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Regulatory Questions Engendered by the Texas Energy Crisis of 2021

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1. Introduction

The February extreme cold weather event in Texas resulted in significant electric outages across the Electric Reliability Council of Texas (ERCOT) system. The disruptions contributed to the loss of human life, with significant economic harms in the aftermath. Understanding the regulatory dynamics, markets, and economics that resulted in widespread power outages across the state will be instrumental for determining whether the price of power that resulted from the crisis warrants modification. Further, understanding the causes of the problem will facilitate redesigning market rules, regulations, and other protocols. It is important to note that the market design in Texas has evolved over many years and that the solutions to the issues raised by the crisis will require the cooperation of many stakeholders.

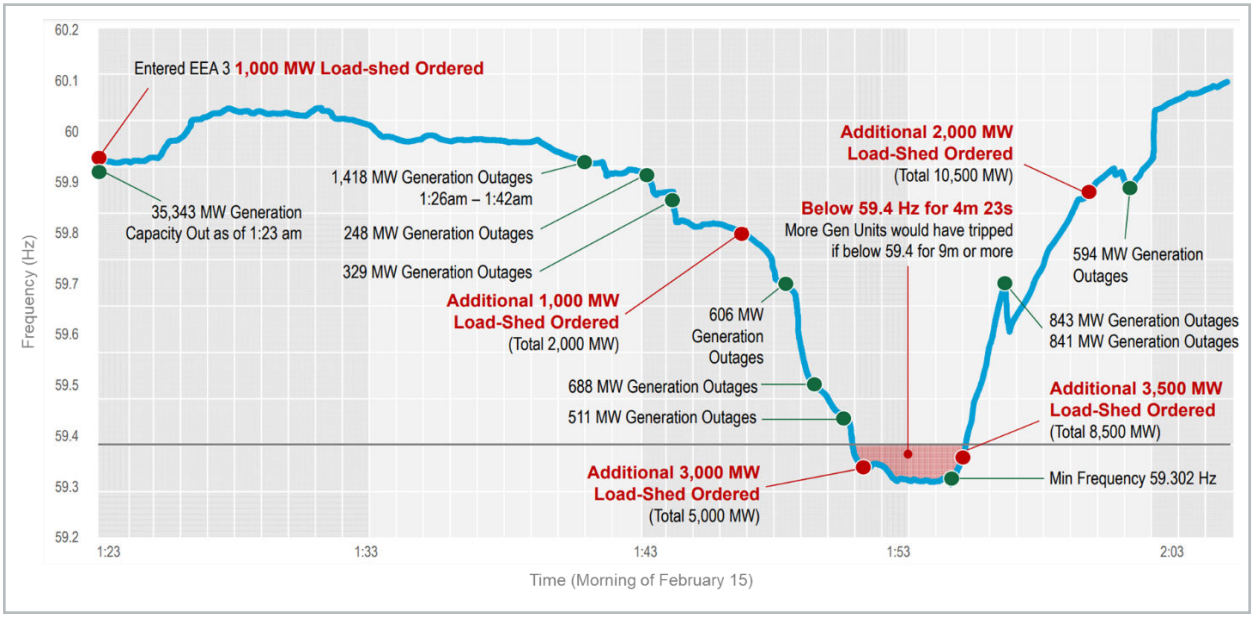
The purpose of this paper is to pose regulatory questions that will facilitate the understanding of the underlying regulatory actions and market behaviors that affected the likelihood of this catastrophic event. Although a thorough investigation and root cause analysis will be required to formulate complete answers, NRRI offers these perspectives and discussion about the role of the current regulatory regime and market design to further promote resource adequacy, resilience, and operating security for a system that has experienced an increasing number of extreme weather events during the past two decades. In presenting these questions, we explain the underlying rationale behind them. The questions elucidate a number of themes: 1) inherent market design flaws, 2) insufficient regulatory oversight, 3) market manipulation, and 4) the distinction between reliability and resilience in designing and managing the electric market.

2. Why Did ERCOT Nearly Black Out?

The cold snap began on February 12, 2021 and resources across the system started to fail over the following days, while loads remained high. At 7:06 p.m. (CST) on the 14th, ERCOT hit a winter peak of 69,222 MW. The system operated without incident through the record winter peak. By early on the 15th, system conditions deteriorated rapidly as an additional 20 GW of generation tripped offline (in addition to the 25 GW that were already out). ERCOT declared an Energy Emergency Alert (EEA-3)[1] at approximately 1:20 a.m. Subsequently, the system operator began efforts to maintain system stability through a series of load sheds. Despite coming within minutes of a cascading blackout, the system operator demonstrated what will likely be studied as a textbook example of managing a power system through severe operating conditions. **Figure 1** demonstrates these developments through a detailed timeline, showing how frequency dropped as prolonged extreme weather and sustained high demand resulted in increased generator outage rates. When frequency drops below established operating limits, generators have protection systems that automatically disconnect the unit from the grid to avoid equipment damage. It is important to recognize that demand-side actions (load curtailments that began at 1:45 a.m.) ultimately allowed the system to recover from dangerously low frequency and avoid an ERCOT-wide blackout.

1 An Energy Emergency Alert-3 (EEA-3) is declared when operating reserves cannot be maintained. See, *ERCOT's use of Energy Emergency Alerts*, http://www.ercot.com/content/wcm/lists/164134/EEA_OnePager_FINAL.PDF

Figure 1: System Frequency during the Initial Minutes of the February Load-Shedding Events[2]



3. Do Generators in ERCOT Have an Obligation to Perform?

No, generators in ERCOT do not have an obligation to perform. The ERCOT market is based on a Hayekian philosophy — that price provides all of the information necessary to ensure efficient availability, dispatch, maintenance, and investment in generation and generator performance.[3] This is an incentive-based system in which the prospect of profits for the sake of power results in optimal system generation investments. Accordingly, generators are only paid for the energy services they provide, incented by price signals, without an obligation to perform. This approach differs from some other organized electric markets,[4] which maintain reliability in part by having financial penalties for failure to serve when needed.

A linchpin of this incentive to perform in ERCOT is setting prices that capture the value of reliability to customers during periods of shortage. "The key connection is with the value of lost load (VoLL) and the probability that the load will be curtailed. Whenever there is involuntary load shed and the system has just the minimum amount of contingency operating reserves, then any incremental reserves would correspondingly reduce the load curtailment. Hence, the price of operating reserves should be set at the value of lost load."[5] For this mechanism to work, there must be "enough room to allow some generators to exercise a little market power and bid high enough to reflect the scarcity rent."[6] This is a delicate dance, balancing the behavior of generators and customer protection.

The Public Utility Commission of Texas's (Texas PUC) administratively approved system-wide price cap for ERCOT (based on an estimate of the VoLL) has tripled

2 ERCOT Presentation – Review of February 2021 Extreme Cold Weather Event. Slide 12, (Axis titles added by NRRI staff, (February 24, 2021), http://www.ercot.com/content/wcm/key_documents_lists/225373/Urgent_Board_of_Directors_Meeting_2-24-2021.pdf

3 "Fundamentally, in a system in which the knowledge of the relevant facts is dispersed among many people, prices can act to coordinate the separate actions of different people in the same way as subjective values help the individual to coordinate the parts of his plan." See Hayek, F., 'The Use of Knowledge in Society," *American Economic Review* (1945): 519-530.

4 Organized energy market operators administer the transmission system independently of, and foster competition for electricity generation among, wholesale market participants, https://www.ferc.gov/industries-data/market-assessments/electric-power-markets

5 Hogan, W., *Electricity Scarcity Pricing Through Operating Reserves: An ERCOT Window of Opportunity* (November 1, 2012): 6, https://scholar.harvard.edu/whogan/files/hogan_ordc_110112r.pdf

6 Hogan, W, Texas Nodal Modal Market Design: Observations and Comments. Presented at ERCOT Energized Conference, Austin, TX (May 2, 2008), https://www.hks.harvard.edu/publications/texas-nodal-market-design-observation-and-comments

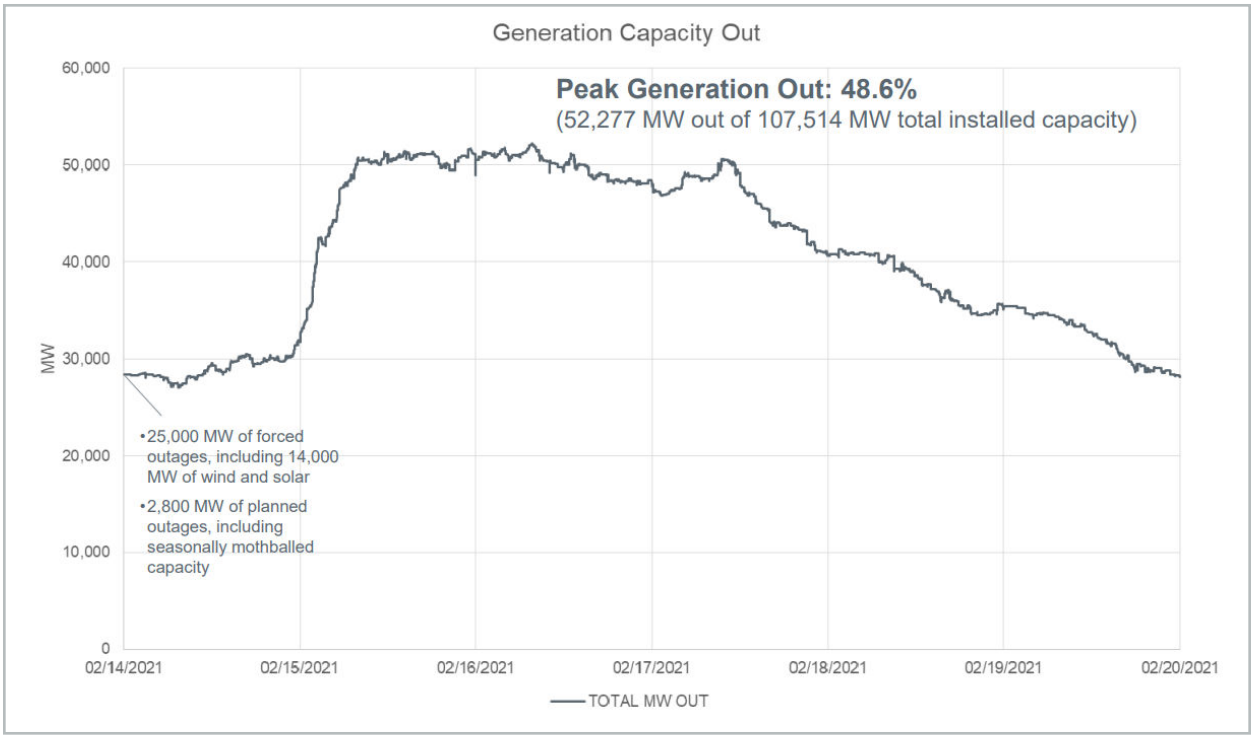
to $9,000/MWh between 2012 and 2015[7] and is incorporated into the automated market management software. This price cap is the highest in the nation. An empirical question is whether the increase in the market price cap has resulted in an improvement in generation performance, or investment in plant winterization.

4. How Did ERCOT and the Texas PUC Respond to System-wide Generator Performance Failure?

During the early stages of the event, generation of all types failed at an unprecedented rate, as demonstrated in **Figure 2**. Prior to shedding load, energy prices had reached or exceeded ERCOT's system-wide offer cap of $9,000/MWh, while prices are typically closer to $22/MWh.[8] As a result of the treatment of load curtailments by the ERCOT market algorithms, prices became very volatile, falling from scarcity pricing to as low as $1,200/MWh. As a result, natural gas-fired plants that were still online (26 GW failed during the event) were at risk of selling electricity at a loss, assuming that they could secure fuel. The result was an incentive that the market was not designed to properly address, highlighting the need to reevaluate scarcity pricing and the important interplay between the natural gas delivery interruptions and impacts to energy prices.[9]

ERCOT alerted the Texas PUC to this apparent anomaly, as the price of natural gas was increasing by

Figure 2: ERCOT Generator Failure during the Freeze[9]



7 The Texas PUC approved raising the energy price cap (high system wide offer cap) from $3,000/MWh to $4,500/MWh in August 2012 and subsequently approved gradually increasing the cap to $5,000 MWh in 2013, $7,000 MWh in 2014, and $9,000 MWh in 2015, http://www.beg.utexas.edu/files/cee/legacy/Gulen%26Soni_Impacts_of_Raising_Price_Caps_ERCOT.pdf. The Texas PUC determined the value of lost load as $9,000; see London Economics International LLC, "Estimating the Value of Lost Load Briefing"(June 17, 2013), http://www.ercot.com/content/gridinfo/resource/2015/mktanalysis/ERCOT_ValueofLostLoad_LiteratureReviewandMacroeconomic.pdf This offer cap was subsequently reviewed within a 2014 Brattle report, "Estimating the Economically Optimal Reserve Margin in ERCOT." http://www.ercot.com/content/wcm/lists/114801/Estimating_the_Economically_Optimal_Reserve_Margin_in_ERCOT_Revised.pdf

8 Gold, R., "Texas Power Market Is Short $2.1 Billion in Payments After Freeze," *Wall Street Journal*, February 26, 2021. https://www.wsj.com/articles/texas-power-market-is-short-2-1-billion-in-payments-after-freeze-11614386958

9 ERCOT Presentation – Review of February 2021 Extreme Cold Weather Event. Slide 13 (February 24, 2021), http://www.ercot.com/content/wcm/key_documents_lists/225373/Urgent_Board_of_Directors_Meeting_2-24-2021.pdf

as much as 10,000 percent.[10] In response to the events of February 15, the Commission held an emergency six-minute meeting and issued an order granting ERCOT the authority to modify market outcomes that were "inconsistent with the fundamental [market] design."[11] The commission justified its decision by stating that "the market price for the energy needed to serve that load should also be at its highest."[12] This action could be seen as an effort to increase market confidence. However, the Commission's order resulted in higher energy prices during a time when customer demand was especially inelastic. The intention of ERCOT and the Texas PUC to incent generators to operate during the crisis was laudable. However, the extent to which these efforts were successful can be evaluated empirically by examining whether the availability of generating units on the system increased. If generators did not respond to the higher prices, then the increased revenues associated with these higher prices are a wealth transfer. The question is whether or not the scarcity pricing regime designed to support resource adequacy is an effective market mechanism for incenting performance during the cold snap. Other market design questions include whether additional market mechanisms, more than prevailing and prospective energy prices, are required to ensure that generators are available to maintain resilience, and what those mechanisms might be. A prudent regulatory decision would have required the Commission to weigh all these factors during that meeting.

ERCOT's request and the Commission's response are highly unusual and raise issues about whether market design processes were prepared for the potential outcomes resulting from prolonged system stress. Although this freeze was especially extreme, it was not unprecedented — with a more severe storm of longer duration occurring in 1989,[13] and another severe and costly freeze in 2011. Other markets typically do not require real-time market changes to be authorized by regulators during a crisis, relying instead on market protocols that allow the system operator to take "out-of-market" actions to prioritize the stability of the system over potential price signals.[14]

The Commission's emergency order that enabled generators to bid $9,000/MWh on its own motion, demonstrates that maintaining scarcity prices was its highest priority. It is important to know why the market software produced the prices that it did after entering into EEA-3. Did the software perform as specified? And was the intent of ERCOT's market design to allow market prices to remain at the $9,000/MWh for as long as supply shortages persist, without regard for generator performance or the magnitude of profits earned? If so, where, when, and how was that considered? It is clear that this foreseeable event was not contemplated in the market design, raising the issue of whether the Commission's order was supported by adequate evidence for these circumstances. It is in the customer's interest for the Commission to reevaluate its order based on complete information about whether the market design actually supported its decision and to determine if the price increases allowed by the order should be readjusted. **Figure 3** demonstrates how the Commission's emergency order to address the dramatic price reduction after the load-shed events resulted in energy prices remaining near (and in some cases above[15]) the system-wide offer cap during most of the event.[16]

10 Paradis, C., "Texas Natural Gas Prices Attract Federal Investigation After 10,000% Spike," *International Business Times,* February 23, 2021, https://www.ibtimes.com/texas-natural-gas-prices-attract-federal-investigation-after-10000-spike-3150792

11 Gold, R., and Blunt, K., "Amid Blackouts, Texas Scrapped Its Power Market and Raised Prices. It Didn't Work." *The Wall Street Journal*, February 25, 2021, https://www.wsj.com/articles/texas-power-regulators-decision-to-raise-prices-in-freeze-generates-criticism-11614268158, Texas PUC Project No. 51617, https://www.puc.texas.gov/51617WinterERCOTOrder.pdf

12 Texas PUC Project No. 51617, https://www.puc.texas.gov/51617WinterERCOTOrder.pdf

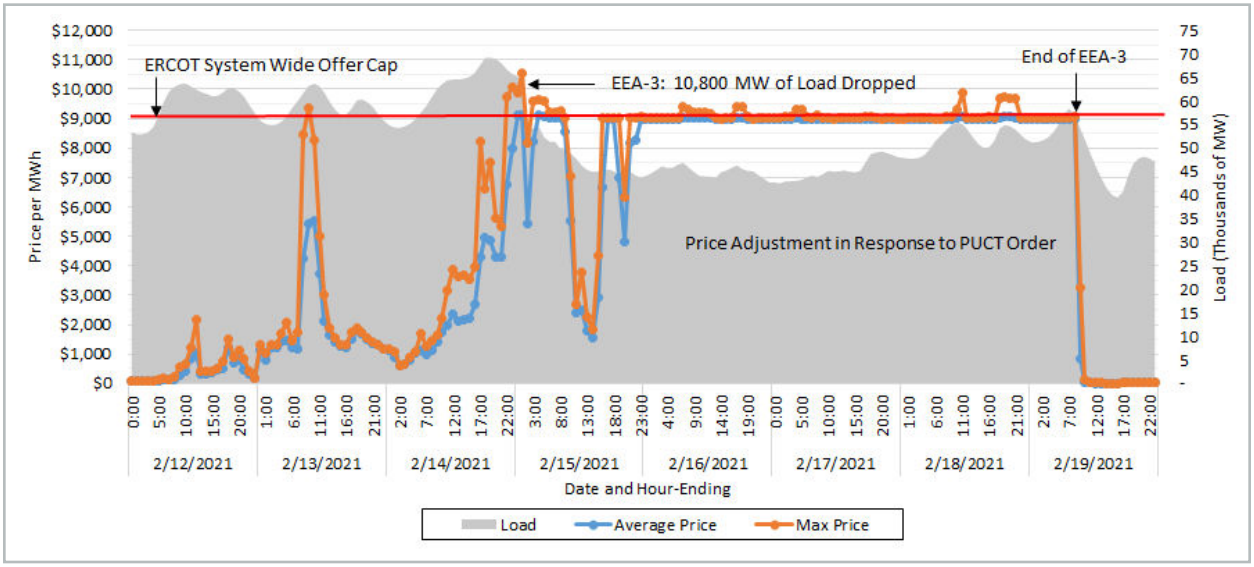
13 NERC whitepaper, *ERCOT Emergency Operations*, December 21-23, 1989, http://www.nerc.com/pa/rrm/ea/February%202011%20Southwest%20Cold%20Weather%20Event/ERCOT%20Emergency%20Operation%201989.pdf

14 For example, the CAISO can perform out-of-market dispatch. These actions are recorded in the market as manual dispatches. See Market Disruption – EIM (January 6, 2021): 12, https://www.caiso.com/Documents/2720.pdf

15 While offers are limited by the energy price cap of $9,000/MWh, the market software can drive prices higher due to congestion and other system constraints. "Methodology for Setting Maximum Shadow Prices for Network and Power Balance Constraints," http://www.ercot.com/services/comm/mkt_notices/archives/4645

16 Texas PUC Project No. 51617, Second Order Directing ERCOT to Take Action and Granting Exception to Commission Rules, https://www.puc.texas.gov/51617WinterERCOTOrder.pdf

Figure 3: Electricity Prices (8 ERCOT Load Zones) and Load during the Cold Weather Event[17]



5. Why is it Important to Investigate Whether Market Power was Exercised during the Freeze?

The Texas wholesale electric market, unlike markets regulated by the Federal Energy Regulatory Commission (FERC), does not require prices to be just and reasonable, thereby limiting the regulatory tools for adjusting prices. Prices in ERCOT are presumed to produce optimal results. The focus of the market design has been to provide generators with adequate revenues, resulting in reduced attention to ratepayer protections. The protection afforded to ratepayers for wholesale market transactions in Texas lies within the Commission's authority to address market power.[18] These remedies include both penalties and the ability to force disgorgement of excess revenues.

The potential exercise of market power goes beyond generator bidding behavior to market fundamentals. There are at least two ways in which the Texas market prices can be manipulated to earn extraordinary profits: passive withholding and gas price manipulation. The FERC has already announced its intent to examine "wholesale natural gas and electricity market activity during last week's extreme cold weather to determine if any market participants engaged in market manipulation or other violations."[19]

a. Did passive withholding exacerbate the crisis?

Withholding production is a recognized form of market power abuse in the electric industry. *Passive withholding* is defined here as the practice of selectively configuring part of a generation portfolio explicitly to exploit market design or system vulnerabilities.

Active withholding occurrs when a company that owns two or more generators in a particular market withholds the supply of one of those generators to increase the overall market price to compensate for the lost revenues of the withheld unit at normal prices. One way to withhold generation is to take a generator offline during needle peaks to perform discretionary inspections, such as deciding to shut down a generator during a time of a critical system conditions to have divers search a unit's cooling

17 Chart developed by NRRI staff using ERCOT's Historical RTM and Settlement Point Prices (SPPs) data for each ERCOT Load Zone). Maximum and average prices are for all intervals and all load zones for each hour, starting at 00:00, February 10, 2021, through 24:00, February 19, 2021. Load zones include: AEN; CPS; HOUSTON; LCRA; NORTH; RAYBN; SOUTH; WEST. http://mis.ercot.com/misapp/GetReports.do?reportTypeId=13061&reportTitle=Historical%20RTM%20Load%20Zone%20and%20Hub%20Prices&showHTMLView=&mimicKey). (Load zone map available here: http://www.ercot.com/news/mediakit/maps

18 According to Chapter 39, Section 39.157 of the Texas Utilities Code: "On a finding that market power abuses or other violations of this section are occurring, the commission shall require reasonable mitigation of the market power…," http://statutes.capitol.texas.gov/StatutesByDate.aspx?code=UT&level=SE&value=39.157&date=3/18/2015

19 FERC News Release: FERC to Examine Potential Wrongdoing in Markets During Recent Cold Snap (February 22, 2021), http://www.ferc.gov/news-events/news/ferc-examine-potential-wrongdoing-markets-during-recent-cold-snap

water intakes for zebra mussels. This is a reasonable thing to do under normal circumstances, but is an exercise of market power when the system is experiencing such a high level of stress.

Passive withholding recognizes that during system emergencies, energy prices will be higher, potentially approaching the offer cap.[20] As a consequence, generator owners may have an incentive to make weatherization enhancements to only a portion of their fleet, enabling those units to operate through extreme temperatures and access higher revenues that would more than compensate for generation units that are forced out of service. Sophisticated generation and trading companies have game theorists who evaluate alternative ways in which their firms can gain profits. In retrospect, a firm that selectively winterized its generators would have made significant profits. The question is whether generators employed a practice of strategically preparing only a portion of its generating fleet for extreme cold weather events, because it would elevate prices and produce added profits.

In the event that a hypothetical entity owning multiple power plants had strategically winterized only a portion of their generation portfolio, thereby contributing to a system-wide shortage, there would be a potential for significant profits to the generators that remained online. Whether or not passive withholding has occurred can be determined by examining the underlying analysis of winterization investments by plant owners, fuel procurement practices, and effected availability for providers with larger generator portfolios.

It will be especially important for regulators to understand the specific actions generator owners and other entities previously undertook to invest in plant winterization or not, especially following the February 2011 cold weather events that resulted in a controlled load shed of 4,000 MW, affecting some 3.2 million customers. According to the joint North American Electric Reliability Corporation (NERC) and FERC report issued after that event, "Generators and natural gas producers suffered severe losses of capacity despite having received accurate forecasts of the storm. Entities in both categories report having winterization procedures in place. However, the poor performance of many of these generating units and wells suggests that these procedures were either inadequate or were not adequately followed."[21] Plant winterization is not mandatory in Texas.[22] In response to the state's energy crisis, the Texas Legislature and NERC are exploring potential mandatory weatherization standards.[23] Although there is an increasing recognition of the need to regulate winterization practices (including ensuring natural gas supply), the state also needs to investigate the underlying investment behavior of ERCOT's generators to determine whether passive withholding occurred.

b. Did natural gas price manipulation drive the peaker net margin?

The February 15 Texas PUC order demonstrates a clear nexus between natural gas prices and allowable prices in the ERCOT market. High natural gas prices provided the Commission with the regulatory rationale for suspending the low system-wide offer cap (LCAP). The impact of this suspension is demonstrated by **Figure 4**, which tracks ERCOT's estimates of the peaker net margin (PNM). ERCOT established the PNM metric[24] to track the net revenue that a hypothetical natural gas generator would earn in a single year, given the relationship between real-time

20 "Maintaining a price cap equal to the value of lost load (VoLL) during outages and prices reflective of marginal system costs in other types of scarcity events will provide efficient signals necessary for market-based responses from generators and demand response." – "Estimating the Economically Optimal Reserve Margin in ERCOT," prepared by Brattle for the Texas PUC, p. xi, http://www.ercot.com/content/wcm/lists/114801/Estimating_the_Economically_Optimal_Reserve_Margin_in_ERCOT_Revised.pdf

21 FERC/NERC Staff, *Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011,* (August 2011): 10, https://www.ferc.gov/sites/default/files/2020-04/08-16-11-report.pdf

22 Travis, A., "Winter preparedness not mandatory at Texas power plants and generators, despite 2011 report" (February 17, 2021), https://www.kxan.com/investigations/winter-preparedness-not-mandatory-at-texas-power-plants-and-generators-despite-2011-report/

23 NERC Standard Project 2019-06 Cold Weather, https://www.nerc.com/pa/Stand/Pages/Project%202019-06%20Cold%20Weather.aspx, Reuters, "Texas Governor Asks Legislature to Mandate Winterization of Generator," https://www.usnews.com/news/top-news/articles/2021-02-18/texas-governor-asks-legislature-to-mandate-winterization-of-generators

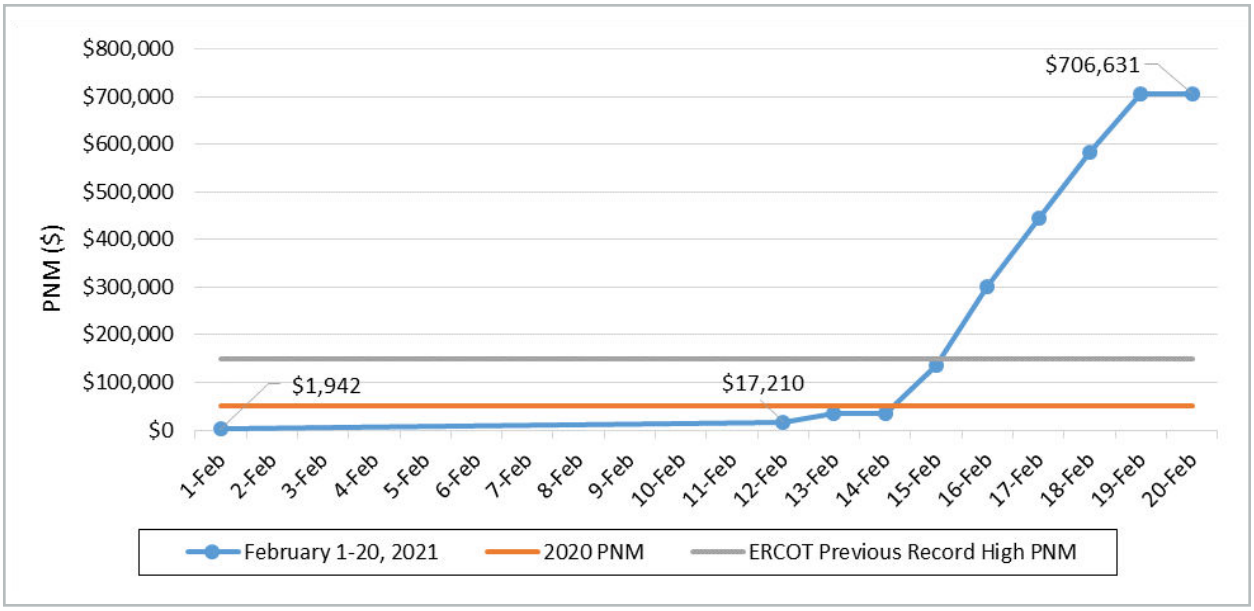
24 See Texas Commission rule 16 TAC § 25.505(g)(6), http://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.505/25.505.pdf

power prices and natural gas spot market prices. As a consequence, it is important to understand the price formulation that led to a 10,000 percent increase in natural gas prices to determine whether or not market power was exercised.

During the February events, ERCOT informed the Commission that generator revenues were approaching the PNM threshold ($315,000/MW-year)[25] or three times the annual cost of a new gas-fired generator. According to the rule, once the PNM threshold is achieved, the system-wide offer cap is set at the LCAP, which is "the greater of either (i) $2,000 per MWh and $2,000 per MW per hour; or (ii) 50 times the natural gas price index value determined by ERCOT (expressed in dollars per MWh and dollars per MW per hour)."[26] The price of natural gas during the event increased significantly, with the Houston Ship Channel spot prices approaching $400/MMBtu. This was a tremendous increase compared to the period both before the freeze and in prior years, when gas prices ranged between $2-3/MMBtu.[27] In response to this price increase, the Commission removed the LCAP of $2,000/MWh "to ensure appropriate energy prices to both consumers and generators"[28] and instead continued to enforce the high system-wide offer cap (HCAP) of $9,000/MWh. As shown in **Figure 4**, the PNM levels during the February event dwarfed prior records, demonstrating a generator's ability to garner extraordinary profits.[29]

The Commission's suspension of the LCAP resulted in some plant owners being exposed to extraordinarily high natural gas prices throughout the supply shortages, as frozen wellheads, pumps, and pipes reduced supply. ERCOT is the only market in the

Figure 4: Peaker Net Margin (PNM) February 1-20, 2021



25 Watson, M. "Texas regulators keep prices near $9,000/MWh cap during rotating outages," *S&P Global*, February 16, 2021, https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/021621-texas-regulators-keep-prices-near-9000mwh-cap-during-rotating-outages

26 See Texas Commission rule 16 TAC § 25.505(g)(6), http://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.505/25.505.pdf

27 Matthews, C., Eaton, C., "U.S. Natural Gas Shortage Hampers Blackout Recovery," https://www.wsj.com/articles/u-s-natural-gas-shortage-hampers-blackout-recovery-11613671759

28 Texas PUC Project No. 51617, Second Order Directing ERCOT to Take Action and Granting Exception to Commission Rules, https://www.puc.texas.gov/51617WinterERCOTOrder.pdf

29 Watson, M., "Texas regulators keep prices near $9,000/MWh cap during rotating outages," *S&P Global*, February 16, 2021, https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/021621-texas-regulators-keep-prices-near-9000mwh-cap-during-rotating-outages

United States whose market rules (the LCAP) tie energy prices directly to a natural gas price index.[30] Without the HCAP, gas prices would have driven energy prices to as high as $17,957/MWh.[31] Whether or not these natural gas prices may have been inflated due to an exercise of market power also warrants investigation by FERC and the appropriate Texas authorities. Whether sustained scarcity pricing was effective in bringing generators back online will be another important question to resolve in the aftermath of these events; for this reason, the Commission may decide either on its own or by direction from the legislature to also examine other market-design enhancements.

6. Was Enabling a Price of $9,000/MWh an Exercise of Structural Market Power?

It is necessary to evaluate whether there were forms of market power that have been experienced here that have not generally been contemplated in the literature. At issue is whether the market structure institutionalized the exercise of market power. The Texas PUC had an especially Hayekian marketcentric response to the emergency. As prices dropped with the curtailment of load, the Commission determined that "(e)nergy prices should reflect scarcity of the supply."[32] There is a more critical question as to whether the Commission order, which indicated prices should reflect scarcity conditions, led to unanticipated price regime both in terms of length and magnitude. The duration during which the price remained at the system-wide cap is unprecedented, with ERCOT reaching these high prices only on one other occasion due to scarcity.[33]

There is a real question of whether the implementation of the revised market rules that enabled market prices to remain at the offer cap for days is a form of market power invoked by the Commission and implemented by ERCOT. There is a presumption by the Commission that enabling such market prices was consistent with the design of the market. However, if this was not contemplated in the market design, then the Commission's actions were taken simply to raise market prices. Without sufficient information to create expectations about the response, this action needs to be investigated to determine whether or not it inappropriately led to the exercise of market power for which profits should be disgorged.

After the Commission issued its order, the PNM increased to over $700,000/MW-year in a matter of days. Given that 356 generating units[34] were impacted during the event as a result of frozen equipment, lack of fuel supply, and several other factors, it is an empirical question as to whether high energy prices resulted in a significant supply response. At issue is whether or not the Commission had a reasonable expectation that generators would actually respond. Indeed, it is important to determine whether this action inappropriately effectuated the enormous wealth transfer that will result in continued economic disruption, customer hardship, bankruptcy, and business failure in the midst of a pandemic.

The *Wall Street Journal* has reported the architect of the ERCOT[35] system has said that "this week's blackouts weren't indicative of a major design flaw, but rather inevitable imperfections stemming from extraordinary weather challenges."[36] This is where the Hayekian view of markets failed the people of

30 See Texas Commission rule 16 TAC § 25.505(g)(6), http://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.505/25.505.pdf

31 Watson, M. "Texas regulators keep prices near $9,000/MWh cap during rotating outages," *S&P Global*, February 16, 2021, https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/021621-texas-regulators-keep-prices-near-9000mwh-cap-during-rotating-outages

32 Texas PUC Project No. 51617, https://www.puc.texas.gov/51617WinterERCOTOrder.pdf

33 A second instance occurred in January 2018; due to a software error and prices were corrected. Texas Coalition for Affordable Power, ERCOT Experiences Record Consumption, Real-Time Prices Reach $9,000 Cap. August 14, 2019, https://tcaptx.com/industry-news/ercot-real-time-prices-hit-record-9000-mark

34 ERCOT Presentation – Review of February 2021 Extreme Cold Weather Event. Slide 19, February 24, 2021, http://www.ercot.com/content/wcm/key_documents_lists/225373/Urgent_Board_of_Directors_Meeting_2-24-2021.pdf

35 See: Hogan, W, "On an "Energy Only" Market Design for Resource Adequacy," - Hogan_Energy_Only_092305.doc (harvard.edu)

36 Blunt, K., Gold, R. – quoting William Hogan "The Texas Freeze: Why the Power Grid Failed," *Wall Street Journal*, February 19, 2021, https://www.wsj.com/articles/texas-freeze-power-grid-failure-electricity-market-incentives-11613777856

Texas. The wealth transfer associated with the market design is not an inevitable imperfection; it is the consequence of a market that was not designed to adequately respond to extreme weather events, which likely will be more common and potentially more widespread. If the Commission determines it was in error and that error resulted in institutionalizing the exercise of market power, it has the responsibility to evaluate the appropriate pricing during the freeze and to correct market prices based upon its powers to mitigate market power.

7. Did ERCOT's Independent Market Monitor Overlook the Potential Impact of Extreme Cold Weather Events?

ERCOT's independent market monitor, Potomac Economics, Inc., has published dozens of monthly, quarterly, and annual reports that examine the energy market structure and various market design attributes. None of these reports has examined the market impacts that might result from significant loss of generation due to extreme winter weather events. The impact of freezes on generation was a known risk that not only resulted in significant economic and customer harm during the freeze of 2011, but also caused over a thousand MW of capacity to trip due to freezing weather events in 2014, 2016, 2017, and 2018.[37] This raises the question of whether market oversight was sufficient to protect customers and other market participants. To answer this question, it is important to understand why the independent market monitor did not evaluate the potential impact of extreme cold weather events on generator profitability and the customer impact.

8. What Other Regulatory, Market Design, and Policy Issues Will Help Prevent a Future Reoccurrence?

a. Is a capacity market needed?

Analysis of different market structures that can support investment in both decarbonization and resilience is warranted. As described in the recent NRRI paper, *Wither the FERC: Overcoming the Existential Threat to Its 'Magic Pricing Formula' through Prudent Regulation,*[38] ERCOT's Operating Reserve Demand Curve (ORDC) is a capacity market. What distinguishes ERCOT's capacity market from those of the ISO-NE, NYISO, and PJM is that they are based on an installed reserve margin construct, whereas ERCOT's capacity market is based on an operating reserve construct. Both can be considered forms of capacity markets. They seek to achieve the same result, an efficient and effective power market, but use very different mechanism to achieve that outcome. As described in the NRRI paper, traditional approaches to capacity market design are under stress, given the increase in customer demand response and zero-marginal cost renewable generation. As a consequence, adopting a capacity market based on an installed reserve construct in Texas at this point would be to substitute one set of market design issues for another. What is clear is that ERCOT needs to examine new market mechanisms, specifically those structures that focus not only on remunerating generator performance, but also on protecting customers.

b. How did a sizable load forecasting error contribute to the event?

ERCOT's under-forecast of load contributed to its challenges by having to address higher than expected demand with generation and infrastructure that were unprepared to handle the extreme cold weather. The ERCOT normal load forecast for the winter peak was 57,699 MW, whereas the actual peak was nearly 70,000 MW.[39] This record exceeded ERCOT's extreme winter forecast of 67,208 MW, as well as the prior winter peak record of 65,915 MW set in January of 2018. Seasonal weather outlook, population growth, and economic projections are the primary drivers of most load forecasts. However, extreme weather events are becoming more frequent and have greater impacts, causing higher demand and reduced generator availability, which calls for improved modeling. Without a forward capacity

37 Allgower, A., Presentation at ERCOT Generator Winter Weatherization Workshop, September 5, 2019, http://www.ercot.com/calendar/2019/9/5/186081

38 Pechman, C., *Whither the FERC? Overcoming the Existential Threat to Its Magic Pricing Formula through Prudent Regulation* (Washington: National Regulatory Research Institute: 2021), https://www.naruc.org/nrri/nrri-library/research-papers/whither/

39 ERCOT, "Seasonal assessments show sufficient generation for winter and spring," Press Release, November 5, 2020, http://www.ercot.com/news/releases/show/216844

market, load forecasting becomes an even more important driver for investment in new capacity. Potential investors depend heavily on these public projections to understand ERCOT's expectation of resource needs and make decisions about building generation. If the winter load forecast had been more accurate, it is likely that it could have driven additional investment in more capacity. An important issue for regulators is whether ERCOT's load forecasting methods are adequate.[40]

c. Is it time for Texas to begin a comprehensive energy planning process?

The recent Texas energy crisis has highlighted the relationship of two critically important energy systems, electricity and gas, to the health and welfare of the people of Texas. Planning is not explicitly performed in Texas, because the state has taken the Hayekian approach—relying on the market to send sufficient price signals for the system to optimally plan. The approach of relying on the market has clearly failed the people of Texas not factoring in the importance of resilience, which is not just a cold weather issue but is important with respect to other extreme weather events, including hurricanes and heat. A comprehensive plan would provide feedback to electricity market design. Among other things, it would evaluate, the vulnerabilities of the system, the role of decarbonization, and the relationship between natural gas, and electricity. It would also evaluate the interplay of the energy system with other life and economy sustaining systems, such as water and health.

d. Is Texas unique in needing to re-evaluate the structure of its market?

There are a number of drivers that will have an impact on the structure of all markets. These include the need to incorporate resilience into market design, the impact of renewables on the market supply curve, and the additional investments needed to decarbonize, presumably while increasing electrification. The challenge in market design is to balance the needs of investors, who provide resources to serve load, with cost and the customer's desire for reliable and cost-effective cost power. There is a growing conversation, such as the one sponsored by the World Resources Institute and Resources for the Future, about the wide variety of ways to design markets.[41] The process of revising the ERCOT market would be enhanced by the participation of the Texas PUC staff and commissioners.

e. How is designing a market for reliability different than designing for resilience?

The nature (scale and scope) of the risk that you are designing the system to withstand is different for reliability than it is for resilience. ERCOT is a market for reliability in the traditional engineering/economics sense. It pays for reliability through scarcity pricing, and that price reflects a valuation of an outage of relative short term in a limited geographic footprint. The outage costs studies used to elicit VoLL evaluate outages for relatively short durations (usually of only a few hours) occurring frequently and without consideration of whether the outage is local or covers a wide-area. One design objective of the ERCOT market is to provide resource adequacy, based upon an expected load forecast and the probability of individual uncorrelated generator outages. The resilience risk is different. It is a systematic risk, also called a common-mode failure, in which large groups of generators are impacted at the same time, resulting in a simultaneous outages, as experienced during the Texas freeze.

f. Is increased integration with the Eastern Interconnection warranted?

Detailed power system planning studies are necessary to identify the benefits of increased reliability through a higher degree of interconnection of ERCOT to the U.S. grid. There likely wouldn't have been enough transfer capacity to make up for the 48.6 percent of ERCOT's generation that failed

40 EPRI outlines the shortcomings or current capacity planning protocols in meeting widespread and persistent outages.
EPRI. *Exploring the Impacts of Extreme Events, Natural Gas Fuel and Other Contingencies on Resource Adequacy*, January 28, 2021 https://www.epri.com/research/products/000000003002019300
Maitra, A. and B. Neenan, *Measuring the Value of Electric System Resiliency: A Review of Outage Cost Surveys and Natural Disaster Impact Study Methods* (Palo Alto, CA: Electric Power Research Institute, 2017). https://www.epri.com/research/products/000000003002009670

41 World Resource Institute, "Market Design for the Clean Energy Transition: Advancing Long-Term Approaches." December 16, 2020, to December 17, 2020, https://www.wri.org/events/2020/12/market-design-clean-energy-transition-advancing-long-term

recently. During the February freeze, the Southwest Power Pool (SPP) and Midcontinent Independent System Operator (MISO), the two neighboring regional transmission organizations, also had operating issues, which necessitated power outages across portions of their systems to maintain system frequency. Importantly, however, increasing ERCOT interconnections would generally increase the available resource pool, which could provide significant reliability and resilience benefits.

9. How Will the Financial Consequences of This Event Be Resolved?

The physical crisis has subsided, thanks to the tireless efforts of many workers involved in system restoration. Most people have returned to their normal lives, but many will bear the long-term economic harm and emotional scars from the impact of this event for the foreseeable future. The staggering financial impacts on the utility sector will reverberate for months or years. Forty-two thousand customers had index rate plans that will bill them based on the market price, which remained at or near $9,000/MWh for several days. One Texas cooperative has already filed for bankruptcy after receiving a $1.8 billion bill for less than a week of power.[42] Some competitive retail suppliers that were not fully hedged and made fixed-price retail sales will have significant revenue shortfalls. So far, ERCOT has reported $2.1 billion in outstanding payments (approximately 17 percent of the amount owed for electric production during the freeze).[43] Additional bankruptcies will likely surface in the coming weeks. Ultimately, the consequences will be felt by customers, competitive retail providers, utilities and — possibly ERCOT itself. Bankruptcy is not a court of equity, and the resolution of these bankruptcies will create significant financial disruption. The Texas PUC will need to determine its role in this process, and how it can work to promote a just and reasonable outcome. To do so, it would be useful to account for the financial flows that occurred as a consequence of the crisis, including where the money came from and where it went, as well as identifying outstanding financial liabilities.

10. Conclusion

The Texas PUC and other relevant agencies, ERCOT, its stakeholders, the Texas legislature, and those harmed by this event need to understand details of how this catastrophic failure occurred. The lessons from this catastrophe must form the basis for future investments, policies, regulations, and market rules designed to ensure that this will never happen again. We hope that these questions and context provided by NRRI will help facilitate that process.

42 Reuters, "Texas power cooperative files for bankruptcy, citing $1.8 billion grid debt," March 1, 2021, https://www.reuters.com/article/us-bankruptcy-brazoselectric-texas-outag-idUSKCN2AT1FE

43 Gold, Russell, "Texas Power Market Is Short $2.1 Billion in Payments After Freeze," *Wall Street Journal*, February 26, 2021, http://www.wsj.com/articles/texas-power-market-is-short-2-1-billion-in-payments-after-freeze-11614386958

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About NRRI

The National Regulatory Research Institute (NRRI) was established in 1976 as the research arm of the National Association of Regulatory Utility Commissioners (NARUC). NRRI provides research, training, and technical support to State Public Utility Commissions. NRRI and NARUC are co-located in Washington, DC.

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