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Paying for Energy Peaks: Learning from Texas

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PAYING FOR ENERGY PEAKS: LEARNING FROM TEXAS' FEBRUARY 2021 POWER CRISIS

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1. INTRODUCTION

From February 14–19, 2021, winter storm Uri blanketed Texas with extreme cold. Tragically, the severe temperatures overwhelmed the state's power system. Texas' power grid ended up more than 20 Gigawatts short of the electricity Texans needed[2] – more power than all of California produces on an average day. Over two-hundred lives were lost[3] and an estimated $295 billion in damage resulted.[4] Yet many had long regarded Texas' electric power system, and its regulation, as a model for others. What happened? That question is the focus of this article.

This article first provides an overview of the severe power outages in February 2021 and the regulation of Texas' electric power system, explaining why Texas is on the forefront of challenges that will grow more prominent as the world transitions to cleaner energy. Next, it discusses competing electric power business models and their regulation, including why many had long viewed Texas as a model of wise electricity regulation, and why the problems revealed by winter storm Uri will only grow more pressing for not just Texas but the entire world as it transitions to more reliance on electricity and a power grid supported by natural gas and renewables. It concludes by discussing Texas' path forward and the broader lessons of this crisis for business lawyers and others. The tremendous economic losses of this episode attest to the importance of business lawyers having a basic understanding of their clients' energy dependencies, the risks that significant power problems could present to

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[2] Keith Everhart & Gergely Molnar, *Severe power cuts in Texas highlight energy security risks related to extreme weather events*, INT'L ENERGY ADMIN. (Feb. 18, 2021), https://www.iea.org/commentaries/severe-power-cuts-in-texas-highlight-energy-security-risks-related-to-extreme-weather-events; *February 2021 Cold Weather Grid Operations: Preliminary Findings and Recommendations- Full Presentation*, FED. ENERGY REGUL. COMM'N (Sept. 23, 2021), https://ferc.gov/media/february-2021-cold-weather-grid-operations-preliminary-findings-and-recommendations-full.

[3] *Winter Storm Related Deaths*, TEX. DEP'T OF STATE HEALTH SERV. (July 13, 2021), https://www.dshs.state.tx.us/news/updates.shtm#wn.

[4] Chris Stipes, *New Report Details Impact of Winter Storm Uri on Texas*, UNIV. HOUSTON (March 29, 2021), https://uh.edu/news-events/stories/2021/march-2021/03292021-hobby-winter-storm.php.

their businesses, and the ability to advise them as they seek to mitigate such vulnerabilities.

2. THE FEBRUARY 2021 SNOWPOCALYPSE AND TEXAS' POWER GRID

The "snowpocalypse" or "snowmageddon" of February 2021,[5] brought several days of subfreezing temperatures to Texas, a state with the unusual situation of having its own power grid.[6] The severe, but not unprecedented,[7] winter storm – "all 254 counties of Texas [were] under a winter storm warning at the same time"[8] – wreaked havoc on the power grid. Widespread outages followed due to a combination of demand surges and supply failures.[9] During this time, approximately four million homes lost power and many remained in the dark for several days.[10] In addition to the power problems, pipes burst, water in toilets froze, and water treatment facilities failed, forcing residents to boil water before consuming it.[11]

The power grid must continuously balance the amount of power demanded by every consumer on the grid – exactly matching the amount of power demanded every time you plug in or unplug your phone or turn the heat up or down.[12] The grid relies upon several sources of energy:

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[5] Winter storm Uri was one of the costliest natural disasters in Texas history. *See* Mitchell Ferman, *Winter storm could cost Texas more money than any disaster in state history*, THE TEX. TRIB. (Feb. 25, 2021), https://www.texastribune.org/2021/02/25/texas-winter-storm-cost-budget/.

[6] Alaska and Hawaii also have their own power grids. Additionally, countries smaller than Texas - for example Spain and France - generally have their own power grids.

[7] The lowest temperature in February 2021 for Dallas was 4 degrees Fahrenheit, but temperatures reached 1 and 2 degrees Fahrenheit in 1905 and 1933, respectively. *See DFW– Temperature Extremes*, NAT'L. WEATHER SERV. (Nov. 17, 2021), https://www.weather.gov/fwd/dgr8mxmn.

[8] Andrea Zelinski, *What Went Wrong With Texas's Main Electric Grid and Could It Have Been Prevented?*, TEX. MONTHLY (Feb. 17, 2021), https://www.texasmonthly.com/news-politics/what-went-wrong-with-texass-main-electric-grid-and-could-it-have-been-prevented. (quoting Dr. Joshua D. Rhodes, a postdoctoral researcher at Webber Energy Group).

[9] Peter Cramton, *Fostering Resiliency With Good Market Design: Lessons From Texas* (May 17, 2021), http://www.cramton.umd.edu/papers2020-2024/cramton-lessons-from-the-2021-texas-electricity-crisis.pdf.

[10] *See* Zelinski, *supra* note 8.

[11] Reese Oxner, *Texans now face a water crisis after enduring days without power,* THE TEX, TRIB. (Feb. 19, 2021), https://www.texastribune.org/2021/02/19/texas-water-power-outages/.

[12] James W. Coleman, *Pipelines & Power-Lines: Building the Energy Transport Future*, 80 OH. STATE L.J. 263, 270 (2019).

wind, solar, hydro, natural gas, coal, nuclear, and others.[13] Naturally, it is easiest to balance the grid if these power sources can be directed to dispatch power when needed. But over time, the grid is using less power from dispatchable sources, such as coal power, and more from non-dispatchable sources such as solar and wind – sources that only provide the limited power that the sun or wind allows in a given moment.[14] Texas is number one among the states for the use of wind energy in electricity production.[15] Consumers demand most power in the early evening hours,[16] but generally solar power is strongest at midday[17] and wind power tends to be strongest in the early morning hours.[18] So power grid managers have to make sure there is enough dispatchable power to meet peak demand, and in recent years natural gas power plants have been the overwhelming choice for new dispatchable power plants.[19]

The Electric Reliability Council of Texas (ERCOT) operates Texas' power grid and is overseen by the Public Utility Commission of Texas (PUCT) and the Texas Legislature.[20] ERCOT's four main responsibilities are to: 1) "[m]aintain system reliability," 2) "[f]acilitate a competitive wholesale market," 3) "[f]acilitate a competitive retail market," and 4) "[e]nsure open access to transmission."[21] ERCOT produces seasonal forecasts of power demand.[22] Unfortunately, its peak demand

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[13] *Update to April 6, 2021 Preliminary Report on Causes of Generator Outages and Derates During the February 2021 Extreme Cold Weather Event*, ERCOT (April 27, 2021) [hereinafter ERCOT Update].

[14] *Renewables became the second-most prevalent U.S. electricity source in 2020*, U.S. ENERGY INFO. ADMIN (July 8, 2021), https://www.eia.gov/todayinenergy/detail.php?id=48896.

[15] *Texas: Profile Analysis*, U.S. ENERGY INFO. ADMIN. (Nov. 17, 2021) https://www.eia.gov/state/analysis.php?sid=TX.

[16] *See Hourly Electricity Consumption Varies Throughout The Day and Across* Seasons, U.S. ENERGY INFO. ADMIN. (Feb. 21, 2020), https://www.eia.gov/todayinenergy/detail.php?id=42915.

[17] *Solar Explained, Where Solar Is Found and Used*, U.S. ENERGY INFO. ADMIN. (Mar. 26, 2021) https://www.eia.gov/energyexplained/solar/where-solar-is-found.php.

[18] *The Central United States Set Several Wind Power Records This Spring*, U.S. ENERGY INFO. ADMIN. (June 12, 2020), https://www.eia.gov/todayinenergy/detail.php?id=44075.

[19] *See generally New U.S. Power Plants Expected to be Mostly Natural Gas Combined-Cycle and Solar PV*, U.S. ENERGY INFO. ADMIN. (Mar. 8, 2019), https://www.eia.gov/todayinenergy/detail.php?id=38612 (showing new electric power capacity has predominantly come from natural gas, solar, and wind power, with no more coal and very little nuclear expected in the future).

[20] *Fact Sheet*, ERCOT (Feb. 2021), http://www.ercot.com/content/wcm/lists/219736/ERCOT_Fact_Sheet_2.12.21.pdf.

[21] *Id.*

[22] *E.g., Final Seasonal Assessment of* Resource Adequacy *for the ERCOT Region (SARA) Winter 2020/2021,* ERCOT (Nov. 5, 2020), https://www.ercot.com/files/docs/2020/11/05/SARA-FinalWinter2020-2021.pdf (outlining expected demand for winter 2020-2021).

forecast for winter 2020–21 proved woefully inadequate.[23] In managing the grid, ERCOT collects information from power operators about how much power they are willing to supply and at what price and matches this information with system demand, to determine market prices.[24]

During the storm, ERCOT asked utilities to shut off power for millions to prevent the grid from failing completely.[25] The shortage reached "as high as 20 GWs and averaged about 10 GWs or 20 percent of demand."[26] By the night of February 15, in an attempt to balance grid supply and demand, ERCOT was ordering an amount of load shedding greater than the amount of power California generates for all its residents.[27] In just the first two days of blackouts, Texas shed roughly more than 500 times what California shed during its summer 2020 rolling blackouts.[28] Eventually, the grid did not have even enough power to sustain both rolling blackouts and the provision of power to critical infrastructure.[29] Hence, millions of Texans had no power for days.[30] Indeed, "ERCOT averaged [having] 34,000 MW [(34GWs)] of generation unavailable (based on expected capacity) for two consecutive days from February 15 to 17, equivalent to nearly half of its all-time winter peak electric load of 69,871 MW."[31]

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[23] *See generally Seasonal Assessment of Resource Adequacy for the ERCOT Region (SARA) Winter 2021/2022*, ERCOT (Nov. 19, 2021), https://www.ercot.com/files/docs/2021/11/19/SARA_Winter2021-22.pdf (reporting a "new aggressive approach" to electric grid management and including "additional low-probability, high-impact scenarios").

[24] *See Market Prices*, ERCOT, https://www.ercot.com/mktinfo/prices (last visited Feb. 1, 2022).

[25] Zelinski, *supra* note 8.

[26] Cramton, *supra* note 9, at 2.

[27] *Compare* Everhart & Molnar, *supra* note 2 (showing shed of 27 GW giga watt of load on the night of February 15), with *State Electricity Profiles, Data for 2020*, U.S. ENERGY INFO. ADMIN. (Nov. 4, 2021), https://www.eia.gov/electricity/state/ (showing that in 2020, California generated 193,074 MWh of electricity, which is 22 GW on average).

[28] Everhart & Molnar, *supra* note 2; *see* Ivan Penn, *California Expresses Frustration as Blackouts Enter 4th Day*, N.Y. TIMES, https://www.nytimes.com/2020/08/17/business/energy-environment/california-blackout-electric-grid.html#:~:text=The%20agency%20that%20manages%20the,said%20regulators%20were%20not%20prepared (Aug. 19, 2020), for more on California's summer rolling blackouts.

[29] Crampton, *supra* note 9, at 7–9.

[30] *Id.* at 7.

[31] *February 2021 Cold Weather Grid Operations: Preliminary Findings and Recommendations- Full Presentation,* et. al, *supra* note 2, at 7.

3. WHAT WENT WRONG?

A number of problems contributed in varying degrees to the power outages, such as: weather related issues, existing plant outages, fuel limitations, equipment problems, transmission line losses, grid frequency related issues[32] However, weather complications (freezing issues[33]) were the most significant factor.[34] The second most important factor was natural gas supply chain issues, which included both declines in production and plant power losses.[35] These multiple weather and supply chain challenges led to a rapid decrease in power generation as demand surged. In turn, this caused a precipitous drop in the grid's frequency, which dipped below the minimum requirement of 59.302 Hz[36] for several minutes and, catastrophically, brought the grid to within minutes of collapse.[37]

The grid's imbalance of supply and demand had two primary causes. The first cause was ERCOT's seasonal forecast, which significantly underestimated the power demand likely to occur in extreme, but possible weather conditions.[38] The second was that the grid's vulnerabilities caused cascading power outages.[39] Wind turbines froze and snow covered solar panels. The severe cold increased the difficulty of pumping natural gas, which shrinks in cold temperatures, out of the ground. Additionally: Texas and the south-central U.S. rely heavily on natural gas for fueling electric generation to meet peak capacity and energy needs.[40] Likewise, the natural gas infrastructure relies heavily on electrical power for producing, processing and transporting natural gas to end-users,

[32] ERCOT Update, *supra* note 13, at 4.
[33] *February 2021 Cold Weather Grid Operations: Preliminary Findings and Recommendations- Full Presentation*, *supra* note 2, at 11 (explaining problems caused by the failure to "winterize" the relevant infrastructure).
[34] ERCOT Update, *supra* note 13 , at 4.
[35] *February 2021 Cold Weather Grid Operations: Preliminary Findings and Recommendations- Full Presentation*, *supra* note 2, at 12–14.
[36] Excessive demand for electricity lowers the frequency level and excessive supply increases it. To maintain the grid's integrity, a tight balancing of supply and demand at all times is necessary to keep the frequency of the grid within a tightly defined range.
[37] Erin Douglas, *Texas was "seconds and minutes" away from catastrophic monthslong blackouts, officials say*, THE TEX. TRIB., (Feb. 18. 2021), https://www.texastribune.org/2021/02/18/texas-power-outages-ercot/.
[38] *The Timeline and Events of the February 2021 Texas Electric Grid Blackouts,* UNIV. OF TEX. AT AUSTIN, ENERGY INST., Jul. 2021, https://www.puc.texas.gov/agency/resources/reports/UTAustin_(2021)_EventsFebruary2021TexasBlackout_(002)FINAL_07_12_21.pdf.
[39] *Id.* at 56.
[40] *February 2021 Cold Weather Grid Operations: Preliminary Findings and Recommendations- Full Presentation*, *supra* note 2 at 5–6.

including natural-gas fired generation and residential heating customers. Careful planning and coordination to manage the needs of the natural gas and electric systems in light of this "interdependency" is important so that both systems are ultimately reliable for consumers, especially during cold weather conditions when the demand for natural gas and electricity are at their highest levels.[41] Hence, a portion of Texas' natural gas production, including plants, pipelines, and field pumps, relies upon electricity. The power outages disrupted such interdependent supply chains.

A variety of failures contributed to the loss of power by critical energy infrastructure. For example, in many cases, critical infrastructure failed to file a one-page form to advise ERCOT of its status as such.[42] In fact, "most of the natural gas production and processing facilities surveyed…were not identified as critical loads or otherwise protected from manual load shedding."[43] As a result, ERCOT's manual load shedding actually contributed to the decrease in natural gas production.[44] In other cases, parts of the natural gas supply chain had signed up for ERCOT's Demand Response Program, which is designed to decrease participants' power costs overall, but meant they could not perform when natural gas was most needed.[45] Additionally, as discussed in Part III, there were vulnerabilities in the grid's scarcity pricing mechanism.

Texas' power grid is particularly at risk from extreme cold temperatures for three reasons. First, its design centers on accommodation of peak demand from high summer temperatures.[46] Second, homes in Texas are generally constructed to expel heat and to keep it out.[47] Third, some homes use electricity (about 60%) and others natural gas (about 40%) for heating and this creates competition for natural gas in the winter.[48] Consequently, both power plants and homes were increasing their demand for natural gas as storm-related disruptions occurred in the natural gas supply chain, drastically reducing natural gas delivery to Texas consumers.[49]

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41 *Id.*

42 Niki Roberts & David H. Sweeny, *Critical Load Designation Critical for Nat Gas Producers*, AKIN GUMP: AG SPEAKING ENERGY (Mar. 29, 2021), https://www.akingump.com/en/experience/industries/energy/speaking-energy/critical-load-designation-critical-for-nat-gas-producers.html.

43 *February 2021 Cold Weather Grid Operations: Preliminary Findings and Recommendations- Full Presentation* , *supra* note 2, at 15.

44 *February 2021 Cold Weather Grid Operations: Preliminary Findings and Recommendations- Full Presentation*, *supra* note 2, at 15.

45 *See The Timeline and Events of the February 2021 Texas Electric Grid Blackouts, supra* note 38.

46 Zelinski, *supra* note 8.

47 *Id.*

48 *Id.*

49 *Id.*

4. ELECTRICITY REGULATION IN TEXAS

As "almost an electricity island",[50] Texas power grid avoids regulation by the Federal Energy Regulatory Commission (FERC). This arrangement permits Texas to have its own energy policy and, arguably, facilitates a high level of innovation and flexibility to address energy challenges. As noted, Texas produces more wind power than any other state,[51] and it has been ramping up its solar power capacity. State regulation of the grid has facilitated the financing necessary for transitioning to cleaner energy sources because it has enabled broad-based cost sharing among Texas consumers rather than having to allocate all costs to actual users.[52]

However, Texas' energy insularity also means that in supply shortages, Texas cannot rely upon other power systems for much help.[53] Without significant interstate grid connections,[54] recovery from a full grid blackout would also take much longer,[55] significantly increasing costs to citizens and businesses.[56] One commentator paints a dire picture of this full blackout scenario:

> [It] would be a delicate and lengthy process that would have to start from zero. It would take many weeks to execute. During that period, aside from what first responders could truck in or airlift from neighboring states, there would be no electricity, no heat, no water, no gasoline, and no standard communications.[57]

Around the world, electricity markets are often managed by traditional, regulated utility monopolies where the government sets power

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[50] Cramton, *supra* note 9, at 24.

[51] *Texas State Energy Profile*, U.S. ENERGY INFO. ADMIN. (last visited Nov. 27, 2021), https://www.eia.gov/state/print.php?sid=TX.

[52] R. Ryan Staine, *CREZ II, Coming Soon to a Windy Texas Plain Near You: Encouraging the Texas Renewable Energy Industry through Transmission Investment*, 93 TEX. L. REV. 521, 525–32 (2014).

[53] Cramton, *supra* note 9, at 25.

[54] *See generally Learn More About Interconnections*, OFF. OF ELEC., https://www.energy.gov/oe/services/electricity-policy-coordination-and-implementation/transmission-planning/recovery-act-0 (last visited Oct. 26, 2021)(explaining, for example, a minimal ERCOT Interconnection exists with the Eastern Interconnection and Mexico and can import up to 1,220 MW).

[55] Cramton, *supra* note 9, at 1.

[56] *Id.*

[57] Cramton, *supra* note 9, at 9.

rates. Jurisdictions that instead use competition tend to rely upon two types of markets: a long-term "capacity market" that pays power plants to be available to provide power and a short-term "energy market" that pays companies to dispatch power to the grid.[58] Regardless of the approach, "[e]lectricity, unlike other products, requires that supply and demand balance every second so that frequency and voltage stay within tight tolerances. Absent this balance, generating units will trip off, causing a catastrophic blackout."[59] Texas' grid must maintain this tight equilibrium for a growing population of almost 30 million.[60] Adding to the challenge, electricity is also expensive and difficult to store[61] as is natural gas.

In capacity markets, power plants are paid for providing capacity even if energy is not ultimately produced.[62] Capacity markets employ different types of capacity mechanisms (such as obligations or requirements) to set minimum demand levels or use futures markets to ensure demand is reliably met.[63] These capacity approaches aim to ensure generators have liquidity, an incentive to make power investments, and attempt to lower generators' upfront investment risk.[64]

Texas, by contrast, uses the second type of market, an "energy-only" approach, which only compensates generators when they actually dispatch power to the grid. This approach has to wrestle with a "missing-money problem," which requires mechanisms to incentivize operators to make costly, upfront power investments when the financial payoffs of these investments depend upon an uncertain future.[65] These "energy-only" markets use scarcity pricing, the practice of increasing prices as demand nears capacity supply limits, to attempt to create such incentives and to ensure reliability.[66]

As it operates an "energy-only" market, ERCOT uses scarcity pricing – a price adder that applies when electricity demand approaches the total available supply.[67] Price increases generally result from increased demand coupled with less efficient production or as a result of the

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[58] Raúl Bajo-Buenestado, *Operating Reserve Demand Curve, Scarcity Pricing and Intermittent Generation: Lessons from the Texas ERCOT Experience*, 149 ENERGY POL'Y. 1 (2021).
[59] Cramton, *supra* note 9, at 1.
[60] *Quick Facts: Texas*, U.S. CENSUS BUREAU (last visited Nov. 27, 2021), https://www.census.gov/quickfacts/TX..
[61] Bill Gates, *It is Surprisingly Hard to Store Energy*, GATESNOTES (Feb. 22, 2016) https://www.gatesnotes.com/energy/it-is-surprisingly-hard-to-store-energy.
[62] Zelinski, *supra* note 8, at 6.
[63] Bajo-Buenestado, *supra* note 58, at 2.
[64] *Id*.
[65] *Id* at 10.
[66] *Id* at 3.
[67] Bajo-Buenestado, *supra* note 58, at 2.

Operating Reserve Demand Curve (ORDC).[68] The ORDC is designed to "ensure electricity prices accurately reflect shortage conditions"[69] and "automatically increases the price of power as reserves get tighter."[70] In theory, generators should be paid a location-based spot price reflecting real-time market conditions and an additional amount, "the ORDC price adder."[71] With this financial incentive, generators should then increase investments in generation units, ultimately restoring adequate market supply.[72] The incentive provided by the price adder supplement should ensure that all power generators are operating at full capacity if necessary in times of significantly elevated demand.[73] Consequently, in extreme conditions, Texas' power system does not rely on market mechanisms alone in attempting to ensure adequate power supply.

However, ERCOT's pricing system failed during winter storm Uri. When ERCOT ordered load shedding to preserve the grid, its pricing algorithms read these power reductions as the grid having excess power capacity. ERCOT's pricing algorithms failed to accurately understand the existing imbalances between the system's demand and supply and to implement prices reflecting these conditions rather than prices corresponding to excess capacity.[74] In response to this calibration failure, PUCT mandated that the grid's then highest allowable price (price cap) of $9000/MWh remain in place for more than three days.[75] Consequently, some Texas power providers spent more in a few short days to purchase power than they had spent in several previous years.[76] Not surprisingly, this resulted in shockingly high electricity bills for many that also triggered several corporate bankruptcies.[77]

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[68] NRG Editorial Voices, *What Texas Businesses Need to Know about Scarcity Pricing this Summer*, NRG ENERGY (last visited Aug. 27, 2021), https://www.nrg.com/insights/energy-education/what-texas-businesses-need-to-know-about-scarcity-pricing-this-s.html.
[69] *Id.*
[70] *Id.*
[71] Bajo-Buenestado, *supra* note 58, at 2.
[72] *Id.*
[73] *Id.*
[74] *The Timeline and Events of the February 2021 Texas Electric Grid Blackouts*, *supra* note 38, at 60–64.
[75] Deanna R. Reitman & Jeffrey Bourdon, *Winter Storm Uri: New Texas legislation aims to improve power grid, restructure the grid's overseeing agency*, DLA PIPER, (June 15, 2021), https://www.dlapiper.com/en/us/insights/publications/2021/06/winter-storm-uri-new-texas-legislation-aims-to-improve-power-grid/.
[76] *The Timeline and Events of the February 2021 Texas Electric Grid Blackouts*, *supra* note 38, at 63.
[77] Reitman & Bourdon, *supra* note 75.

However, ERCOT's ability to meet peak power demands via the ORDC came under scrutiny even before February 2021.[78] Distorted price signals can be a challenge for market-oriented approaches, which rely upon scarcity pricing to ensure optimal reliability.[79] For example, in Texas' case, researchers have demonstrated that the significant levels of wind-generated power, which comprised about 20% of energy sources for ERCOT in 2019, can have an adverse impact upon the accuracy of the ORDC pricing mechanism.[80] In contrast to other sources of power, wind is uncontrollable or "non-dispatchable," meaning that it does not (and cannot) respond to market conditions.[81] Wind energy failures occurred in the storm as some windmills froze, but except for "two brief instances,"[82] the resulting wind energy losses did not exceed those that ERCOT had anticipated as potentially possible in extreme weather conditions.[83]

Natural gas supply chain failures proved more consequential. February 2021 saw the "largest U.S. monthly decline of natural gas production on record."[84] The Railroad Commission of Texas (Commission) regulates oil and gas production and transport in Texas.[85] It is arguably the most important oil and gas regulator in the world.[86] As noted, the reliability of Texas' power grid is dependent upon natural gas power plants, some of which rely upon electricity to operate.[87] ERCOT had expected thermal resource losses of approximately 14GWs, but actual losses were closer to 30GWs.[88]

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78 Bajo-Buenestado, *supra* note 58. Extreme cold weather in February 2011 also caused power outages and reductions. *See* Federal Energy Regulatory Commission & North American Electric Reliability Corporation, *Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1–5, 2011* (Aug. 2011), https://www.ferc.gov/sites/default/files/2020-04/08-16-11-report.pdf.

79 Bajo-Buenestado, *supra* note 58. Extreme cold weather in February 2011 also caused power outages and reductions. *See* Fed. Energy Reg. Comm'n & North American Electric Reliability Corporation, *Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011* (Aug. 2011), https://www.ferc.gov/sites/default/files/2020-04/08-16-11-report.pdf.

80 Bajo-Buenestado, *supra* note 58, at 2–3.

81 *Id.*

82 Cramton, *supra* note 9.

83 *Id.*

84 FERC et. al, *supra* note 2, at 5.

85 *About Us*, R.R. COMM'N OF TEX. (last visited Mar. 2, 2022) https://www.rrc.texas.gov/about-us.

86 James W. Coleman, *Rebuilding the Texas Railroad Commission*, 20 OIL GAS & ENERGY L. 1, 1, 4–5 (2022).

87 Nate Chute, *What Percentage of Texas Energy is Renewable? Breaking Down the State's Power Sources from Gas to Wind.*, AUSTIN AMERICAN-STATESMAN (Feb. 17,2021, Updated Feb. 19 2021), https://www.statesman.com/story/news/2021/02/17/texas-energy-wind-power-outage-natural-gas-renewable-green-new-deal/6780546002/.

88 Cramton, *supra* note 9 at 1.

5. THE ROLE OF NATURAL GAS IN THE TRANSITION TO CLEANER ENERGY

As energy markets increasingly turn to renewable resources, adequate supplies of natural gas are tremendously important.[89] It is the critical resource for ensuring power reliability as energy markets transition because of its dispatchability in shortages.[90] The challenge, however, of natural gas is that, like electricity, and unlike more traditional sources of energy such as coal and uranium, it is exceedingly difficult and expensive to store.[91] Thus, the natural gas system depends on an extensive supply chain to provide just-in-time delivery of whatever volume of natural gas is necessary to meet current demand for heat and electricity.[92] And turning to electric heating, rather than natural gas heating, counterintuitively increases natural gas consumption because burning natural gas for electricity to turn back into heat is far less efficient than simply burning the gas directly for heat.[93] Texas produces more gas than any other U.S. state and the United States produces far more natural gas than any other country, so gas is generally in ample supply.[94] Winter storm Uri, however, revealed that the interconnected natural gas and electricity supply chains can be fragile because of their constant dependence on balancing supply and demand in both markets.[95]

This challenge will grow more and more acute as the country attempts to clean up its energy system by: 1) relying on electricity to meet

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[89] For example, reduced supplies of natural gas have recently proved problematic and contributed to energy price increases. Joe Wallace, *Energy Prices in Europe Hit Records After Wind Stops Blowing*, WALL ST. J. (Sept. 13, 2021), https://www.wsj.com/articles/energy-prices-in-europe-hit-records-after-wind-stops-blowing-11631528258; *See, e.g.*, Nichola Groom & Andrea Ricci, *California asks Biden administration to allow gas plants to run at maximum*, REUTERS (Sept. 9, 2021), https://www.reuters.com/business/energy/california-asks-biden-administration-allow-gas-plants-run-maximum-2021-09-09.

[90] *See generally* James W. Coleman, *Energy Market and Policy Revolutions: Regulatory Process and the Cost of Capital*, ENERGY L. AND ECON. (2018).

[91] *Id.*

[92] *See generally Id.*

[93] Neil Leslie, *Full-Fuel-Cycle Energy and Emission Factors for Building Energy Consumption – 2018 Update*, AMERICAN GAS ASS'N, Jan. 2019, at 38 tbl. 5 (showing that electric heating only provides 1/2.53 of the heat energy in the natural gas burned), https://www.aga.org/globalassets/research--insights/reports/22433-ffc-final-report-2019-01-14.pdf.

[94] Bill Brown, *United States Continued to Lead Global Petroleum and Natural Gas Production in 2020*, U.S. ENERGY INFO. ADMIN. (July 19, 2021), https://www.eia.gov/todayinenergy/detail.php?id=48756#; Chute, *supra* note 87.

[95] Wallace, *supra* note 89.

more and more of human needs for transportation and heating, and 2) relying on natural gas to replace dirtier sources of electricity and back up renewable sources of energy that do not require fuel combustion, but cannot be dispatched to the grid on command.[96] And the final step in decarbonization will be ensuring that natural gas powered back-up is used as little as possible.[97] Thus, natural gas infrastructure will be used less and less but become more and more important as the last-resort source of dispatchable electricity to meet all the human needs that are growing increasingly dependent on the power grid.[98] As human health and safety increasingly depends on the availability of inconsistently used gas infrastructure, the private gas industry will increasingly be subject to utility-type reliability regulations.[99] Regulated rate utilities may find it easier to accept the need to build and maintain rarely-used gas infrastructure so long as they can pass the rates on to utility consumers,[100] but in competitive market states such as Texas, it may prove difficult to find companies that want to invest in costly infrastructure that will only rarely be used.[101]

6. THE PATH FORWARD

A multitude of problems contributed to the disastrous human and economic costs of winter storm Uri. To prevent a repeat of this episode, regulation that gets the economic incentives of the grid's ecosystem right is necessary.[102] Fixing Texas' power grid ultimately requires a multifaceted approach, including the implementation of relatively straightforward reforms and of solutions to more complex questions. The former category includes simple changes such as ensuring that critical infrastructure appropriately registers as such with ERCOT and does not enroll in incentive programs such as the Demand Response Program. It also encompasses better seasonal forecasting by ERCOT and a faster action when load shedding is necessary, both changes should aid in preventing the grid's frequency failure; the clear identification of critical grid infrastructure; the refinement of ERCOT's scarcity pricing algorithms; and, improved communication between ERCOT and the Commission and among these regulators, power grid participants, and the public.

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[96] Coleman, *supra* note 90.
[97] *Id.*
[98] *Id.*
[99] *See generally* James W. Coleman, *Policymaking by Proposal: How Agencies Are Using Proposed Rules to Transform Industry Long Before Final Rules Are Tested in Court*, 24 GEO. MASON L. REV. 497 (2017).
[100] *Id.* at 499–500.
[101] *See generally* Coleman, *supra* note 90.
[102] *Id.*

The more complex issues include: 1) whether Texas should connect to one or both of the wider, national electric grids, 2) implementing effective penalties for failure to weatherize the power supply chain properly, and 3) effectively financing the firm resources necessary to ensure grid reliability, that is, a transition to a capacity market model with guaranteed payments or retaining an energy-only approach, but with more frequent and increased price spikes?

In June 2021 Texas' legislature passed a number of reforms to improve reliability of its power grid.[103] These reforms center on: requiring the weatherization of power generators and fines for non-compliance; restructuring of ERCOT's governance structure; and, increasing consumer awareness of energy shortages, including an emergency pricing program and alerts.[104] However, the new law does not define "weatherization," leaving ERCOT or the Commission to define this term. Consequently, "weatherization" could include a host of changes, ranging from the mostly costless (the identification of critical infrastructure) to somewhat costly (insulating key power plant sensors and cooling water that should not freeze) to the extremely costly (defrosting capabilities at all gas wells).

7. CONCLUSION

Texas' February 2021 power crisis holds several lessons for business lawyers. First, this episode, and its aftermath, highlights the importance of taking a holistic perspective of a client's business risks, including its energy dependencies, and incorporating this point of view into the provision of legal services. Second, it reinforces the need for effective, timely communication for business lawyers with all stakeholders. Third, it demonstrates how important it is to identify the critical components (infrastructure) of a clients' business model and take steps to safeguard its integrity. Finally, it illustrates the need for accurate forecasting and pricing mechanisms; the potential issues supply chain vulnerabilities and disruptions can cause; the role of and behaviors encouraged by incentive structures; and, the critical task of planning for extreme, but not unprecedented, conditions.

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[103] *See generally* Reitman & Bourdon, *supra* note 75.

[104] The changes to ERCOT's governance structure include: a decrease in the overall number of directors and those eligible to vote; qualification requirements for most directors; an independence requirement; a Texas residency requirement; and, a political appointment process for the ERCOT board selection committee. *Id.*