at the highest point due to the impacts of various extreme weather conditions.
- Controlled outages were implemented to prevent statewide blackout.
 - Electric demand had to be limited to available generation supply.
- Local utilities were limited in their ability to rotate outages due to the magnitude of generation unavailability and the number of circuits with critical load.

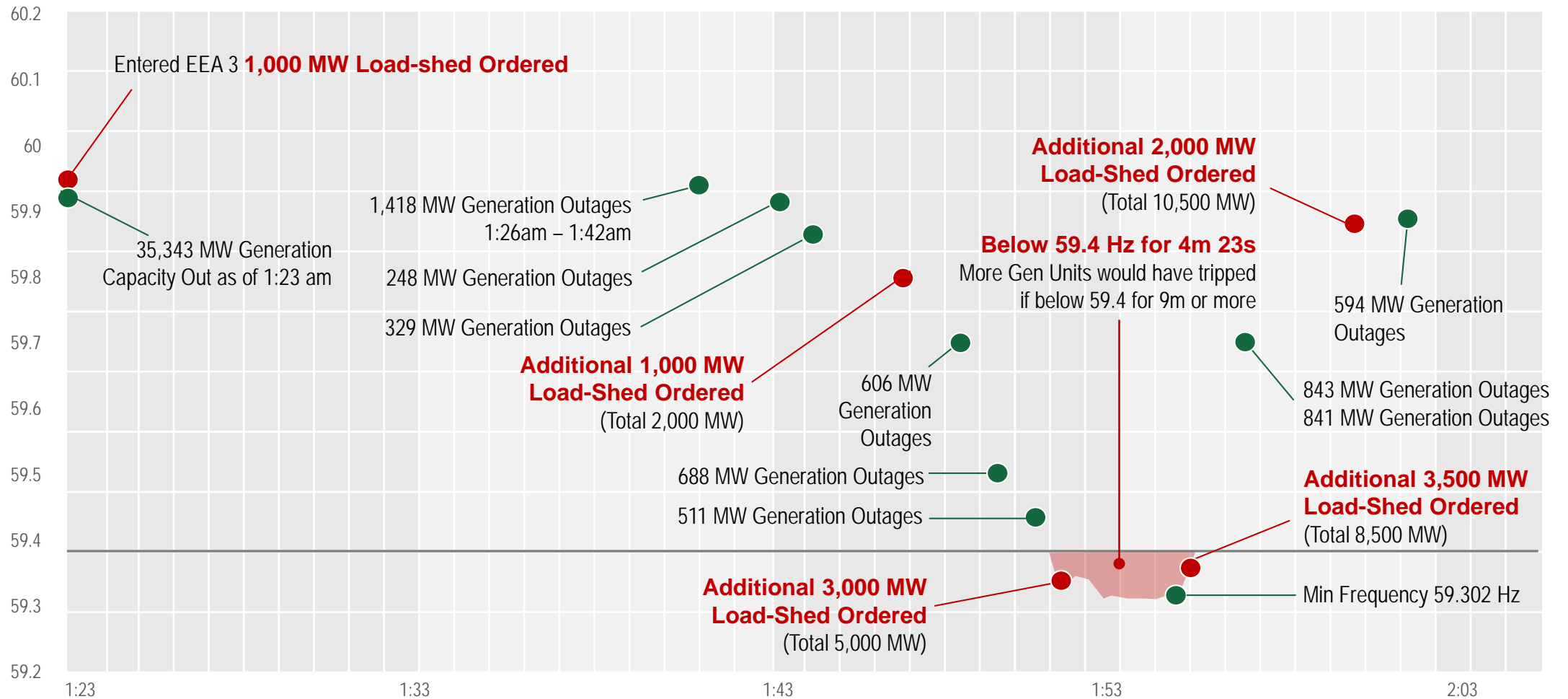
Sunday, February 14 – Monday, February 15



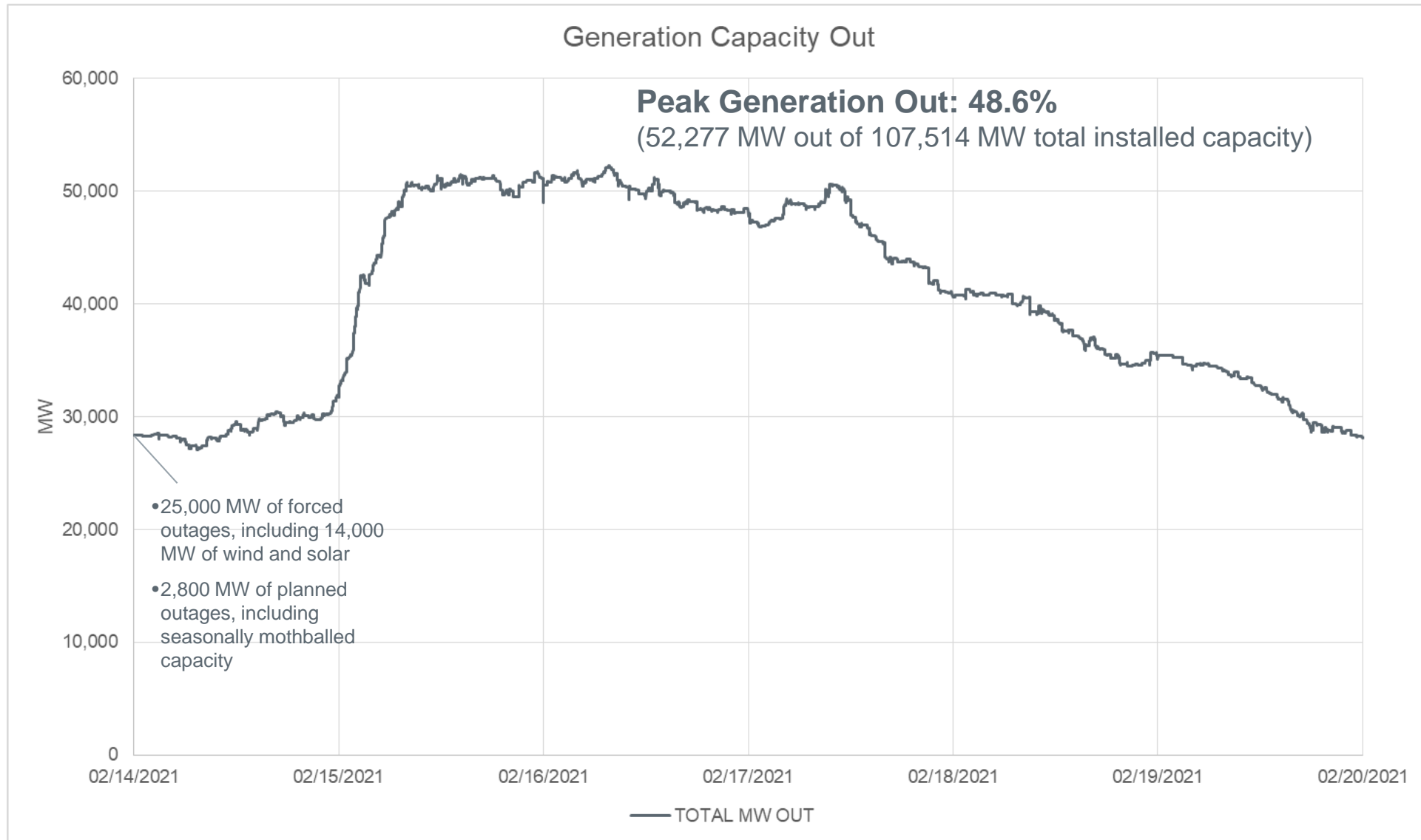
Note: All times are approximate



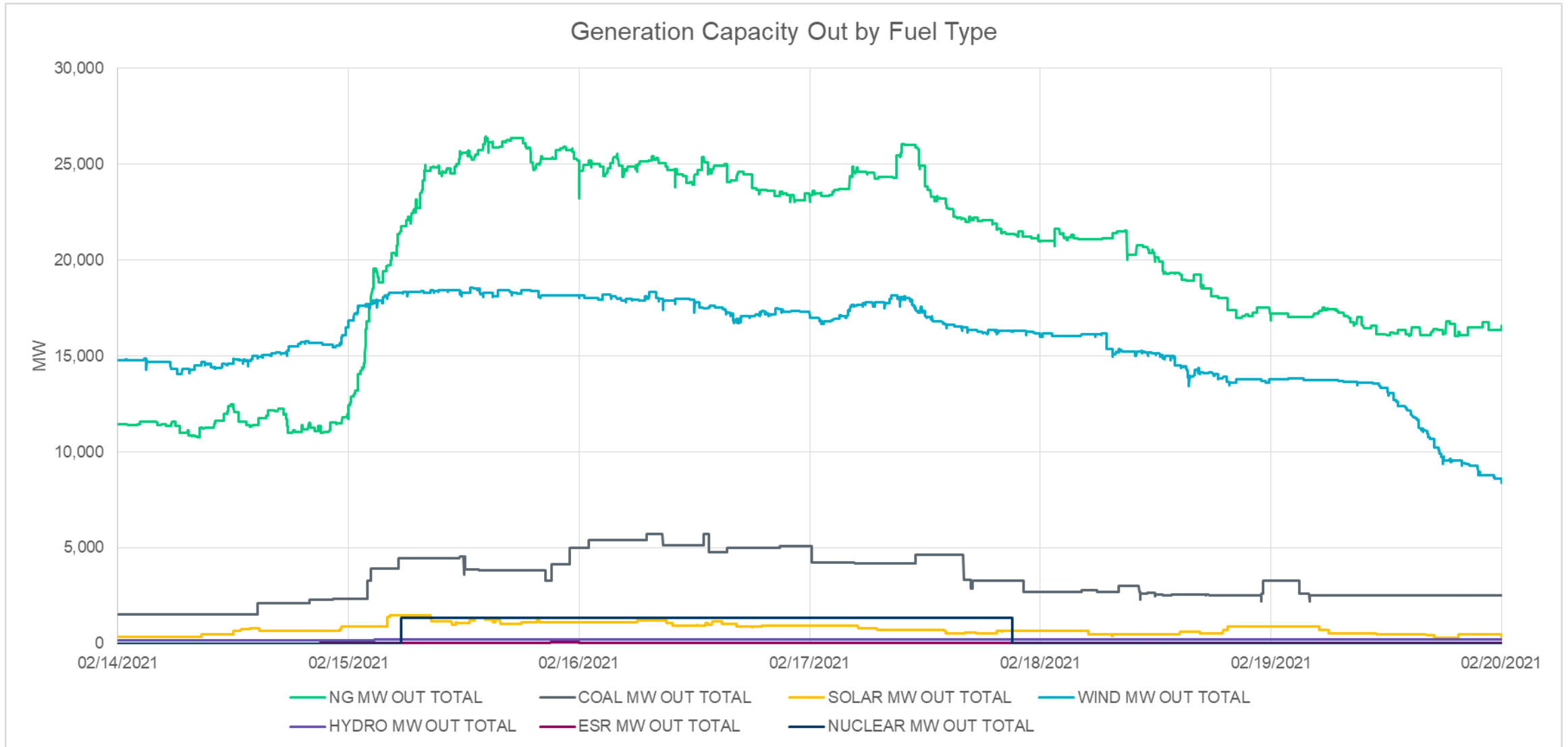
Rapid Decrease in Generation Causes Frequency Drop



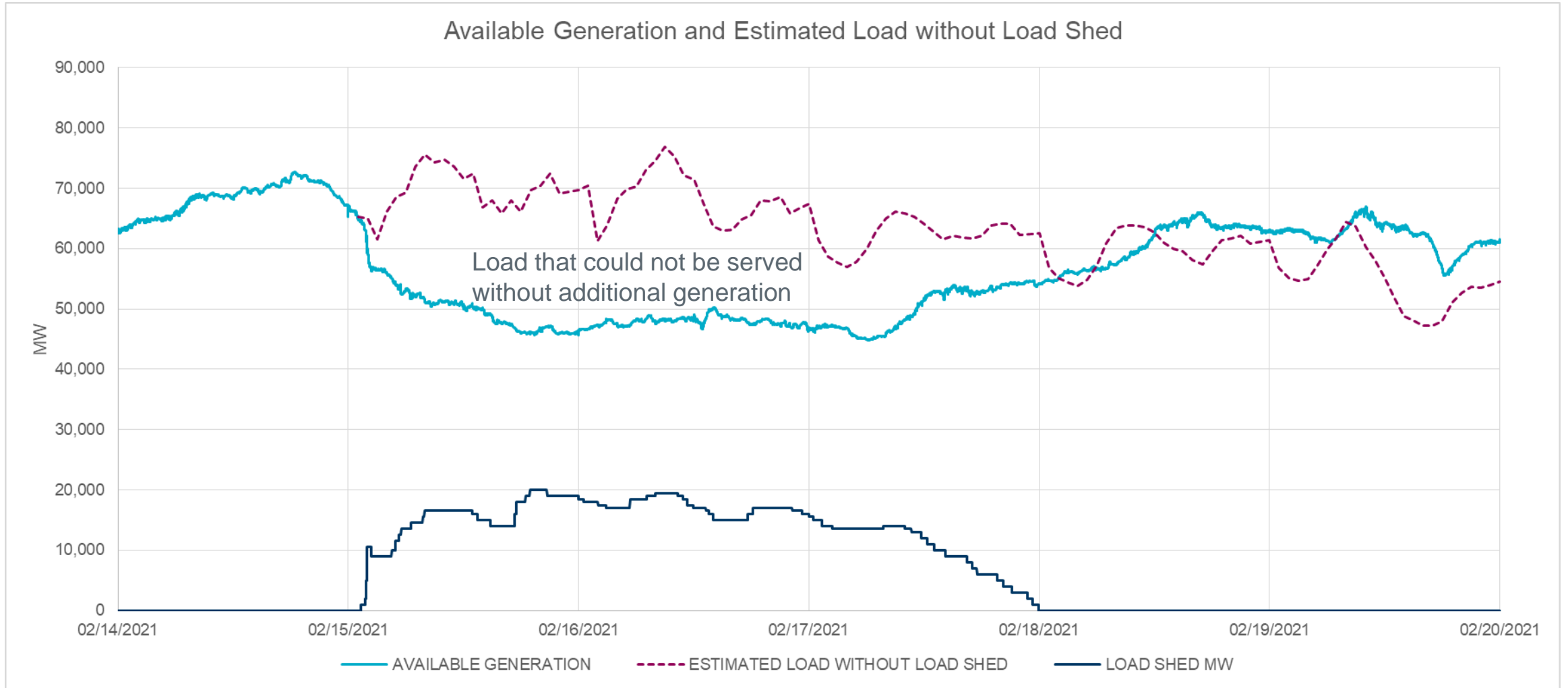
Generation Capacity Out February 14 – 19, 2021



Generation Capacity Out by Fuel Type



Available Generation and Estimated Load Without Load Shed



Available Generation shown is the total HSL of Online Resources, including Quick Starts in OFFQS. The total uses the current MW for Resources in Start-up, Shut-Down, and ONTEST.








Key Events (Monday, February 15 – Friday, February 19)

- More than 16,500 control room calls with generators and transmission owners (normal: ~5,000/week).
- Multiple daily coordinating calls between transmission owners and operations management.
- Monday, February 15
 - Up to an additional ~24,000 MW net generation unavailable due to extreme weather; loss of generation was 52,277 MW (approximately 48.6%) at the highest point.
 - 20,000 MW peak load shed.
 - Limited gas availability for gas-fired power plants.
 - Multiple DC-Tie constraints due to neighboring area emergencies.
 - Daily Texas Energy Reliability Council meetings.
- Tuesday, February 16
 - No net gain in generation as some generators were restored and others became unavailable.
 - Decreased volume of controlled outages during the day, increased for evening peak.
- Wednesday, February 17
 - Moderating temperatures allowed reduction in controlled outages, small net gain in generation.
- Thursday, February 18
 - Continued gain in generation.
 - 12:42 a.m. - Canceled last controlled outage orders - some outages remained due to ice storm damage; need for manual restoration and return of large industrial facilities.
- Friday, February 19 (all times approximate)
 - 9 a.m. - Returned to emergency operations level 2
 - 10 a.m. – Returned to emergency operations level 1
 - 10:35 a.m. – Returned to normal operations

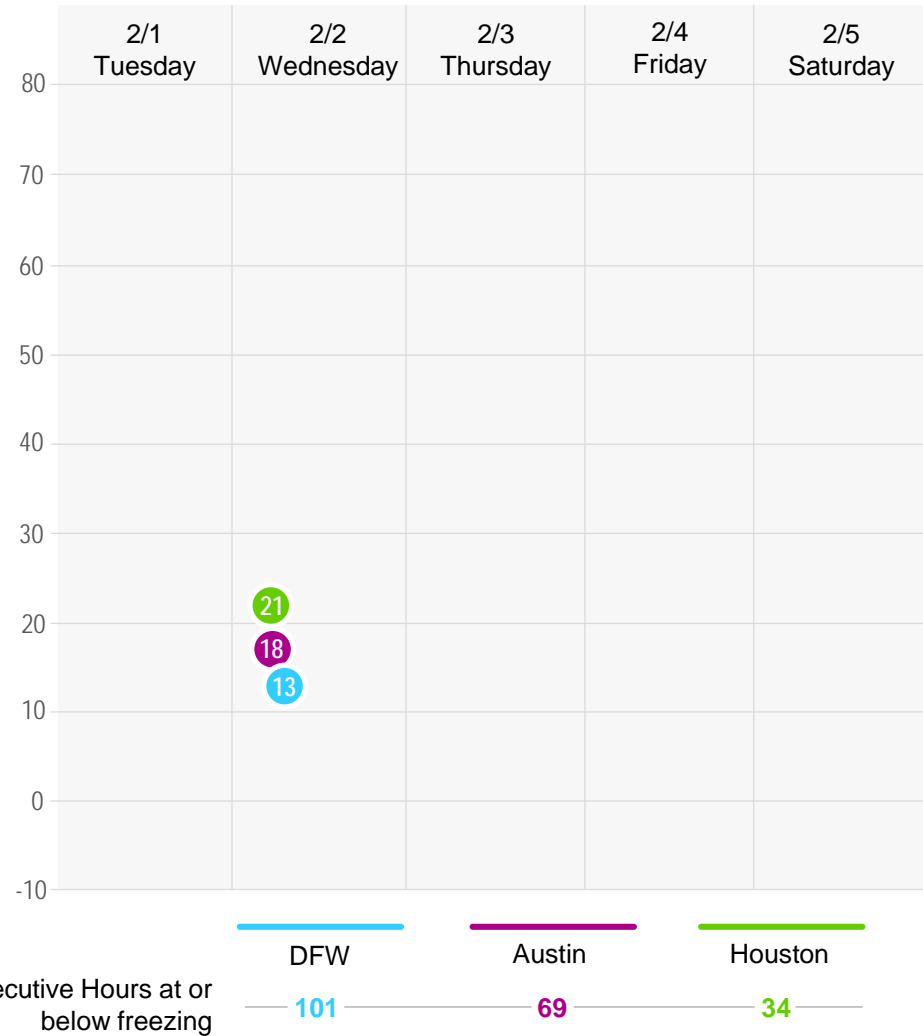


Generation Weatherization

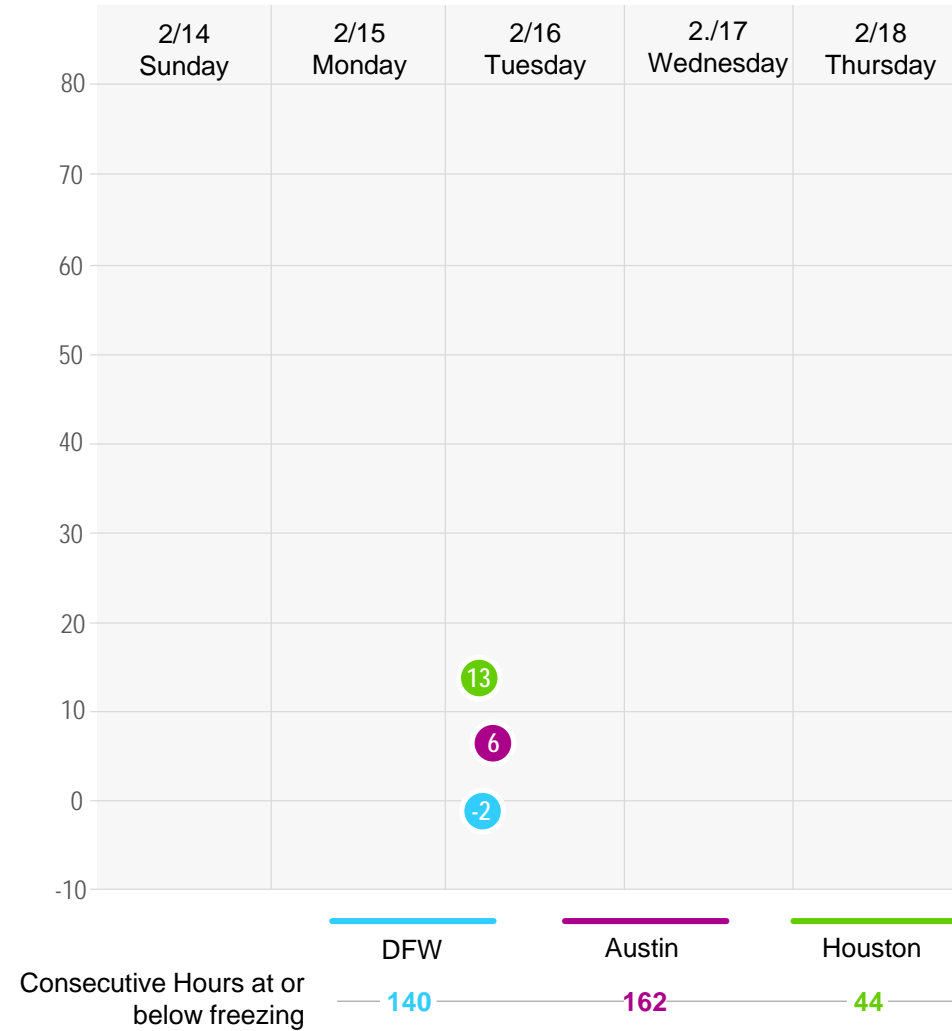
-  Generation owners and operators are not required to implement any minimum weatherization standard or perform an exhaustive review of cold weather vulnerability. No entity, including the PUC or ERCOT, has rules to enforce compliance with weatherization plans or enforce minimum weatherization standards.
-  In 2011, the PUC amended its rules to authorize ERCOT to conduct generator site visits to review compliance with weatherization plans. Spot checks include reviewing the weatherization plan, verifying that plant personnel are following the plan and providing recommendations based on PUC requirements, lessons learned or best practices.
-  We currently perform spot checks at power plant units at the rate of about 80/year. Whenever possible, a Texas Reliability Entity (TRE) representative joins ERCOT for these spot checks.
-  While we request and review detailed plant records, the only entity that can confirm that a plant is “weatherized” to any particular standard is the entity that owns or operates the plant.
-  Each year, TRE and ERCOT host an annual workshop on weatherization with generation owners to review lessons learned and best practices.

2011 vs. 2021 Event Temperature Comparison

February 2011



February 2021



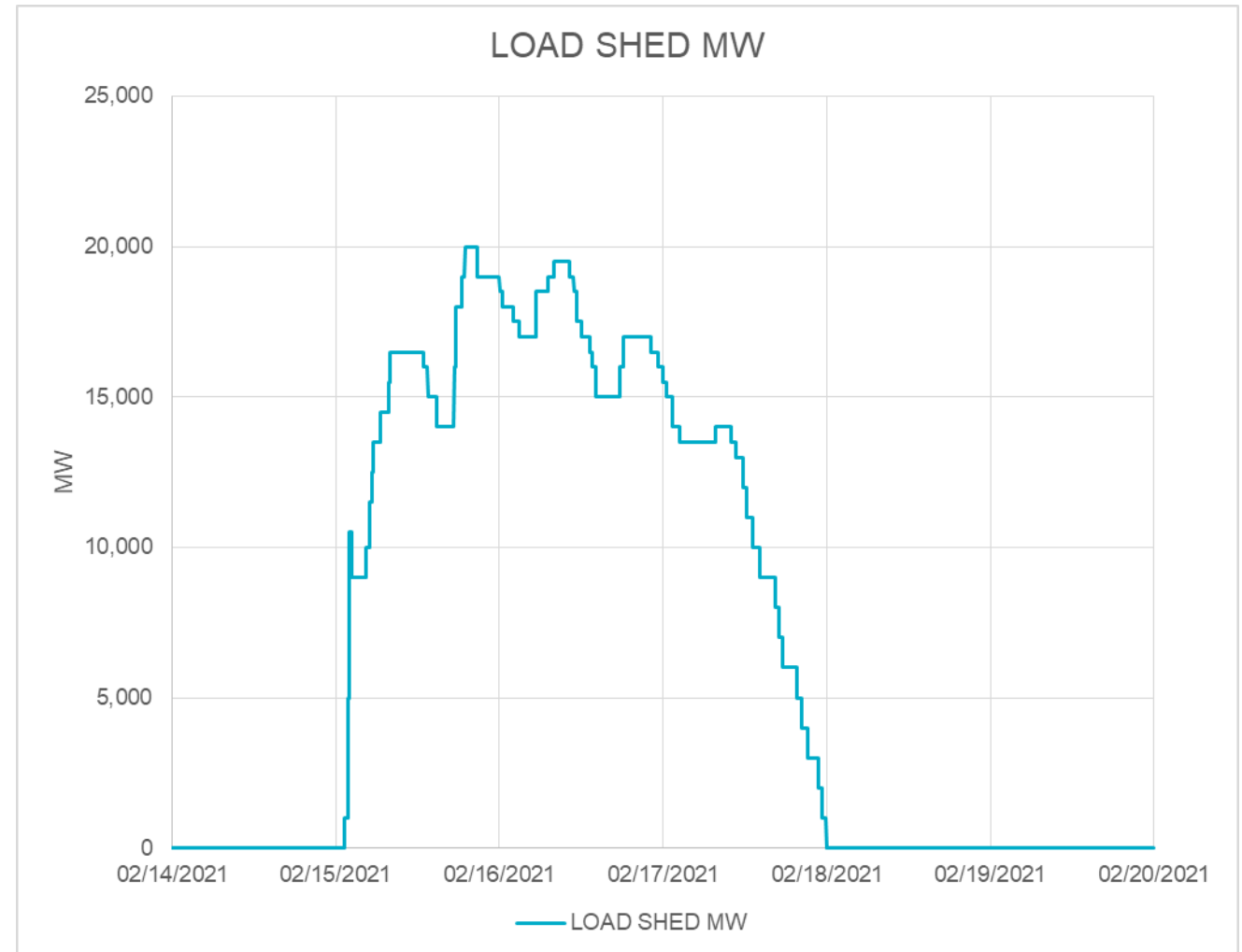
2011 vs. 2021 Event Comparison

	2011	2021
Maximum generation capacity forced out at any given time (MW)	14,702	52,277
Generation forced out one hour before start of EEA3 (MW)	1,182	2,489
Cumulative generation capacity forced out throughout the event (MW)	29,729	46,249*
Cumulative number of generators outaged throughout the event	193	356
Cumulative gas generation de-rated due to supply issues	1,282	9,323
Lowest frequency	59.58	59.30
Maximum load shed requested (MW)	4,000	20,000
Duration load shed request (hours)	7.5	70.5
Estimated peak load (without load shed)	59,000	76,819

*Note: "Cumulative" values for 2021 were calculated using NERC 2011 report methodology. Cumulative amount for 2021 starts at 00:01 on February 14, 2021

Load Shed Ordered By Transmission Owner

Transmission Operator	% of MW
AEP Texas Central Company	8.7
Brazos Electric Power Cooperative Inc.	4.95
Brownsville Public Utilities Board	0.37
Bryan Texas Utilities	0.51
CenterPoint Energy Houston Electric LLC	24.83
City of Austin DBA Austin Energy	3.71
City of College Station	0.28
City of Garland	0.75
CPS Energy (San Antonio)	6.79
Denton Municipal Electric	0.48
GEUS (Greenville)	0.15
Lamar County Electric Cooperative Inc*	0.07
LCRA Transmission Services Corporation	5.96
Oncor Electric Delivery Company LLC	36.01
Rayburn Country Electric Cooperative Inc.	1.3
South Texas Electric Cooperative Inc.	2.52
Texas-New Mexico Power Company	2.62
ERCOT Total	100.00



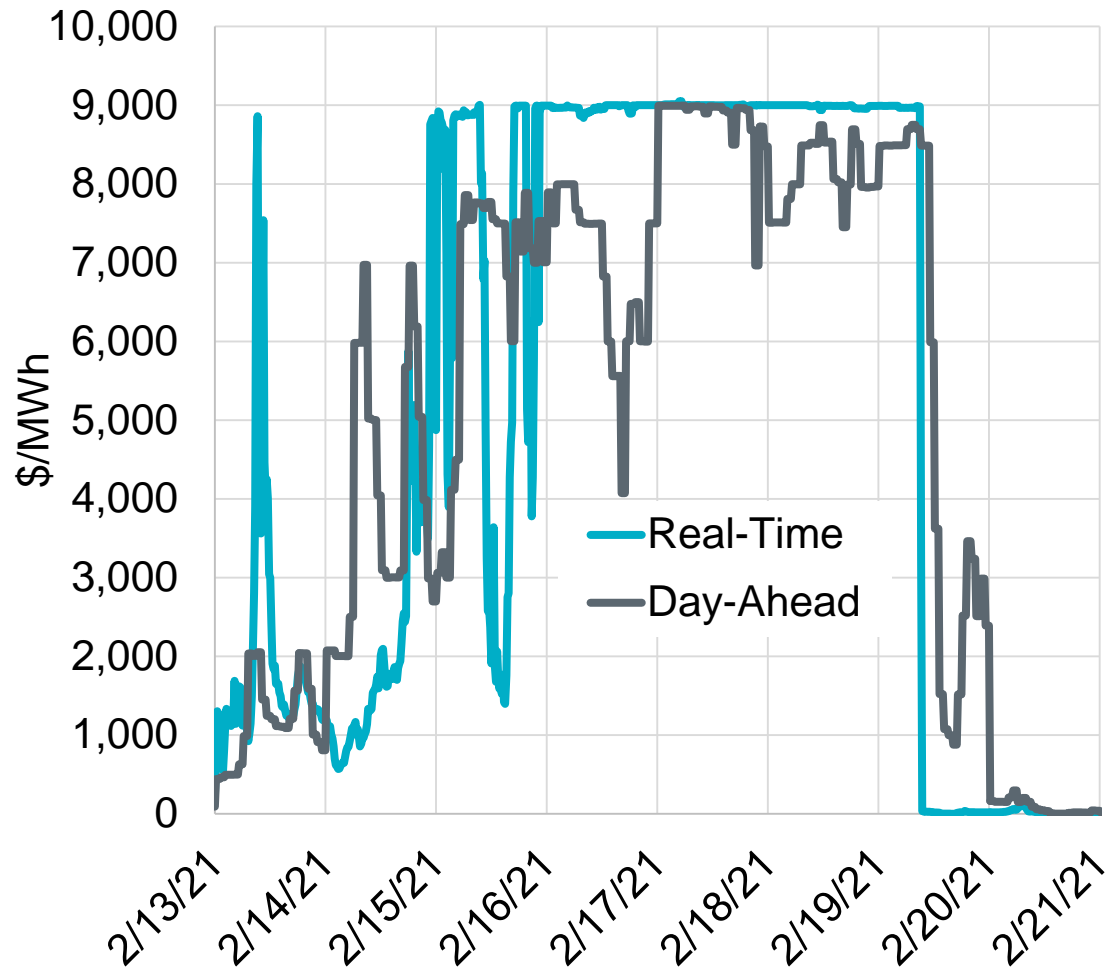
Status of Recommendations After February 2011

A report published by the North American Electric Reliability Corporation following the February 2011 cold weather event contained several recommendations applicable to ERCOT. Over the past 10 years, ERCOT has made changes that support those recommendations.

Significant modifications include:

- Implemented the Seasonal Assessment of Resource Adequacy report that includes an analysis for extreme winter weather.
- Began a resource weatherization process that includes an annual workshop, review of resource weatherization plans and spot checks of facilities.
- Added additional staff (Shift Engineer and Resource Reliability Desk) in the control room.
- Modified the Ancillary Services procurement to allow additional procurement in anticipation of severe weather.
- Established the Gas Electric Working Group and created a notification procedure for QSEs to notify ERCOT if there are anticipated fuel restrictions.
- Modified the survey sent to natural gas generators that collects fuel switching capability for some resources in preparation for each winter season.
- Changed the rules and processes for withdrawing approval of resource outages in anticipation of severe weather.

Real-Time and Day-Ahead System-Wide Pricing



Average system-wide pricing around the event relative to other historical periods (in \$/MWh)

Date Range	Real-Time	Day-Ahead
2/14/21 2/19/21	\$6,579.59	\$6,612.23
January '21	\$20.79	\$21.36
February '20	\$18.27	\$17.74

This data is using the ERCOT Hub Average 345-kV Hub prices

Hedging by Market Participants

- ERCOT has limited visibility into other methods of hedging that Market Participants may engage in, including but not limited to commodities exchanges and bilateral contracts.
- With the information available to ERCOT, the level of energy hedging by Load Serving Entities varied from fairly long to fairly short relative to their physical load. This could also vary by operating day for the same entity.
- These positions would have been affected by load reductions resulting from the instructed firm load shed and other losses of load, as well as loss of generation through de-ratings or outages that occurred during the event.