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THE TEXAS ENERGY GRID: MEASURES TAKEN SINCE WINTER STORM URI AND HOW IT COMPARES TO GERMANY'S POWER INFRASTRUCTURE

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INTRODUCTION	129
PART I: THE STRUCTURE OF TEXAS' ENERGY GRID	129
PART II: SUMMARY OF THE EVENTS AND THE KEY FAILURES THAT LED TO THE CRISIS	130
PART III: ANALYSIS OF STEPS THAT NEED TO BE TAKEN IN TEXAS TO AVOID ANOTHER CRISIS	132
A. Protection of Critical Gas Infrastructure from Load Shedding	133
B. Weatherization of the Power Infrastructure	133
C. Increase of Stored Energy	135
D. Reform of the Structure of the Energy Market	137
a. Introduction to the Discussion: Option of a Capacity Market	137
b. Standardized Fixed Price Forward Contract Approach	137
c. Performance Credit Mechanism	138
d. Broader Policy Trend Disfavoring Renewable Energy Sources	139
E. Interconnecting Texas' Energy Grid	141
PART IV. COMPARISON BETWEEN THE ENERGY MARKET OF TEXAS AND GERMANY	145
A. Outline of the German Energy Market	145
B. Common Basic Features	147
C. Electricity Rates	148
D. Grid Reliability	149
a. Weather Resilience of the Grid	150

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Fall 2023

b. Continuous Climate Adaptation and Efficient Crisis Management	153
i. Continuous Climate Adaptation	153
ii. Efficient Crisis Management	154
E. Interconnectedness of the German Energy Grid	155
CONCLUSIONS	156

Introduction

In February 2021, winter storm Uri brought unusually cold temperatures to Texas. This led to a dramatic blackout in Texas during which over ten million Texans lost power—many of them for several days.¹ These events cost 210 lives, the economic damage exceeds \$20 billion.² Due to the interdependencies of electricity and water infrastructure, it is estimated that nearly 50 percent of Texans were out of running water for more than two days.³ Since climate change will most likely increase the frequency of extreme weather events, a thorough analysis of legislative and policy responses to this power crisis is highly relevant.⁴ This article will provide key facts about the structure of Texas’ energy grid (II) and will give a brief summary of the events of the crisis and causes that led to the blackouts (III). Then it will list the necessary steps to prevent a repetition of this crisis and analyze whether they have already been taken (IV). Finally, it will compare the energy grid of Texas and Germany (V). This comparison will analyze why the German energy grid is much more reliable and how it benefits from the interconnections to its neighboring countries.

Part I: The Structure of Texas’ Energy Grid

The U.S. power grid is divided into three sections: the Eastern Interconnection, the Western Interconnection and the Texas energy grid. Texas has only very limited ties with the other two interconnections⁵ and this isolation is intentional. Since Texas’ utilities do not engage in interstate commerce, they are not subject to Federal Energy Regulatory Commission (FERC)

¹ Joshua W. Busby et al., *Cascading risks: Understanding the 2021 winter blackout in Texas*, 77 ENERGY RES. & SOC. SCI. 1 (2021).

² Stratton Horres, Karen Bashor & Taylor Buono, *The Texas energy grid, a power crisis that didn't have to happen: Will there be a repeat?*, WestLaw Today (Dec. 2, 2021), [https://today.westlaw.com/Document/I775d28a6536811ec9f24ec7b211d8087/View/FullText.html?transitionType=Default&contextData=\(sc.Default\)&firstPage=true](https://today.westlaw.com/Document/I775d28a6536811ec9f24ec7b211d8087/View/FullText.html?transitionType=Default&contextData=(sc.Default)&firstPage=true) [https://perma.cc/H3J8-N6E7].

³ Yael R. Glazer et al., *Winter Storm Uri: A Test of Texas’ Water Infrastructure and Water Resource Resilience to Extreme Winter Weather Events*, 8 J. OF EXTREME EVENTS 1, 3–6 (2021).

⁴ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, WORKING GROUP I, FULL REPORT CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP I TO THE SIXTH ASSESSMENT REPORT, 1, 1610 (Aug. 2021), https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf.

⁵ THE UNI. OF TEX. AT AUSTIN ENERGY INSTITUTE, THE TIMELINE AND EVENTS OF THE FEBRUARY 2021 TEXAS ELECTRIC GRID BLACKOUTS, 1, 13 (July 2021), <https://energy.utexas.edu/sites/default/files/UTAustin%20%282021%29%20EventsFebruary2021TexasBlackout.pdf> [https://perma.cc/AUT6-JLQ3].

regulation and oversight.⁶ According to Section 201 of the Federal Power Act (FPA), FERC has only jurisdiction over “the transmission of electric energy in interstate commerce and the sale of such energy at wholesale in interstate commerce.”⁷

Texas’ intrastate grid is mainly run by the Electric Reliability Council of Texas (ERCOT), a non-profit entity, who in turn is overseen by the Public Utility Commission of Texas (PUC) and the Texas Legislature.⁸ Texas has a deregulated grid, which means that generating stations, transmission lines, and distribution networks are not owned and operated by one entity, but by different companies.⁹ Furthermore, Texas uses an energy-only market where power plants are only remunerated for the electricity they actually generate and provide.¹⁰ One alternative would be a capacity market, where operators are paid for the mere commitment to have capacity available in the future.

Part II: Summary of the Events and the Key Failures that Led to the Crisis

Due to the freezing temperatures, demand was exceptionally high.¹¹ Early on February 15, 2021, 8000 Megawatt (MW) of gas power plants stopped operating because the plants were out of fuel or had frozen equipment.¹² Another 2000 MW of wind turbines shut down because of low winds or ice on turbine blades.¹³ When ERCOT realized that demand would exceed supply, it ordered load shedding to prevent uncontrolled blackouts.¹⁴

There is consensus that a combination of factors caused the energy crisis in Texas.¹⁵ The most important were the lack of winterization of generation facilities, the insufficiency of natural gas supply, and the inadequacy of both the weather forecast and ERCOT’s demand forecast.¹⁶ Furthermore, it was highly problematic that “[m]ost natural gas production and processing facilities . . . were not identified as critical load or otherwise protected from load shedding.”¹⁷

In regard to the lack of weatherization, it is first important to point out that a phenomenon like winter storm Uri was not unprecedented in Texas.¹⁸ For example, there was another major winter storm blackout in 2011. The storm itself was not as severe as winter storm Uri, but it

⁶ Kate Galbraith, *Explainer: Why does Texas have its own power grid?*, TEX. TRIB. (Feb. 15, 2021), <https://www.texastribune.org/2011/02/08/explainer-why-does-texas-have-its-own-power-grid/> [<https://perma.cc/HPD7-QBXL>].

⁷ 16 U.S.C. § 824.

⁸ ERCOT, FACT SHEET (Nov. 2023), https://www.ercot.com/files/docs/2022/02/08/ERCOT_Fact_Sheet.pdf [<https://perma.cc/L9G5-75WE>].

⁹ Dean Jepsen, *Examining the 2021 Texas Power Grid Crisis*, 27 PUB. INT. L. REP. 23 (2021).

¹⁰ Busby et al., *supra* note 1, at 6.

¹¹ *Id.* at 2.

¹² *Id.*

¹³ *Id.*

¹⁴ *Id.*

¹⁵ THE UNI. OF TEX. AT AUSTIN ENERGY INSTITUTE, *supra* note 5, at 7-9.

¹⁶ FERC, THE FEBRUARY 2021 COLD WEATHER OUTAGES IN TEXAS AND THE SOUTH CENTRAL UNITED STATES | FERC, NERC AND REGIONAL ENTITY STAFF REPORT 1, 15-17 (Nov. 2021), <https://www.ferc.gov/media/february-2021-cold-weather-outages-texas-and-south-central-united-states-ferc-nerc-> [<https://perma.cc/H29Z-NGZ6>] and; THE UNI. OF TEX. AT AUSTIN ENERGY INSTITUTE, *supra* note 5, at 18-25.

¹⁷ FERC, FEBRUARY 2021 COLD WEATHER GRID OPERATIONS: PRELIMINARY FINDINGS AND RECOMMENDATIONS - FULL PRESENTATION 15 (Sep. 2021), <https://www.ferc.gov/media/february-2021-cold-weather-grid-operations-preliminary-findings-and-recommendations-full> [<https://perma.cc/F4N7-V5N3>].

¹⁸ James Doss-Gollin et al., *How unprecedented was the February 2021 Texas cold snap?*, 16 ENV'T. RSCH. LETTERS at 1-6 (2021).

Fall 2023

caused comparable problems.¹⁹ In response to this blackout, the Texas legislature passed a law that instructed the PUC to analyze and report on whether electric utilities and the electric grid are adequately prepared for extreme weather events.²⁰ In 2012, the PUC published the mandated report and included recommendations on how to better weatherize power plants.²¹ FERC and the North American Electric Reliability Corporation (NERC) published a similar report in 2011.²² Experts agree that these recommendations have not been followed.²³

Almost two-thirds of the total supply shortfall was attributed to natural gas.²⁴ This is quite notable considering that Texas usually has immense natural gas supplies.²⁵ In fact, after Russia and the entire U.S., Texas is the world's largest producer of natural gas.²⁶ Since the gas and electricity systems in Texas are interdependent, a failure in one of the systems can affect the other.²⁷ Here, the sharp deficit of electricity from natural gas was attributable to power outages at compressor stations which had the consequence of cutting off gas-fired power plants from their supply.²⁸ The freezing of natural gas wells and gathering pipelines impeded electricity generation from natural gas.²⁹ Additionally, several coal and gas-fired plants were offline for regular maintenance which power generators usually schedule during Texas' mild winter months.³⁰ As a result, 14 GW of thermal capacity was intentionally shut down in the days prior to the blackouts.³¹ It was also highly problematic that Texas did generally not have enough natural gas in storage and that many natural gas-based electricity producers did not have gas stored on-site.³² Texas' energy-only market, with its scarcity pricing method, does not set incentives for large

¹⁹ THE UNI. OF TEX. AT AUSTIN ENERGY INSTITUTE, *supra* note 5, at 71.

²⁰ Texas Util. Code Section 186.007.

²¹ QUANTA TECHNOLOGY, LLC, REPORT ON EXTREME WEATHER PREPAREDNESS: BEST PRACTICES 1, 14–18 (Sept. 2012), <https://www.preventionweb.net/publication/report-extreme-weather-preparedness-best-practices> [<https://perma.cc/FEP3-USXF>].

²² FERC & NERC, 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/2020-05/ReportontheSouthwestColdWeatherEventfromFebruary2011Report.pdf> [<https://perma.cc/J3GS-Y6RA>].

²³ Rachel Frazin, *Regulator: Evidence suggests Texas 'absolutely' didn't follow recommendations to winterize power equipment*, THE HILL (Mar. 24, 2021), <https://thehill.com/policy/energy-environment/544767-reliability-group-leader-says-evidence-suggests-texas-absolutely/> [<https://perma.cc/4CUY-AU5N>]; Asher Price & Bob Sechler, *Winter storm blackouts plagued Texas in 2011, too. Recommendations made afterward went unenforced*, USA TODAY (Feb. 18, 2021), <https://www.usatoday.com/story/news/nation/2021/02/18/state-energy-winter-protections-lacking-reports-have-suggested/4490501001/> [<https://perma.cc/ZM4V-RGCM>].

²⁴ Busby et al., *supra* note 1, at 2.

²⁵ *Id.*

²⁶ *Id.*

²⁷ *Id.*

²⁸ *Id.*

²⁹ *Id.*

³⁰ *Id.* at 4.

³¹ Monika O'Shea, Riti Goel & Rebecca Miller, *Breaking down the Texas winter blackouts: what went wrong?*, WOOD MACKENZIE (Feb. 19, 2021), <https://www.woodmac.com/news/editorial/breaking-down-the-texas-winter-blackouts/> [<https://perma.cc/ML2M-UCEE>].

³² THE UNI. OF TEX. AT AUSTIN ENERGY INSTITUTE, *supra* note 5, at 8–9, 45–48.

storage capacities.³³ The lack of gas reserves of power plants can be attributed to the fact that Texas produces so much natural gas on its own that it is cheaper for most power plants to obtain their natural gas directly from the well or processing plant instead of storing it onsite.³⁴

Another factor responsible for the Texas energy crisis was the inaccuracy of ERCOT's forecasts. For the scenario of an extreme outage, ERCOT predicted a maximum outage of 14 GW of thermal energy.³⁵ However, winter storm Uri led to outages of over 30 GW of thermal capacity—which is more than 40 percent of ERCOT's entire thermal capacity.³⁶ Similarly, ERCOT's demand forecast was wrong: the maximum demand in the “extreme winter scenario” was 67.2 GW,³⁷ but later on, ERCOT estimated that without load shedding the peak demand would be at 76.8 GW.³⁸ One likely reason for the inadequacy of these predictions is that ERCOT (as well as NERC) tend to use historical weather data for planning their energy systems.³⁹ It is crucial that ERCOT considers future-oriented data and better prepares for risk scenarios caused by climate change.⁴⁰

Finally, it should be noted that many natural gas facilities did not apply to be classified as critical infrastructure and therefore were cut off from power during load shedding.⁴¹ Soon thereafter, the PUC directed the utilities responsible for load shedding to restore power to these critical gas facilities.⁴² However, restoring power to these gas facilities in the midst of the power crisis meant cutting power elsewhere, which resulted in a major challenge for grid operators.⁴³

Part III: Analysis of the Steps that Need to be Taken in Texas to Avoid Another Crisis

What measures has Texas taken to avoid another power crisis from happening? As more than two years have passed since the events of winter storm Uri, this section will also analyze what measures have already been implemented.

³³ Colin Lanier, AN ASSESSMENT OF POLICY RECOMMENDATIONS IN THE AFTERMATH OF WINTER STORM URI 1, 13 (2022), <https://scholar.colorado.edu/downloads/xw42n9112> [<https://perma.cc/LLL5-EHBT>].

³⁴ Cameron Kinvig, *Energy Policies Lead to Texas Power Crisis*, LEXIS NEXIS (June 8, 2021), <https://www.lexisnexis.com/community/insights/legal/practical-guidance-journal/b/pa/posts/energy-policies-lead-to-texas-power-crisis> [<https://perma.cc/KSW3-XUCS>].

³⁵ Adam Barth, Jesse Noffsinger & Humayun Tai, *The Texas power crisis: Shining a light on the generation outages*, MCKINSEY & COMPANY (Mar. 11, 2021), <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-power-and-gas-blog/the-texas-power-crisis-shining-a-light-on-the-generation-outages> [<https://perma.cc/D32G-9CDQ>].

³⁶ *Id.*

³⁷ Busby et al., *supra* note 1, at 4.

³⁸ *Id.*

³⁹ Clean Future Act: Powering a Resilient and Prosperous America: Virtual Hearing Before the Subcommittee on Energy of the Committee on Energy and Commerce, House of Representatives, 117th Cong., First Sess. 27 (2021) (statement of Alison Silverstein).

⁴⁰ *Id.*

⁴¹ Erin Douglas, *Paperwork failures worsened Texas blackouts, sparking mid-storm scramble to restore critical fuel supply*, TEX. TRIB. (Mar. 18, 2021), <https://www.texastribune.org/2021/03/18/texas-winter-storm-blackouts-paperwork/> [<https://perma.cc/69SA-839H>].

⁴² *Id.*

⁴³ *Id.*

Fall 2023

A. Protection of Critical Gas Infrastructure from Load Shedding

The first necessary measure considered in this paper is ensuring that critical gas infrastructure is protected from load shedding. The final report on the Uri power outage issued by FERC, NERC and several regional entities recommended the joint issuance of guidelines by several regional entities “to assist natural gas infrastructure entities in identifying critical natural gas infrastructure loads to manual and automatic load shedding entities”⁴⁴ Even before this report was issued, in June 2021, the Texas Legislature adopted House Bill 3648 that mandated the PUC and the Railroad Commission of Texas to work together to adopt regulation that sets up a process for designating natural gas infrastructure as critical.⁴⁵ To implement this bill, the PUC adopted amendments to 16 Texas Administrative Code (TAC) §25.52 and the Railroad Commission issued new TAC §3.65, both of which became effective in December 2021.⁴⁶ The two provisions require critical natural gas facilities to provide so-called critical customer information to their electric utility or the independent system operator. TAC §3.65(i) also stipulates that critical natural gas facilities that do not comply with this obligation may have to pay a penalty.

B. Weatherization of the Power Infrastructure

The winter storm Uri highlighted the urgent need to weatherize the Texas energy grid.⁴⁷ Early on, a law was proposed to make weatherization of power plants mandatory.⁴⁸ In June 2021, the 87th Texas legislature adopted Senate Bills 2⁴⁹ and 3.⁵⁰ Senate Bill 3 mandates the PUC to adopt rules that require the adequate preparation of generation and transmission facilities for weather emergencies.⁵¹ It requires ERCOT to ensure that generation and transmission facilities comply with the rules adopted by the PUC.⁵² In case of non-compliance, the PUC can impose penalties of up to \$1 million per day.⁵³ Prior to the adoption of Senate Bill 3, there were no mandatory weatherization requirements, so the passage of this bill was definitely an important

⁴⁴ FERC, FEBRUARY 2021 COLD WEATHER OUTAGES, *supra* note 16, at 239–40.

⁴⁵ Public Utility Commission of Texas, *Critical Natural Gas*, <https://www.puc.texas.gov/industry/electric/cng/default.aspx> [<https://perma.cc/3JLX-XQE9>] (last visited July 9, 2023).

⁴⁶ *Id.*

⁴⁷ Busby et al., *supra* note 1, at 7.

⁴⁸ Robert T. Garret & Allie Morris, *House panel OKs storm bills to require weatherizing Texas power plants, revamping grid management*, DALLAS MORNING NEWS (Mar. 18, 2021), <https://www.dallasnews.com/news/politics/2021/03/19/house-panel-oks-storm-bills-to-require-weatherizing-texas-power-plants-revamping-grid-management/> [<https://perma.cc/59UT-D2TZ>].

⁴⁹ S.B. 2, 2021 Leg., 87th Sess. (Tex. 2021).

⁵⁰ S.B. 3, 2021 Leg., 87th Sess. (Tex. 2021).

⁵¹ Texas Util. Code Sections 35.0021, 38.075.

⁵² *Id.*

⁵³ *Id.*

step.⁵⁴ However it falls short of what is necessary to adapt the power infrastructure to extreme weather conditions. For example, Senate Bill 3 does not require the weatherization of consumer infrastructure like pipes or home insulation.⁵⁵ This is regrettable given that the lack of adequate insulation in private homes heavily increases energy demand during extreme temperatures—both hot and cold—and even leads to deaths.⁵⁶ Reducing consumer demand would be an important measure to prevent future drastic blackouts. It would also save the state government money: a study by the American Council for an Energy Efficient Economy found that retrofitting 14 million homes in Texas over the next seven years would eliminate up to 15,000 MW of summer peak load, and 25,300 MW of winter peak load, and would cost circa \$9.1 billion.⁵⁷ Consumers would highly benefit from having more comfortable homes and lower energy bills.⁵⁸ The latter would be particularly impactful for low-income communities due to the fact that “Texas households earning less than \$25,000 a year already spend 12 percent of their income on home energy.”⁵⁹

On the other hand, without reducing consumer energy demand, ERCOT would have to build ten new power plants to meet peak demand, which would cost about \$8 billion.⁶⁰ This proposal, originally put forward by the company Berkshire Hathaway Energy,⁶¹ has recently been reintroduced in the 88th Texas Legislature as Senate Bill 6.⁶² This bill was criticized for its negative effect on renewable energy sources and for investing in natural gas power plants that will lead to more greenhouse gas emissions.⁶³ Furthermore, critics stated that it will raise energy

⁵⁴ Avery Travis, *Winter preparedness not mandatory at Texas power plants and generators, despite 2011 report*, KXAN (Feb. 18, 2021), <https://www.kxan.com/investigations/winter-preparedness-not-mandatory-at-texas-power-plants-and-generators-despite-2011-report/> [https://perma.cc/7XPP-F356]

⁵⁵ Isabella Zou, *Texas power generation companies will have to better prepare for extreme weather under bills Gov. Greg Abbott signed into law*, TEX. TRIB. (Mar. 12, 2023), <https://www.texastribune.org/2021/06/08/greg-abbott-texas-power-grid-ercot/> [https://perma.cc/T425-7XAP].

⁵⁶ Amal Ahmed, *Millions of Texans lack home weatherization that can save energy, lives*, TEX. CLIMATE NEWS (Mar. 8, 2022), <https://texasclimatenews.org/2022/03/08/millions-of-texans-lack-home-weatherization-that-can-save-energy-lives/> [https://perma.cc/383H-5KRQ].

⁵⁷ STEVE NADEL, JENNIFER AMANN & HELLEN CHEN, *ENERGY EFFICIENCY AND DEMAND-RESPONSE: TOOLS TO ADDRESS TEXAS’ RELIABILITY CHALLENGES 1, 4* (Aug. 2023), https://www.aceee.org/sites/default/files/pdfs/energy_efficiency_and_demand_response_-_tools_to_address_texas_energy_reliability_problems_-_encrypt.pdf; For the significant economic advantages of reducing energy demand, see also Jeff St. John, *Clean energy dodges a bullet in the Texas legislature*, CANARY MEDIA (May 31, 2023), <https://www.canarymedia.com/articles/politics/clean-energy-dodges-a-bullet-in-the-texas-legislature> [https://perma.cc/GZM8-V8NS].

⁵⁸ Ahmed, *supra* note 56; NADEL, AMANN & CHEN, *supra* note 57, at 8.

⁵⁹ John Matson & Sneha Ayyagari, *Efficient, Resilient Buildings Can Help Texas Weather the Next Crisis*, RMI (Mar. 25, 2021), <https://rmi.org/efficient-resilient-buildings-can-help-texas-weather-the-next-crisis/> [https://perma.cc/Y7CU-ZB37].

⁶⁰ Ahmed, *supra* note 56; Mitchell Ferman, *Texas energy companies push back against Berkshire Hathaway’s \$8 billion plan for backup power*, TEX. TRIB. (Apr. 15, 2021), <https://www.texastribune.org/2021/04/15/texas-power-grid-berkshire-hathaway/> [https://perma.cc/6YKH-UULA].

⁶¹ Zack Hale & Garrett Hering, *Warren Buffett’s \$8.3B plan to avert Texas blackouts raises eyebrows*, S&P GLOBAL MARKET INTELLIGENCE (Mar. 26, 2021), <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/warren-buffett-s-8-3b-plan-to-avert-texas-blackouts-raises-eyebrows-63379966> [https://perma.cc/RZK5-62R5].

⁶² S.B. 6, 2023 Leg., 88th Sess. (Tex. 2023).

⁶³ Mose Buchele, *Texas state lawmakers unveil plan to curb renewable energy, subsidize natural gas*, KUT 90.5 (Mar. 10, 2023), <https://www.kut.org/energy-environment/2023-03-10/texas-state-lawmakers-unveil-plan-to-curb-renewable-energy-subsidize-natural-gas> [https://perma.cc/3JF2-P2SW].

Fall 2023

bills and might not even improve the reliability of the Texas energy grid.⁶⁴ Ultimately, the 88th Texas Legislature did not adopt Senate Bill 6, a (preliminary) victory for renewable energy supporters.⁶⁵ However, like the 87th Texas Legislature, the 88th Legislature failed to enact any legislation to mandate or incentivize energy demand reductions.⁶⁶

Back to Senate Bill 3 and the 87th legislature: another important point of criticism is that gas power plants only need to be winterized when they are designated as “critical.”⁶⁷ As the natural gas sector bears significant responsibility for the February 2021 power outages, the justification of this regulation is highly questionable.⁶⁸ Furthermore, Senate Bill 3 does not define what is meant by “weatherization,” which means that it might suffice to only implement minimal, inexpensive measures.⁶⁹

The aforementioned Senate Bill 2 of the 87th legislature modified the composition of ERCOT’s board of directors by reducing the number of members from 16 to 11 and providing that out of these 11, only nine members can vote.⁷⁰ Eight of the total 11 members are elected by a new three-member selection committee.⁷¹ The governor, the lieutenant governor, and the speaker of the Texas House of Representatives can each appoint one member to this committee.⁷² Senate Bill 2 therefore gave the state government more influence over the board.⁷³

C. Increase of Stored Energy

Texas should also increase the amount of energy it has in storage. First, it is important to ensure that power plants fueled by natural gas have sufficient local gas storage.⁷⁴ The Texas legislature has not taken any measures in this regard. Second, winter storm Uri showed that Texas needs to increase its energy reserves more generally. Texas’ high demand for energy storage can be attributed to its large share of wind energy which accounts for 24.8 percent of ERCOT’s total capacity.⁷⁵ While both wind and solar energy are intermittent energy sources,

⁶⁴ *Id.*; Sergio Florez, *Editorial: PUC wants a risky overhaul of Texas electric grid. We're not yet convinced.*, HOUS. CHRON. (March 10, 2023), <https://www.houstonchronicle.com/opinion/editorials/article/texas-electric-grid-overhaul-risky-17824441.php> [<https://perma.cc/UMW3-ZAPZ>].

⁶⁵ St. John, *supra* note 57.

⁶⁶ *Id.*

⁶⁷ Isabella Zou, *supra* note 55.

⁶⁸ *Id.*; Meghan A. Brobst, *Sovereign Immunity, Entrenched Power, and Isolationism: How to Hold Ercot Accountable to Texas Residents in the Aftermath of the February 2021 Winter Storm*, 8 ONE J. 205, 232–233 (2022); Teddy Gonzalez & Jillian Knox, *In the Dark: The Scapegoating of Renewables After Grid Failures*, 63 NAT. RESOURCES J. 30, 56 (2023).

⁶⁹ Colleen M. Baker & James W. Coleman, *Paying for Energy Peaks: Learning from Texas February 2021 Power Crisis*, 23 TENN. J. BUS. L. 463, 475 (2022).

⁷⁰ Isabella Zou, *supra* note 55.

⁷¹ *Id.*

⁷² *Id.*

⁷³ *Id.*

⁷⁴ FERC, FEBRUARY 2021 COLD WEATHER OUTAGES, *supra* note 16 at 43.

⁷⁵ Frank A. Wolak, *Long-Term Resource Adequacy in Wholesale Electricity Markets with Significant Intermittent Renewables*, National Bureau of Economic Research, Working Paper No. 29033, 28 (2021); Nate Chute, *What*

wind energy is much more prone to prolonged periods with very low energy production.⁷⁶ Furthermore, during these periods of low production, Texas cannot import more electricity from other states as it lacks the necessary interconnections, making storage even more important.⁷⁷ A pathway forward that would be in line with the broader endeavor to decarbonize is increasing battery storage for renewable wind and solar energy.⁷⁸ However, there have been no significant legislative attempts in this direction. Instead, the Texas legislature takes the pathway of building more natural gas power plants (see above). This is, however, not in line with efforts to reduce greenhouse gasses, and would only foster energy security if these power plants are appropriately weatherized. On the more positive climate side, the company Eolian L.P. announced in February 2023 that it will build two battery storage facilities in Mission, Texas that will add 200 MW of capacity to Texas' energy grid.⁷⁹ The financing of this project is enabled by the Inflation Reduction Act (IRA) that newly introduced investment tax credits for standalone energy storage technology.⁸⁰ Before the IRA, federal tax credits were only offered for storage that was paired with renewable energy generation.⁸¹ It is expected that this extension of the tax credits will generate storage investments of up to \$1 trillion in the upcoming years,⁸² so there is hope that battery storage in Texas will increase. This hope is heavily backed up by ERCOT's own data: the amount of available battery storage in Texas rose from around 833 MW at the end of 2021 to nearly 1,999 MW in October 2022.⁸³ Moreover, according to the Energy Information Administration (EIA), power plant owners and operators in Texas are planning to add an additional 7.9 GW of battery capacity from 2022 to 2025.⁸⁴ However, continuing efforts of the Texas legislature to promote dispatchable (nonrenewable) power generation threaten the further increase of battery storage in Texas as the growing availability of dispatchable energy renders battery storage less profitable.⁸⁵

percentage of Texas energy is renewable? Breaking down the state's power sources from gas to wind, AUSTIN AMERICAN STATESMAN (Feb. 17, 2021), <https://www.statesman.com/story/news/2021/02/17/texas-energy-wind-power-outage-natural-gas-renewable-green-new-deal/6780546002/> [<https://perma.cc/GX6A-VVGE>].

⁷⁶ Wolak, *supra* note 75, at 28.

⁷⁷ *Id.* at 28–29.

⁷⁸ Lanier, *supra* note 33, at 14; Wolak, *supra* note 75, at 25, 28; Peter Cramton, Fostering resiliency with good market design: Lessons from Texas 16, ECONPAPERS, Discussion Paper, No. 145 (2022), <https://econpapers.repec.org/paper/ajkajkdps/145.htm>.

⁷⁹ Robert Walton, *200-MW Texas project is first to leverage IRA tax credit for stand-alone energy storage*, Eolian says, UTILITY DIVE (Feb. 14, 2023), <https://www.utilitydive.com/news/eolian-ira-credits-storage-texas/642694/> [<https://perma.cc/5KHA-FPHQ>].

⁸⁰ *Id.*

⁸¹ Convergent Energy & Power, *IRA sets the stage for US energy storage to thrive*, UTILITY DIVE (Nov. 7, 2022), <https://www.utilitydive.com/spons/ira-sets-the-stage-for-us-energy-storage-to-thrive/635665/> [<https://perma.cc/2PXJ-PH7R>].

⁸² *Id.*

⁸³ Mark Watson, *Battery storage leads 400-MW addition to Texas power grid's commercially operating resources*, S&P GLOBAL COMMODITY INSIGHTS (Nov. 2, 2022), <https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/110222-battery-storage-leads-400-mw-addition-to-texas-power-grids-commercially-operating-resources> [<https://perma.cc/PN95-PRDM>].

⁸⁴ U.S. ENERGY INFO. ADMIN., *U.S. battery storage capacity will increase significantly by 2025* (Dec. 8, 2022), <https://www.eia.gov/todayinenergy/detail.php?id=54939> [<https://perma.cc/4XEV-D67U>].

⁸⁵ Russell Gold, *The Texas GOP's War on Renewable Energy*, TEX. MONTHLY (June 2023), <https://www.texasmonthly.com/news-politics/texas-republican-war-on-renewable-energy/> [<https://perma.cc/4UBS-LGBM>].

Fall 2023

D. Reform of the Structure of the Energy Market

a. Introduction to the Discussion: Option of a Capacity Market

A broader, more complicated issue is the structure of Texas' energy market. Does it need to be changed? And if so, how? The power outages of winter storm Uri have shown that Texas' energy-only market is not able to manage the risks of extreme and relatively rare weather events. It seems likely that the scarcity pricing mechanism used in ERCOT's energy-only market fails to ensure the availability of sufficient capacity because consumers are not primarily driven by prices when they use a resource that is essential to their daily life, such as energy.⁸⁶ In the aftermath of winter storm Uri, different opinions emerged on what a better market structure could look like. Several scholars discussed the introduction of a capacity market that would allow planning entities to better predict the amount of future energy output, and therefore to better match demand and supply.⁸⁷ However, calls for capacity markets can be countered by pointing out that the issue during winter storm Uri was not the lacking existent capacity, but the lack of operable capacity.⁸⁸ Furthermore, a capacity market where a regulatory authority decides how much capacity needs to be procured at the auction would stand in stark contrast to Texas' current approach of relying on free market dynamics for the allocation of its energy resources.⁸⁹

b. Standardized Fixed Price Forward Contract Approach

Another way to reform the Texas energy market would be to implement the so-called standardized fixed price forward contract (SFPFC) approach. Proponents claim that this long-term resource adequacy mechanism is able to ensure reliable electricity supply in a market with a large share of renewables and significant electrification trends for personal transportation and space heating⁹⁰ as it is the case in Texas.⁹¹ This is especially relevant since the Inflation

⁸⁶ Brobst, *supra* note 68, at 236, 241.

⁸⁷ *Id.* at 240–41; Richard G. Smead, *ERCOT—The Eyes of Texas (and the World) Are Upon You: What Can be Done to Avoid a February 2021 Repeat*, 37 CLIMATE & ENERGY, 17.

⁸⁸ Kenneth B. Medlock III & Shih Yu (Elsie) Hung, *Resource Adequacy in ERCOT: How Long-term Market Design Reforms Could Enhance Reliability*, BAKER INSTITUTE (Dec. 12, 2022),

<https://www.bakerinstitute.org/research/resource-adequacy-ercot-how-long-term-market-design-reforms-could-enhance-reliability> [<https://perma.cc/V3N5-EJLT>]; TODD AAGAARD & ANDREW N. KLEIT, THE 2021 ERCOT POWER CRISIS. CAPACITY MARKETS WOULD NOT HAVE HELPED, IAEE ENERGY FORUM 18 (2021),

<https://www.iaee.org/documents/EF213full.pdf>; Wolak, *supra* note 75, at 26; Peter Cramton, *supra* note 78.

⁸⁹ Brad Bowen, *Texas Wind Energy and the Missing Money Problem*, 100 TEX. L. REV. 771, 793, 802 (2022).

⁹⁰ Wolak, *supra* note 75, at 2.

⁹¹ John Kent, *The magnetic pull of electric vehicles is slowly drawing Texas in*, Tex. Climate News (Oct. 15, 2022), <https://texasclimatenews.org/2022/10/15/the-magnetic-pull-of-electric-vehicles-is-slowly-drawing-texas-in/> [<https://perma.cc/MF6X-DG4A>]. In fact, electricity is already the most used fuel for heating homes in Texas. In 2020, over 60 percent of housing units in Texas used electricity for heating. See Jessica Aizarani, *Distribution of residential heating fuel consumed in Texas in 2021, by type*, STATISTA (June 8, 2023),

Reduction Act will further accelerate the electrification of heating and transportation in Texas and elsewhere.⁹²

The SFPFC mechanism does not prescribe a specific amount of capacity.⁹³ Instead, it warrants that all of the expected consumer demand is auctioned off on an hourly basis several years ahead of the actual energy delivery.⁹⁴ These contracts are concluded between owners of generators and retailers who are obliged to buy their yearly power demand through these standardized contracts in advance at a fixed price.⁹⁵ This mechanism is expected to give generators a strong incentive to have the contracted amount of capacity available and to bid at marginal cost.⁹⁶ Going into the depths of this mechanism would go beyond the scope of this paper, but it would be a promising model for Texas' market that has high electricity demand and a large share of renewables.

c. Performance Credit Mechanism

However, Texas has recently adopted a different approach: In January 2023, the PUC approved the performance credit mechanism (PCM).⁹⁷ This is a new market mechanism designed to ensure power supply in situations such as Winter Storm Uri, when extreme temperatures lead to high electricity consumption and at the same time less electricity is generated because of equipment malfunctions at thermal power plants or because wind or photovoltaic energy sources have low output.⁹⁸ Under the PCM, retail electric providers have to buy performance credits from power generators based on their load in time periods in which reliability is at high risk.⁹⁹ Power generators in turn are awarded these credits based on their ability to supply power during these periods.¹⁰⁰ The generators are supposed to use the income generated by the credits to build new dispatchable power plants, such as nuclear, natural gas- and coal-fired plants.¹⁰¹ The retail electric providers on the other hand will forward the extra costs for the credits to their

<https://www.statista.com/statistics/1231906/residential-heating-fuel-distribution-in-texas/> [<https://perma.cc/W8G2-ZB9K>].

⁹² Bob Henson, *Heat pumps are catching on. New rebates, tax breaks may turbocharge the trend*, TEX. CLIMATE NEWS (Mar. 2, 2023), <https://texasclimatenews.org/2023/03/02/heat-pumps-are-catching-on-new-rebates-tax-breaks-may-turbocharge-the-trend/> [<https://perma.cc/3UH3-2PZ9>]; Peter Slowik et. al., *Analyzing the impact of the Inflation Reduction Act on electric vehicle uptake in the United States*, POLICY COMMONS 1, 12–16 (2023).

⁹³ Mark C. Thurber, Fletcher H. Passow, Trevor L. Davis & Frank A. Wolak, *Game-based investigation of standardized forward contracting for long-term resource adequacy*, THE ELECTRICITY J., 2 (2022).

⁹⁴ *Id.* at 1–2.

⁹⁵ *Id.* at 2.

⁹⁶ *Id.*

⁹⁷ Emily Foxhall, *State regulators approve controversial Texas electricity market reform*, TEX. TRIB. (Jan. 19, 2023), <https://www.texastribune.org/2023/01/19/texas-electricity-market-reform-puc-grid-vote/> [<https://perma.cc/KZF9-HEZZ>].

⁹⁸ *Id.*

⁹⁹ ENERGY+ENVIRONMENTAL ECONOMICS, ASSESSMENT OF MARKET REFORM OPTIONS TO ENHANCE RELIABILITY OF THE ERCOT SYSTEM (Nov. 2022) at 21–22, https://www.ethree.com/wp-content/uploads/2023/05/E3-PUCT_Assessment-of-Market-Reform-Options-to-Enhance-Reliability-of-the-ERCOT-System_11.10.22-Sent.pdf [<https://perma.cc/F95J-54SH>].

¹⁰⁰ *Id.*

¹⁰¹ Jennifer Runyon, *Texas adopts performance credit scheme in bid to ensure resource adequacy*, POWER GRID INT'L. (Jan. 20, 2023), <https://www.power-grid.com/policy-regulation/texas-adopts-new-performance-credit-mechanism-to-ensure-resource-adequacy/#gref> [<https://perma.cc/LK74-QA9C>]; Emily Foxhall & Alex Ford, *What you need to know about Texas' complex—but important—electricity market reform plan*, TEX. TRIB. (Mar. 1, 2023), <https://www.texastribune.org/2023/03/01/texas-power-market-public-utility-commission-electricity-credits/> [<https://perma.cc/ZUG5-MU2J>].

Fall 2023

customers.¹⁰² The PCM is based on the assumption that these newly constructed dispatchable power plants will be able to produce electricity in periods of energy scarcity. While it is true that these plants could produce energy independently from wind or sunshine, it is also true that it was mainly dispatchable energy that failed during Winter Storm Uri. In general, the PCM is highly contested: commentators immediately pointed out that it would not increase reliability and would only result in higher electricity bills.¹⁰³ It was estimated that the PCM will lead to \$5.7 billion of additional annual costs for consumers.¹⁰⁴

Critics also point out that it was not adequately analyzed and has never been tested elsewhere.¹⁰⁵ Alison Silverstein, who worked as a senior adviser at the PUC, described the PCM as “poorly understood, poorly-analyzed, [and] unproven” and warned of the negative long-term consequences its adoption could have.¹⁰⁶ In May 2023, the 88th Texas legislature confirmed the adoption of the PCM.¹⁰⁷ Fortunately, the legislature did not ignore all criticism: it adopted House Bill 1500 which states that the annual costs of the PCM cannot exceed \$1 billion and lists additional requirements the PCM needs to fulfill before it can be implemented.¹⁰⁸

d. Broader Policy Trend Disfavoring Renewable Energy Sources

Unfortunately, the PCM is only one aspect of a broader policy endeavor in Texas that aggressively supports fossil energy and attacks renewables.¹⁰⁹ In the 88th Texas Legislature, Republicans introduced many highly concerning anti-clean energy bills. Some of the worst ones were ultimately not adopted, but the 88th Legislature still resulted in an overall loss for renewables.

A bill that did not make it through was Senate Bill 2015 which would have mandated that from 2024 on, 50 percent of newly constructed power plants would have to be dispatchable.¹¹⁰ It would have also allowed providers to “label the electricity generated using natural gas produced in this state as ‘green’ electricity.”¹¹¹ Furthermore, Republicans did not succeed in adopting

¹⁰² Runyon, *supra* note 101.

¹⁰³ Foxhall & Ford, *supra* note 101.

¹⁰⁴ Robert Walton, *Performance credit mechanism could cost Texas energy consumers \$5.7B annually, broad coalition warns*, UTILITY DIVE (Mar. 2, 2023), <https://www.utilitydive.com/news/texas-puc-performance-credit-mechanism-ercot-report/643977/> [<https://perma.cc/2BLP-K2YL>].

¹⁰⁵ *Id.*

¹⁰⁶ Foxhall, *supra* note 97.

¹⁰⁷ H.B. 1500, 2023 Leg., 88th Sess. (Tex. 2023).

¹⁰⁸ *Id.*

¹⁰⁹ Mitchell Schnurman, *Renewable energy saves money, creates jobs and cuts emissions. Why is Texas targeting it?*, DALLAS MORNING NEWS (Mar. 24, 2023), <https://www.dallasnews.com/business/energy/2023/03/24/renewable-energy-saves-money-creates-jobs-and-cuts-emissions-why-is-texas-targeting-it/> [<https://perma.cc/9VDZ-4AUG>]; Gold, *supra* note 85.

¹¹⁰ S.B. 2015, 2023 Leg., 88th Sess. (Tex. 2023).

¹¹¹ *Id.*

Senate Bill 624 that would have submitted (only) renewable power projects to new permitting restrictions.¹¹²

Republicans also introduced Senate Bill 7 that requires intermittent power sources to pay for ancillary services provided by ERCOT.¹¹³ This basically means that wind and solar sources would need to build non-intermittent on-site backup generation or have to pay extra for their intermittency, therefore making renewables less profitable.¹¹⁴ Senate Bill 7 itself was not adopted, but its content was integrated into the adopted House Bill 1500, albeit with the modification that it will not be implemented until 2027.¹¹⁵ Moreover, House Bill 1500 introduces “allowances” for the costs of building new transmission lines to generation resources, which especially affects wind and solar energy sources that are located in remote areas.¹¹⁶ The 88th Legislature also adopted Senate Bill 2627 which creates a fund that allocates up to \$7.2 billion for the construction of and upgrades to dispatchable power plants.¹¹⁷ The bill provides loans at 3 percent interest and completion bonuses for the construction of or updates to gas-fired power plants.¹¹⁸ The implementation of Senate Bill 2627 requires a constitutional amendment which will be voted on in November 2023.¹¹⁹

These hostile policies towards renewables are shocking, but not surprising. At least in part, they are the result of a false narrative started by Republican politicians. During the outages caused by winter storm Uri, Texas Governor Greg Abbott repeatedly claimed publicly that frozen wind turbines were responsible for the blackouts.¹²⁰ He asserted that this shutdown of wind turbines shows that fossil fuels are necessary for a reliable grid.¹²¹ Over the next two days, Fox news blamed renewable energy over 128 times for the outages.¹²² Many other Texan politicians followed Abbott’s example to wrongfully scapegoat wind energy.¹²³ It seems possible that Texan Republicans spread this kind of disinformation to distract from their own failures in regulating the ERCOT grid, in particular not adequately winterizing its infrastructure.¹²⁴

Furthermore, recent legislation heavily favoring fossil fuels can be explained by campaign donations Republicans receive. After the adoption of Senate Bill 3, that basically exempted natural gas infrastructure from weatherization requirements, Governor Abbott received

¹¹² S.B. 624, 2023 Leg., 88th Sess. (Tex. 2023).

¹¹³ S.B. 7, 2023 Leg., 88th Sess. (Tex. 2023).

¹¹⁴ Buchele, *supra* note 63; Michelle Lewis, *Texas leads the US in renewables, but some state senators want to sabotage that*, ELECTREK (Mar. 10, 2023), <https://electrek.co/2023/03/10/texas-leads-the-us-in-renewables-but-some-state-senators-want-to-sabotage-that/> [<https://perma.cc/TM65-S86B>].

¹¹⁵ H.B. 1500, 2023 Leg., 88th Sess. (Tex. 2023).

¹¹⁶ *Id.*; Emily Foxhall, *Fossil fuels got a boost from lawmakers aiming to fix Texas’ grid, while renewable energy escaped stricter regulations*, TEX. TRIB. (June 5, 2023), <https://www.texastribune.org/2023/06/05/texas-bills-energy-natural-gas-fossil-fuel-renewables/> [<https://perma.cc/9W9N-NS45>].

¹¹⁷ S.B. 2627, 2023 Leg., 88th Sess. (Tex. 2023).

¹¹⁸ *Id.*

¹¹⁹ *Id.*; Brad Johnson, *Legislature Strikes Last-Minute Deal on Chapter 313 Replacement, ERCOT Power Plant Loans*, THE TEXAN (May 28, 2023), https://thetexan.news/state/legislature/88th-session/legislature-strikes-last-minute-deal-on-chapter-313-replacement-ercot-power-plant-loans/article_66e34ae7-9c5d-56c9-8eb8-e171aeb0fd14.html [<https://perma.cc/AYA2-UXBD>].

¹²⁰ Teddy Gonzalez & Jillian Knox, *In the Dark: The Scapegoating of Renewables After Grid Failures*, 63 NAT. RES. J. 30, 44 (2023).

¹²¹ *Id.*

¹²² *Id.*

¹²³ *Id.* at 44-45.

¹²⁴ *Id.* at 47-49.

Fall 2023

\$4.6 million in campaign donations from the energy industry.¹²⁵ This included a donation of \$1 million from oil industry leader Kelcy Warren whose pipeline company earned \$2.4 billion during the energy crisis caused by Winter Storm Uri.¹²⁶ It is also very revealing to look at the funding of Senator Schwertner who authored the above-mentioned Senate Bills 2015, 7 and 2627 of the 88th Legislature as well as Senate Bill 3 of the 87th Legislature. In the fundraising period following the 2015 legislative session, 3 percent of his campaign contributions came from the energy industry.¹²⁷ In the 2021 fundraising period, the energy industry contributed 32 percent of his campaign funding.¹²⁸ In this context, it is also important to mention the Texas Public Policy Foundation (TPPF), a conservative group lobbying on behalf of the oil and gas industry. Brent Bennett, a TPPF policy staffer, made many direct changes to the above-mentioned House Bill 1500 and this bill reflects key agenda points of the TPPF, like the additional transmission costs for renewables.¹²⁹ TPPF has broad influence over politics in Texas and even successfully lobbies against renewable energy in other states like Massachusetts, Arizona and West Virginia.¹³⁰ Unsurprisingly, TPPF was also at the forefront of blaming intermittent energy sources, particularly wind energy, for the blackouts caused by winter storm Uri.¹³¹

E. Interconnecting Texas' Energy Grid

Finally, there is a strong case for better integrating the Texas energy grid with the Eastern and the Western Interconnection and possibly also Mexico.¹³² In part it is argued that this would have not fully protected Texans from the effects of winter storm Uri because the two neighboring markets, i.e., Mexico and the Eastern Interconnection, were limited in their ability to provide

¹²⁵ Mitchell Ferman & Carla Astudillo, *Energy industry showers Gov. Greg Abbott, other Texas politicians with campaign cash after they passed power grid bills*, TEX. TRIB. (Aug. 4, 2021), <https://www.texastribune.org/2021/08/04/texas-energy-industry-donations-legislature/> [<https://perma.cc/LB79-7HY8>].

¹²⁶ *Id.*

¹²⁷ *Id.*

¹²⁸ *Id.*

¹²⁹ Oliver Milman & Dharna Noor, *Alarm at rightwing push to reverse clean-energy success in Texas and beyond*, GUARDIAN (June 8, 2023), <https://www.theguardian.com/us-news/2023/jun/08/rightwing-backlash-reverse-clean-energy-success-texas> [<https://perma.cc/H22E-J5P8>].

¹³⁰ *Id.*; David Gelles, *The Texas Group Waging a National Crusade Against Climate Action*, N.Y. TIMES (June 20, 2023), <https://www.nytimes.com/2022/12/04/climate/texas-public-policy-foundation-climate-change.html> [<https://perma.cc/Q95W-K2PU>].

¹³¹ TEXAS POLICY FOUNDATION, PUSHED TO THE BRINK: THE 2021 ELECTRIC GRID CRISIS AND HOW TEXAS IS RESPONDING at 4, 5, 20, 23 (Aug. 2022), <https://www.texaspolicy.com/pushed-to-the-brink-the-2021-electric-grid-crisis-and-how-texas-is-responding/> [<https://perma.cc/2YSH-98K2>].

¹³² JOHN MCNEECE, VERONICA IRASTORZA & JEREMY M. MARTIN, A CALL FOR DEEPER INTEGRATION BETWEEN THE ELECTRICAL SYSTEMS OF THE UNITED STATES AND MEXICO, 13–15 (2022), https://www.wilsoncenter.org/sites/default/files/media/uploads/documents/US%20Mexico%20Grid%20Integration%20McNeece_Irastorza_Martin.pdf [<https://perma.cc/JV4S-W6W3>].

Texas with additional power as they had operational problems of their own.¹³³ However, this finding seems to be untrue. MISO and SPP (the western portion of the Eastern Interconnection) were also affected by winter storm Uri, but suffered far less blackouts, mainly because they imported a significant amount of power from PJM (the eastern portion of the Eastern Interconnection) where weather conditions were less extreme.¹³⁴

In line with this finding, many commentators conclude that Texas would significantly benefit from an interconnected grid during extreme weather conditions.¹³⁵ A February 2023 draft report by the U.S. Department of Energy finds that “[i]ncreased transfer capacity with neighbors will enable Texas to address capacity shortages when the system is stressed under emergency conditions” and will therefore foster resource adequacy and reliability.¹³⁶

In addition to the general benefit of removing stress from the grid in case of emergency, an interconnected grid would improve ERCOT’s black start capabilities.¹³⁷ “Black start” describes the process of restarting a power system after a power outage independently of external energy sources.¹³⁸ “Black start resources” are generators that are capable of initiating a black start.¹³⁹ The final report by FERC, NERC and regional entities states that in a similar scenario, Texas might not be able to do a black start on its own.¹⁴⁰ In fact, during the events of February 2021, 82 percent of ERCOT’s 28 black start resources were—at least temporarily—either completely unable to operate or could only operate at reduced capacity.¹⁴¹ As ERCOT was less than five minutes away from a complete black-out,¹⁴² those limited black-start resources are

¹³³ Todd Levin, Audun Botterud, W. Neal Mann, Jonghwan Kwon & Zhi Zhou, *Extreme weather and electricity markets: Key lessons from the February 2021 Texas crisis*, 6 SCIENCE DIRECT 1-7 (2022); Loren Steffy, *Texas’s Independence Didn’t Cause the Power Crisis*, TEX. MONTHLY (Feb. 27, 2021), <https://www.texasmonthly.com/news-politics/texas-isolated-power-grid-ercot/> [<https://perma.cc/BM2H-Q3ZM>]. See also Matthew Hause & Lars-Olof Kihlstrom, *Tilting at Windmills: Drivers, Risk, Opportunity, Resilience and the 2021 Texas Electricity Grid Failure*, 32 INCOSE at 5 (2022) (arguing against the advantageousness of interconnecting ERCOT more generally).

¹³⁴ FERC, FEBRUARY 2021 COLD WEATHER OUTAGES, *supra* note 16, at 10; MICHAEL GOGGIN, TRANSMISSION MAKES THE POWER SYSTEM RESILIENT TO EXTREME WEATHER, ACORE 7–8 (2021). See also Paul Robbins, *Backup Plan Part 2: How the Texas Electric Grid Broke*, AUSTIN BULLDOG (Oct. 4, 2021), <https://theaustinbulldog.org/backup-plan-part-2-how-the-texas-the-electric-grid-broke/> [<https://perma.cc/4FWS-MLWR>] (suggesting that power could have been imported from the Western Interconnection).

¹³⁵ Lucas Davis, *The Most Obvious Way to Avoid Another Texas Blackout*, ENERGY INSTITUTE AT HAAS (Jan. 31, 2022), <https://energyathaas.wordpress.com/2022/01/31/the-most-obvious-way-to-avoid-another-texas-blackout/> [<https://perma.cc/K9XZ-AGM7>]; FERC, FEBRUARY 2021 COLD WEATHER OUTAGES, *supra* note 16, at 235.

¹³⁶ U.S. DEPT. OF ENERGY, NATIONAL TRANSMISSION NEEDS STUDY 9 (Feb. 2023), <https://www.energy.gov/sites/default/files/2023-02/022423-DRAFTNeedsStudyforPublicComment.pdf> [<https://perma.cc/EA3B-DMGY>].

¹³⁷ FERC, FEBRUARY 2021 COLD WEATHER OUTAGES, *supra* note 16, at 235; Clean Future Act: Powering a Resilient and Prosperous America: Virtual Hearing Before the Subcommittee on Energy of the Committee on Energy and Commerce, House of Representatives, 117th Cong., First Sess. 66 (2021) (statement of Alison Silverstein); Panel Discussion from the Energy Bar Association’s Texas Symposium “The Texas Energy System at the Crossroads: Lessons in the Wake of Major Storms,” *Fuel Assurance, Reliability, Resilience, and the Generation Resource Mix: Repairing Vulnerabilities Exposed in the Crisis*, 42 ENERGY L.J. 375, 390 (2021).

¹³⁸ FERC, FEBRUARY 2021 COLD WEATHER OUTAGES, *supra* note 16, at 235.

¹³⁹ *Id.* at 235-36.

¹⁴⁰ *Id.*

¹⁴¹ *Id.* at 236.

¹⁴² Busby et. al., *supra* note 1, at 4.

Fall 2023

highly concerning. In order to be capable of a black start, it would therefore be pivotal for ERCOT to be able to import additional power.¹⁴³

But integrating the ERCOT grid would not only be beneficial in case of extreme weather events. It could also help to better balance renewable, non-dispatchable energy.¹⁴⁴ If Texas had interstate connections, it would be able to export its surplus of wind and solar energy instead of curtailing it.¹⁴⁵ ERCOT's curtailment of wind and solar power almost tripled from 2019 to 2021, resulting in curtailments of over 6.6 million MWh in 2021.¹⁴⁶ Furthermore, more than 62,000 MW of solar capacity is currently being planned in Texas,¹⁴⁷ which would lead to further congestion without added transmission lines (or storage).

The Western Energy Imbalance Market (WEIM) shows how the export of abundant renewables could be possible. The WEIM enables participating regions to engage in last-minute trading of power.¹⁴⁸ The WEIM “balances fluctuations in supply and demand by automatically finding lower-cost resources to meet real-time power needs.”¹⁴⁹ Similarly, Texas could import wind power which is abundant in the Midwest and surplus solar power from the Southwest when production of these resources is low in Texas.¹⁵⁰ This power exchange is especially favored by the fact that due to varying time zones, different regions do not reach their peak demand simultaneously.¹⁵¹

Many even argue for better integration of the three U.S. grids more generally, sometimes referred to as a “macro-grid.”¹⁵² A more efficient regional distribution of wind and solar power

¹⁴³ FERC, FEBRUARY 2021 COLD WEATHER OUTAGES, *supra* note 16, at 235.

¹⁴⁴ See Meredith Fowle, *The Little Energy Market That Could*, ENERGY INSTITUTE AT HAAS (Oct. 7, 2019), <https://energyathaas.wordpress.com/2019/10/07/the-little-energy-market-that-could/> [https://perma.cc/H9DL-222Z].

¹⁴⁵ For avoided curtailments in California, see CAISO, *California ISO - Key Statistics*, <http://www.caiso.com/Documents/Key-Statistics-Dec-2021.pdf> [https://perma.cc/R3D8-F62K] (last visited July 9, 2023).

¹⁴⁶ Adam Wilson, *As IRA drives renewables investment, attention turns to transmission upgrades*, S&P GLOBAL MARKET INTELLIGENCE (Sep. 27, 2022), <https://www.spglobal.com/marketintelligence/en/news-insights/research/as-ira-drives-renewables-investment-attention-turns-to-transmission-upgrades> [https://perma.cc/XFU9-T6R6].

¹⁴⁷ *Id.*

¹⁴⁸ Western Energy Imbalance Market, *How it works*, <https://www.westerneim.com/Pages/About/HowItWorks.aspx> [https://perma.cc/K82F-PXGF] (last visited July 9, 2023).

¹⁴⁹ *Id.*

¹⁵⁰ Matt Simon, *Texas' Icy Disaster Makes the Case for Uniting the US Grid*, WIRED (Feb. 25, 2021), <https://www.wired.com/story/texas-disaster-makes-the-case-for-uniting-the-grid/>.

¹⁵¹ *Id.*

¹⁵² Clean Future Act: Powering a Resilient and Prosperous America: Virtual Hearing Before the Subcommittee on Energy of the Committee on Energy and Commerce, House of Representatives, 117th Cong., First Sess. 69 (2021) (statement of Scott H. Peters); Fatima Maria Ahmad, *The Road Ahead After Transformational Climate Legislation*, 47 FLETCHER FORUM OF WORLD AFFAIRS 129, 134–36 (2023); James Temple, *Stitching together the grid will save lives as extreme weather worsens*, MIT TECHNOLOGY REVIEW, <https://www.technologyreview.com/2022/07/28/1056483/stitching-together-the-grid-will-save-lives-as-extreme-weather-worsens/> [https://perma.cc/QWF8-4HGX] (last visited July 28, 2022); Barbara Tyran, *Extreme weather events are expanding — the US power grid is not*, UTILITY DIVE (Mar. 16, 2023), <https://www.utilitydive.com/news/extreme-weather-events-are-expanding-the-us-power-grid-is-not/645184/> [https://perma.cc/E2SF-LU9X].

does not only require the integration of ERCOT, but also construction of more high voltage lines between the Eastern and the Western Interconnection.¹⁵³ Both building interstate connections for Texas as well as strengthening the connection of the Eastern and Western Interconnections would be expensive. But two studies show that benefits would outweigh costs by a ratio ranging from 1.2 to 2.5.¹⁵⁴ Coming back to the winter storm Uri: a study showed that each potential GW of additional transmission capacity coming from ties between ERCOT and the Southeast would have saved consumers \$993 million in the days of the storm alone.¹⁵⁵ It costs circa \$700 million per GW of transfer capacity to build long distance transmission lines.¹⁵⁶ Therefore, the money saved through one additional GW of transmission capacity just during winter storm Uri would have more than offset the costs of constructing this transmission line.¹⁵⁷

Given that ERCOT's interconnection with neighboring states has many benefits and is strongly recommended by the Department of Energy, the question is whether any steps are being taken in that direction at the state level. The 87th and 88th Texas Legislature did not adopt any laws that would lay the ground for interconnecting ERCOT. This can be explained by the above-mentioned unwillingness, especially of Texas' Republicans, to subject ERCOT to FERC regulation. When Democrat Beto O'Rourke ran for Governor in 2021 and 2022, he used "fix the damn grid" as campaign slogan and demanded that Texas should build interconnections to the national grid, so that Texas could import power from other states in case of emergency and export its surplus of renewable energy.¹⁵⁸ However, O'Rourke did not get elected, and the interconnection-demand vanished again—until now. In November 2022, Democratic Senator Zaffrini introduced Senate Bill 31 in the 88th Texas Legislature which would set the legal basis for transmission and distribution utilities in Texas to import power from other states and build the needed transmission lines.¹⁵⁹ The bill allows utilities to "construct, own, and operate facilities as necessary to: (1) access transmission service from outside of the ERCOT power region; and (2) purchase power at wholesale from outside of the ERCOT power region."¹⁶⁰ While it seems like the bill would not allow for the construction of transmission lines to export power, this point remains unclear. If adopted, this bill would probably subject Texas to FERC's regulation. In February 2023, the bill was referred to the Committee on Business and Commerce. However, interconnecting ERCOT has clearly become a partisan issue,¹⁶¹ which makes the adoption of this bill very unlikely with the current majority ratios. Aside from the huge political obstacle, the stars have never been this favorable for construction of transmission lines from Texas to

¹⁵³ *Id.*

¹⁵⁴ Aaron Bloom et al., *The Value of Increased HVDC Capacity Between Eastern and Western U.S. Grids: The Interconnections Seam Study*, 37 IEEE TRANSACTIONS ON POWER SYSTEMS 1760-1769 (2021), Jim McCalley et. al., *Transmission Design at the National Level: Benefits, Risks and Possible Paths Forward*, PSERC, 23–32 (2012).

¹⁵⁵ Michael Goggin & Jesse Schneider, *The One-Year Anniversary of Winter Storm Uri: Lessons Learned and the Continued Need for Large-Scale Transmission* 7 (2022).

¹⁵⁶ *Id.* at 8.

¹⁵⁷ *Id.* at 7-8.

¹⁵⁸ Philip Jankowski, *Beto O'Rourke, other Texas Democrats say they can fix the grid. Here's what experts think*, THE DALLAS MORNING NEWS (Aug. 19, 2022), <https://www.dallasnews.com/news/politics/2022/08/19/beto-orourke-other-texas-democrats-say-they-can-fix-the-grid-heres-what-experts-think/> [<https://perma.cc/9N8M-3HJU>].

¹⁵⁹ S.B. 31, 2023 Leg., 88th Sess. (Tex. 2023).

¹⁶⁰ *Id.*

¹⁶¹ Jankowski, *supra* note 158; Paul Krugman, *How the Wind Became Woke*, THE NEW YORK TIMES (May 30, 2023), <https://www.nytimes.com/2023/05/30/opinion/texas-wind-renewable-energy.html> [<https://perma.cc/X2QA-THK7>].

Fall 2023

neighboring states. Section 50152 appropriates \$760 million to provide grants to transmission siting authorities and state governments to further the siting of interstate transmission lines.¹⁶²

Part IV. Comparison Between the Energy Market of Texas and Germany

The following section will compare the energy markets in Texas and Germany. This comparison might not be obvious at first sight, but there are a surprising number of similarities. In the past, Texas and Germany have even been called “energy twins.”¹⁶³ This part of the article will briefly outline the German energy market (A), will describe the main common features of the energy markets in Texas and Germany (B), and will compare electricity rates in the two regions (C). It will also compare the reliability of the energy grids (D) and will finally point out how Germany benefits from an interconnected power grid (E).

A. Outline of the German Energy Market

Just like Texas, Germany has an unbundled energy market. Generation, transmission and distribution are operated by different companies.¹⁶⁴ In fact, Germany and Texas unbundled their energy networks at a similar time.¹⁶⁵ Germany's electricity grid consists of a maximum voltage transmission grid and distribution grids at high, medium and low voltage.¹⁶⁶ There are four transmission system operators—Amprion, 50Hertz, TenneT, and TransnetBW—that are supervised by the Federal Network Agency (Bundesnetzagentur).¹⁶⁷ Germany has an energy-only market which is supported by an additional capacity reserve.¹⁶⁸ This is an instrument outside the regular electricity market intended to guarantee security of supply.¹⁶⁹ It is only

¹⁶² Inflation Reduction Act of 2022, H.R.5376, 17th Cong. § 50152.

¹⁶³ BENTHAM PAULOS, TEXAS AND GERMANY: ENERGY TWINS? (2014), https://us.boell.org/sites/default/files/paulos_-_energy_twins_version.pdf [<https://perma.cc/K8UU-U8RU>].

¹⁶⁴ Felix Mormann, Dan Reicher & Victor Hanna, *A Tale of Three Markets: Comparing the Renewable Energy Experiences of California, Texas, and Germany*, 35 STAN. ENV'T L. J. 55, 65–66 (2016).

¹⁶⁵ *Id.*

¹⁶⁶ Kerstine Appunn & Ruby Russell, Set-up and challenges of Germany's power grid, CLEAN ENERGY WIRE, <https://www.cleanenergywire.org/factsheets/set-and-challenges-germanys-power-grid> (June 10, 2021); FEDERAL MINISTRY FOR ECONOMIC AFFAIRS AND CLIMATE ACTION, GRIDS AND INFRASTRUCTURE, [HTTPS://WWW.BMWK.DE/REDAKTION/EN/ARTIKEL/ENERGY/ELECTRICITY-GRIDS-OF-THE-FUTURE-01.HTML](https://www.bmwk.de/Redaktion/EN/Artikel/Energy/Electricity-Grids-of-the-Future-01.html) (July 20, 2023).

¹⁶⁷ *Id.*

¹⁶⁸ Kai Uwe Pritsche & Katharina Reinhardt, *Germany*, in CAPACITY MECHANISMS IN THE EU ENERGY MARKETS: LAW, POLICY, AND ECONOMICS, 296, 306, 312-13 (Leigh Hancker et al. ed., 2nd edn, Oxford, 2022; online edn, Oxford Academic, 19 Jan. 2023), <https://doi-org.libproxy.berkeley.edu/10.1093/oso/9780192849809.003.0015> (last visited Apr. 4, 2023); ACATECH, LEOPOLDINA & AKADEMIEUNION, INVESTITIONSANREIZE SETZEN, RESERVEKAPAZITÄTEN SICHERN: OPTIONEN ZUR MARKTINTEGRATION ERNEUERBARER ENERGIEN, SCHRIFTENREIHE ZUR WISSENSCHAFTSBASIERTEN POLITIKBERATUNG, 18 (2023).

¹⁶⁹ Pritsche & Reinhardt, *supra* note 179, at 312-13; ACATECH, LEOPOLDINA & AKADEMIEUNION, *supra* note 168, at 18.

activated when the market fails to cover the total electricity demand with the available supply.¹⁷⁰ The European Commission has authorized this capacity reserve only until September 2025.¹⁷¹

Germany has a large share of renewable energy: in 2022, 48.3 percent of its energy supply came from renewable sources with wind accounting for 25.9 percent and solar for 11.4 percent.¹⁷² Germany completed its phase-out of nuclear energy in April 2023.¹⁷³ Furthermore, due to Russia's invasion of Ukraine, Germany stopped importing Russian oil at the beginning of 2022.¹⁷⁴ In August 2022, Russia cut off its gas supplies to Germany.¹⁷⁵ Before that, Germany imported 55 percent of its gas and 35 percent of its oil from Russia.¹⁷⁶ The federal government (Bundesregierung) chose to react to this shift by further increasing its share of renewables.¹⁷⁷ In April 2022, the federal government proposed the goal that by 2030, renewable energy sources should supply at least 80 percent of the electricity consumed in Germany.¹⁷⁸ This target was later officially adopted by the federal legislature (Bundestag).¹⁷⁹ Unlike the Texas energy market, the German energy market is highly integrated.¹⁸⁰ It is part of the "internal energy market" of the European Union (EU), a common, integrated electricity and gas market which facilitates non-discriminatory competition between the EU member states.¹⁸¹ The "internal energy market" was

¹⁷⁰ Pritsche & Reinhardt, *supra* note 179, at 313; ACATECH, LEOPOLDINA & AKADEMIEUNION, *supra* note 168, at 18.

¹⁷¹ EUROPEAN COMMISSION, COMMISSION DECISION OF 7.2.2019 ON THE AID SCHEME SA.45852 - 2017/C (ex 2017/N), 25 (Feb. 7, 2018), https://ec.europa.eu/competition/state_aid/cases/269083/269083_1983030_171_13.pdf.

¹⁷² ENERDATA, *Germany's power consumption falls in 2022, generation from renewables rises*, <https://www.enerdata.net/publications/daily-energy-news/germanys-power-consumption-falls-2022-generation-renewables-rises.html> [https://perma.cc/C9X5-689U] (last visited Dec. 6, 2023).

¹⁷³ Laura Paddison, Nadine Schmidt & Inke Kappeler, 'A new era': *Germany quits nuclear power, closing its final three plants*, CNN (Apr. 15, 2023), <https://www.cnn.com/2023/04/15/europe/germany-nuclear-phase-out-climate-intl/index.html> [https://perma.cc/QA3P-CNBP]; DIE BUNDESREGIERUNG, DER ATOMAUSSTIEG MACHT UNSER LAND SICHERER (Apr. 19, 2023), <https://www.bundesregierung.de/breg-de/aktuelles/ausstieg-aus-der-kernkraft-2135796> [https://perma.cc/FSA9-5LRF].

¹⁷⁴ *Germany says it is no longer reliant on Russian energy*, BBC NEWS (Jan. 18, 2023), <https://www.bbc.com/news/business-64312400> [https://perma.cc/7B9A-HXGY].

¹⁷⁵ *Id.*

¹⁷⁶ *Id.*; Jakob Bauer et. al., *Energieabhängigkeit von Russland: Ein heikler Entzug*, DIE ZEIT (Apr. 29, 2022), <https://www.zeit.de/wirtschaft/2022-04/energieabhaengigkeit-russland-deutschland-gas-oe> [https://perma.cc/J64Z-NWH5].

¹⁷⁷ DEUTSCHER BUNDESTAG, DRUCKSACHE 20/1630, GESETZESENTWURF DER BUNDESREGIERUNG, 1–2 (May 2, 2022), <https://dserver.bundestag.de/btd/20/016/2001630.pdf> [https://perma.cc/97XE-Y5PX]; DIE BUNDESREGIERUNG, KLIMAFREUNDLICH UND KRISENSICHER (May 22, 2023), <https://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/energieversorgung-sicherheit-2040098> [https://perma.cc/7QQK-QWYV].

¹⁷⁸ DIE BUNDESREGIERUNG, WE'RE TRIPLING THE SPEED OF THE EXPANSION OF RENEWABLE ENERGIES (Dec. 23, 2022), <https://www.bundesregierung.de/breg-de/themen/klimaschutz/amendment-of-the-renewables-act-2060448> [https://perma.cc/YX6M-HLVU].

¹⁷⁹ Victoria Harsch & Judith Schäfer, *Wie das Osterpaket das Energierecht im Jahr 2022 reformiert*, KLIMR 2022, 334, 334–35.

¹⁸⁰ Federal Ministry for Economic Affairs and Climate Action, *Electricity Market*, <https://www.bmwk.de/Redaktion/EN/Dossier/electricity-market-of-the-future.html> [https://perma.cc/8W2Z-QQUH] (last visited Oct. 24, 2023).

¹⁸¹ EUROPEAN PARLIAMENT, *Internal Energy Market*, <https://www.europarl.europa.eu/factsheets/en/sheet/45/internal-energy-market> [https://perma.cc/553T-9AA4] (last visited Nov. 17, 2023).

Fall 2023

shaped by several EU directives and regulations (EU secondary law).¹⁸² The EU continuously aims at integrating the electricity markets of the EU member states more closely.¹⁸³ In 2021, Germany exported 70.8 TWh to its direct neighbor countries and imported 51.7 TWh from them.¹⁸⁴

B. Common Basic Features

Germany and Texas have more similarities than one might think. Both regions have a large population¹⁸⁵ and strong economies. According to its gross domestic product (GDP), Germany ranks 4th among all countries (2021 GDP of \$ 4,259,935 million¹⁸⁶). With a GDP of \$2,051,769 million in 2021,¹⁸⁷ Texas ranks as the 9th largest economy in the world.¹⁸⁸ Both regions have a large and growing share of renewables. 26 percent of Texas' energy supply is wind power, which is very similar to Germany's 25.9 percent. Solar power makes up four percent of Texas' energy mix which falls behind Germany's 11.4 percent. However, Texas' solar sector is quickly expanding.¹⁸⁹ Texas and Germany both have a similar energy market structure. They both have energy-only markets that rely on scarcity pricing to align supply and demand.¹⁹⁰

¹⁸² JURGEN KUHLING, ENZYKLOPADIE EUROPARECHT, EUROPAISCHES BINNENMARKT – UND WIRTSCHAFTSORDNUNGSRECHT, 1434–37 (Armin Hatje & Peter-Christian Müller-Graff, eds., 2nd ed. 2021).

¹⁸³ FEDERAL NETWORK AGENCY FOR ELECTRICITY, GAS, TELECOMMUNICATION, POST AND RAILWAY (BUNDESNETZAGENTUR–BNETZA) AND FEDERAL CARTEL OFFICE (FCO), MONITORING REPORT 241 (2022), https://www.bundeskartellamt.de/SharedDocs/Publikation/EN/Berichte/Energie-Monitoring-2022.pdf;jsessionid=1EB5F9EC8E5649BC72DA9F3090F6D0BF.2_cid362?__blob=publicationFile&v=4 [<https://perma.cc/A9FS-UFKV>].

¹⁸⁴ *Id.* at 249.

¹⁸⁵ See Alexa Ura, *Texas is now home to 30 million people*, TEX. TRIB. (Dec. 22, 2022), <https://www.texastribune.org/2022/12/22/texas-population-growth-30-million-census/> [<https://perma.cc/MKR7-BN2N>]; Destatis, *Current Population of Germany*, https://www.destatis.de/EN/Themes/Society-Environment/Population/Current-Population/_node.html [<https://perma.cc/B73H-TX46>] (last visited July 20, 2023).

¹⁸⁶ WORLD BANK, *Gross Domestic Product 2022*, https://databankfiles.worldbank.org/public/ddpext_download/GDP.pdf [<https://perma.cc/R3K2-FYZ7>] (last visited July 20, 2023).

¹⁸⁷ U.S. DEPARTMENT OF COMMERCE, BUREAU OF ECONOMIC ANALYSIS, GROSS DOMESTIC PRODUCT BY STATE AND PERSONAL INCOME BY STATE, 4TH QUARTER 2022 AND YEAR 2022 10 (Mar. 2023), <https://www.bea.gov/sites/default/files/2023-03/stgdppi4q22-a2022.pdf> [<https://perma.cc/K2P8-BEV6>].

¹⁸⁸ See WORLD BANK, *supra* note 186; Nia Bradley & Shannon Halbrook, *Understanding GDP*, TEX. COMPTROLLERS (Feb. 2022), <https://comptroller.texas.gov/economy/fiscal-notes/2022/feb/gdp.php> [<https://perma.cc/QJU7-6T5B>].

¹⁸⁹ U.S. ENERGY INFO. ADMIN., MORE THAN HALF OF THE NEW U.S. ELECTRIC GENERATING CAPACITY IN 2023 WILL BE SOLAR (Feb. 6, 2023), <https://www.eia.gov/todayinenergy/detail.php?id=55419&src=email> [<https://perma.cc/LD3Z-STZH>].

¹⁹⁰ BUNDESMINISTERIUM FÜR WIRTSCHAFT UND ENERGIE, UMSETZUNGSPLAN FÜR DEUTSCHLAND NACH ART. 20 STROMBINNENMARKTVERORDNUNG (BVMO) 13 (June 2021), https://energy.ec.europa.eu/system/files/2021-06/20210615_umsetzungsplan_deutschland_art_20_bmvo_final_0.pdf [<https://perma.cc/DJS8-HMKQ>]. However, Germany recently introduced a cap on gas and electricity prices to protect consumers and businesses from the sharp spike in energy costs. DIE BUNDESREGIERUNG, BASISVERSORGUNG ZU GÜNSTIGEREN PREISEN (July 2023),

Furthermore, they both unbundled their markets at similar times which enabled retail customers to choose out of a range of different power suppliers.¹⁹¹

Finally, Texas and Germany have both recently experienced a drastic energy crisis. Texas experienced severe power outages in 2021 that were largely due to failures in the natural gas supply (see above). Germany is now facing a drastic energy crisis due to the halt of natural gas supply from Russia. While the two crises, of course, have extremely different causes and consequences, they both sparked a debate about restructuring the energy market as well as changing the composition of the energy mix.¹⁹²

C. Electricity Rates

The following section will compare electricity prices in Germany and Texas. It will analyze both wholesale rates and retail rates. It is important to keep in mind that Texas experienced a drastic energy crisis in February 2021 and Germany is in an ongoing energy crisis since Russia's invasion of Ukraine. Recent electricity rates reflect these events.

In 2020, the average day ahead wholesale rate in Germany was €30.47/MWh,¹⁹³ and in 2021 it went up to €96.85/MWh.¹⁹⁴ In 2022, after the Russian invasion of Ukraine, it reached €235.45/MWh.¹⁹⁵ In Texas on the other hand, the average day ahead wholesale rate in 2020 was \$24/MWh.¹⁹⁶ In 2021, the year of winter storm Uri, the average day ahead wholesale rate was \$157/MWh.¹⁹⁷ For 2022, there is no average wholesale rate available yet, but rates ranked from \$34/MWh to \$182/MWh.¹⁹⁸ These numbers indicate that wholesale rates in Texas are lower than in Germany. This can be explained by the fact that Texas has access to abundant natural gas resources that are significantly cheaper than the natural gas that Germany imports.¹⁹⁹ This is

<https://www.bundesregierung.de/breg-de/themen/entlastung-fuer-deutschland/strompreisbremse-2125002>
[<https://perma.cc/PZJ4-V2YA>].

¹⁹¹ PAULOS, *supra* note 163, at 4.

¹⁹² Tagesschau, *Grüner Stahl: EU erlaubt Milliarden-Beihilfe für Thyssenkrupp* (July 20, 2023),

<https://www.tagesschau.de/wirtschaft/technologie/energieversorgung-unabhaengigkeit-energiepolitik-101.html>
[<https://perma.cc/DK4P-X9WP>];

Seyed Ehsan Hosseini, *Transition away from fossil fuels toward renewables: lessons from Russia-Ukraine crisis*, 1 FUTURE ENERGY 2, 3 (2022); Erin Douglas, *A year after the electric grid failed, Texas focuses on reliability, not climate change*, TEX. TRIB. (Feb. 15, 2022) <https://www.texastribune.org/2022/02/15/texas-power-grid-climate-change/> [<https://perma.cc/4UDZ-8BWP>].

¹⁹³ BUNDESNETZAGENTUR, THE ELECTRICITY MARKET IN 2021 (Jan. 7, 2022),

<https://www.smard.de/page/en/topic-article/5892/206870> [<https://perma.cc/JJG2-YAR5>].

¹⁹⁴ BUNDESNETZAGENTUR, THE ELECTRICITY MARKET IN 2022 (Jan. 2, 2023), <https://www.smard.de/page/en/topic-article/5892/209668> [<https://perma.cc/2MZE-HQ86>].

¹⁹⁵ *Id.*

¹⁹⁶ POTOMAC ECONOMICS, 2021 STATE OF THE MARKET REPORT FOR THE ERCOT ELECTRICITY MARKETS 45 (2022), <https://www.potomaceconomics.com/wp-content/uploads/2022/05/2021-State-of-the-Market-Report.pdf>
[<https://perma.cc/Z848-2U7C>].

¹⁹⁷ *Id.*

¹⁹⁸ POTOMAC ECONOMIES, ERCOT WHOLESALE ELECTRICITY MARKET MONTHLY REPORT (July 11, 2022), https://www.potomaceconomics.com/wp-content/uploads/2022/07/Nodal_Monthly_Report_2022-06.pdf
[<https://perma.cc/G8Y8-2YK3>]; U.S. ENERGY INFO. ADMIN., WHOLESALE U.S. ELECTRICITY PRICES WERE VOLATILE IN 2022 (Jan. 10, 2023), <https://www.eia.gov/todayinenergy/detail.php?id=55139>
[<https://perma.cc/4GHM-MT4X>].

¹⁹⁹ Mormann, *supra* note 164, at 93; INTERNATIONAL ENERGY AGENCY, *Natural gas prices in Europe, Asia and the United States, Jan 2020-February 2022* (Feb. 24, 2022), <https://www.iea.org/data-and-statistics/charts/natural-gas-prices-in-europe-asia-and-the-united-states-jan-2020-february-2022> [<https://perma.cc/Q6DA-FTG5>].

Fall 2023

especially true after the halt of gas supply from Russia that—as already mentioned—led to a drastic spike in gas prices.

The differences between retail electricity prices are far more striking: in 2021 the average retail electricity rate in Texas was 9.14 US cents/kWh,²⁰⁰ and in 2022 it was 13.9 US cents/kWh.²⁰¹ In Germany, average retail electricity rates in the first half of 2021 were at 32.6 Euro cents/kWh.²⁰² In the first half of 2022, the average retail price increased to 33.5 Euro cents/kWh.²⁰³ At the beginning of 2023, the retail electricity price reached a peak with 48.2 Euro cents/kWh.²⁰⁴ In the past, this significant difference was due to the fact that Germany refinanced its feed-in tariffs for renewable energy over a levy added primarily to the bills of retail customers.²⁰⁵ However, because of the sharp increase in electricity prices, the German legislature abolished this levy as of July 2022.²⁰⁶ Remaining differences between electricity prices in Texas and the US can be attributed to federal tax incentives for renewables in the U.S. that drive down energy costs and are funded by taxpayers nationwide.²⁰⁷ Another contributing factor is the deliberate use of price signals in Germany to create incentives for energy efficiency.²⁰⁸ And of course, the differences in gas prices also affect the retail rates. In fact, municipal utilities in Germany expect that retail electricity rates will remain at least twice as high as in pre-war times for the foreseeable future.²⁰⁹

D. Grid Reliability

A point of comparison central to this paper is the reliability of the energy grid. It can be measured by the System Average Interruption Duration Index (SAIDI). SAIDI measures the annual power interruption by providing the average amount of minutes or hours end users have

²⁰⁰ U.S. ENERGY INFO. ADMIN., STATE ELECTRICITY PROFILES (Nov. 10, 2022), <https://www.eia.gov/electricity/state/> [<https://perma.cc/QV9R-7Q27>].

²⁰¹ Kristina Zagame, *Texas Electricity Rates and Providers (2023)*, ECOWATCH (last updated Oct. 13, 2023), <https://www.ecowatch.com/electricity/rates/tx> [<https://perma.cc/XZN2-HNQS>].

²⁰² STATISTISCHES BUNDESAMT, PRESS RELEASE NO. 466 OF 1 OCTOBER 2021, https://www.destatis.de/EN/Press/2021/10/PE21_466_61243.html [<https://perma.cc/STR9-J8SU>] (last visited November 17, 2023).

²⁰³ STATISTISCHES BUNDESAMT, *Erdgas-und Stromdurchschnittspreise*, https://www.destatis.de/DE/Themen/Wirtschaft/Preise/Erdgas-Strom-Durchschnittspreise/_inhalt.html [<https://perma.cc/259G-NEHT>] (last visited July 20, 2023).

²⁰⁴ Klaus Stratmann, *Bleibt Strom für Verbraucher 2023 teuer?*, HANDELSBLATT (May 23, 2023).

²⁰⁵ Mormann, *supra* note 164, at 92–95.

²⁰⁶ THE FEDERAL GOVERNMENT, RELIEF FOR ELECTRICITY CONSUMERS (Apr. 27, 2022), <https://www.bundesregierung.de/breg-en/federal-government/renewable-energy-sources-act-levy-abolished-2011854> [<https://perma.cc/R3L8-MKC8>].

²⁰⁷ Mormann, *supra* note 164, at 96–97.

²⁰⁸ *Id.* at 95–96.

²⁰⁹ Der Spiegel, *Stadtwerke rechnen mit dauerhafter Verdopplung der Gas-und Strompreise* (Jan. 26, 2023), <https://www.spiegel.de/wirtschaft/service/gas-und-strom-preise-stadtwerke-rechnen-mit-dauerhafter-verdopplung-a-780c1eba-63a3-41f6-baf6-77aff74364fa> [<https://perma.cc/T9DN-W5EC>].

been without power supply.²¹⁰ The SAIDI in Germany reached a record low with 10.7 minutes in 2020 and slightly increased to 12.7 minutes in 2021.²¹¹

The SAIDI in Texas, on the other hand, was at 432.7 minutes of average power outage per customer in 2020 and at 1175.3 minutes (!) in 2021. In 2020, Texans experienced power outages that were 40.4 times as long as the outages experienced by German end customers. In 2021, outages in Texas were 92.5 times as long as outages in Germany. Why does the reliability of these two grids differ so much? Important factors are (1) the differing weather resilience of the two grids and (2) Germany's successful long term planning and efficient crisis management. The (lacking) integration of the energy grid is also decisive, but will be explored in a separate section (E).

a. Weather Resilience of the Grid

The German power grid is much more weather resilient than the ERCOT grid. First, it is important to point out that Texas and Germany are both experiencing considerable amounts of extreme weather events as evidenced by the costs incurred by them. In fact, with damages of €167.299 billion in the time span from 1980 to 2022, Germany was the country with the highest extreme weather costs in the European Union.²¹² Similarly, Texas is the state with the highest extreme weather costs in the United States, with costs of circa \$380 billion from 1980-2022.²¹³

It has already been shown that the ERCOT grid lacked resilience against extreme weather, and it is questionable whether the measures implemented since Uri will lead to significant improvements. Germany's power infrastructure, on the other hand, is much more weather resilient. The main reason for this is a factor that has not been discussed yet: Germany's high use of underground cables.²¹⁴ In general, there is "a strong and statistically significant correlation between the percentage of underground power lines and higher reliability."²¹⁵ In 2018, 82 percent of Germany's transmission lines were underground.²¹⁶ As Germany is currently

²¹⁰ Tam Kemabonta, *Grid Resilience analysis and planning of electric power systems: The case of the 2021 Texas electricity crisis caused by winter storm Uri (#TexasFreeze)*, 34 THE ELECTRICITY J. 107044 (2021).

²¹¹ Bundesnetzagentur, *Kennzahlen der Versorgungsunterbrechungen Strom*, https://www.bundesnetzagentur.de/DE/Fachthemen/ElektrizitaetundGas/Versorgungssicherheit/Versorgungsunterbrechungen/Auswertung_Strom/start.html [<https://perma.cc/W473-YSHY>] (last visited Oct. 24, 2023).

²¹² EUROPEAN ENVIRONMENT AGENCY, *ECONOMIC LOSSES FROM WEATHER- AND CLIMATE-RELATED EXTREMES IN EUROPE* (Oct. 6, 2023), <https://www.eea.europa.eu/en/analysis/indicators/economic-losses-from-climate-related> [<https://perma.cc/V7Z6-FMV6>].

²¹³ Adam B. Smith, *2022 U.S. billion-dollar weather and climate disasters in historical context*, CLIMATE.GOV (Jan. 10, 2023), <https://www.climate.gov/news-features/blogs/beyond-data/2022-us-billion-dollar-weather-and-climate-disasters-historical> [<https://perma.cc/C3RK-BZKY>].

²¹⁴ ACATECH, LEOPOLDINA & ADADEMIEUNION, *SIND BLACKOUTS IN DEUTSCHLAND WAHRSCHEINLICH?* 9 (Jan. 2023), https://www.leopoldina.org/fileadmin/redaktion/Publikationen/Nationale_Empfehlungen/2023_ESYS_Impuls_Blackouts.pdf [<https://perma.cc/R89K-7Z69>]; Peter Sopher, *Germany's Energiewende Proves Electricity Can Be Clean and Reliable*, BREAKING ENERGY (Oct. 21, 2014), <https://breakingenergy.com/2014/10/21/germanys-energiewende-proves-electricity-can-be-clean-and-reliable/> [<https://perma.cc/68NY-CUMP>]; Peter Fairley, *Germany's Grid: Renewables-Rich and Rock-Solid*, IEEE SPECTRUM (Aug. 28, 2014), <https://spectrum.ieee.org/germanys-superstable-solarsoaked-grid> [<https://perma.cc/J52G-TS8M>].

²¹⁵ Steve A. Fenrick & Lullit Getachew, *Cost and reliability comparisons of underground and overhead power lines*, 20 UTILITIES POLICY 31, 35–36 (2012).

²¹⁶ EnBW, *Transport*, <https://www.enbw.com/energie-entdecken/verteilung-und-transport/stromnetz/> [<https://perma.cc/362A-TP2Y>] (last visited July 20, 2023).

Fall 2023

planning to build the longest underground high-voltage transmission line in the world, this number will even increase.²¹⁷ In Texas, only approximately 19.1 percent of transmission lines run underground.²¹⁸ Buried transmission lines are not only perceived as more aesthetically pleasing;²¹⁹ they are also more resilient to several extreme weather events.²²⁰ Underground cables are better protected against high wind speeds, ice storms and heavy snowfalls because they cannot be destroyed by the weight of ice and snow or by falling trees.²²¹ During Uri, transmission lines were damaged or destroyed by trees and branches that broke under the heavy ice.²²² In February 2023, several days of freezing rain caused many trees to fall on transmission lines putting 400,000 people out of power, some of them for several days.²²³ Furthermore, buried protection lines are completely protected from wildfires and they also carry almost no risk of actively starting them.²²⁴ The California Camp Fire which was unprecedented in fatalities and destruction was caused by a tree that damaged PG&E's aging transmission lines.²²⁵ Also in Texas in 2011, a devastating wildfire which destroyed almost 1,600 homes was started by falling trees that damaged power lines.²²⁶ These extreme weather events have sparked debates about burying transmission lines. PG&E now intends to bury 10,000 miles of its power lines in

²¹⁷ World's longest underground transmission line will transport wind energy to Germany's grid, RENEWABLE ENERGY WORLD (Sept. 8, 2021), <https://www.renewableenergyworld.com/news/worlds-longest-underground-transmission-line-will-transport-wind-energy-to-germanys-grid/#gref> [<https://perma.cc/2UKJ-SCU8>].

²¹⁸ Peter H. Larsen, *A Method to Estimate the Costs and Benefits of Undergrounding Electricity Transmission and Distribution Lines*, 60 ENERGY ECONOMICS 47, 57 (2016).

²¹⁹ *Id.* at 48.

²²⁰ Dimitris N. Trakas & Nikos D. Hatziaargyriou, *Strengthening Transmission System Resilience Against Extreme Weather Events by Undergrounding Selected Lines*, 37 IEEE TRANSACTIONS ON POWER SYSTEMS 2808, 2810 (2022).

²²¹ *Id.*

²²² AUSTIN ENERGY, FEBRUARY WINTER STORMS, AFTER-ACTION REPORT (Oct. 2021), <https://austinenergy.com/-/media/project/websites/austinenergy/about/Feb2021-WinterStormsAfterActionReport.pdf> [<https://perma.cc/95L2-GHH8>].

²²³ Erin Douglas, Emily Foxhall & Pooja Salhotra, *In Central Texas, an urban tree canopy bends to the ice*, THE TEX. TRIB. (Feb. 2, 2023), <https://www.texastribune.org/2023/02/02/central-texas-ice-storm-trees-blackouts/> [<https://perma.cc/NR7C-A4PM>]; Dave Montgomery & Ava Sasani, *In Austin, Recovery From Winter Storm Is Slow and Piecemeal*, THE NEW YORK TIMES (Feb. 5, 2023), <https://www.nytimes.com/2023/02/05/us/austin-power-outages-ice-storm.html> [<https://perma.cc/N5QB-JDA9>]; Samantha Aguilar, *How freezing rain, tree-lined neighborhoods and above-ground power lines prolonged Austin power outages*, THE TEX. TRIB. (Feb. 7, 2023), <https://www.texastribune.org/2023/02/07/austin-ice-storm-power-outages-2023/> [<https://perma.cc/85G8-LGKS>].

²²⁴ Sofia Taylor & Line A. Roald, *A framework for risk assessment and optimal line upgrade selection to mitigate wildfire risk*, 213 ELECTRIC POWER SYSTEMS RESEARCH 1 (2022).

²²⁵ *Id.*; Daniel A. Zuniga Vazquez, Feng Qiu, Neng Fan & Kevin Sharp, *Wildfire Mitigation Plans in Power Systems: A Literature Review*, 37 IEEE TRANSACTIONS ON POWER SYSTEMS 3540, 3540 (2022).

²²⁶ Jim Forsyth, *Trees and power lines caused major Texas fire*, REUTERS (Sept. 21, 2011), <https://www.reuters.com/article/us-wildfires-texas/trees-and-power-lines-caused-major-texas-fire-idUSTRE78J76A20110920> [<https://perma.cc/PZG5-XKCR>].

California to prevent wildfires.²²⁷ As a reaction to the power outages in February 2023, the Austin City Council instructed city staff to analyze the feasibility of putting transmission lines underground.²²⁸ However, a major hurdle to broader endeavors in Texas to bury transmission lines is the enormous costs involved. In 2013, a report of the Edison Electric Institute estimated that converting existing transmission lines from overhead to underground costs from \$536,760 to \$12,000,000 a mile, depending, among other things, on their location.²²⁹ The costs of converting existing distribution lines range between \$158,100 and \$5,000,000.²³⁰ Peter Lake, chairman of the PUC, estimates that it would cost at least \$1 million per mile to convert overhead power lines in Texas to underground lines.²³¹ In 2011, a study by the Public Service Commission of Wisconsin found that building new underground lines costs 4 to 14 times as much as constructing overhead lines.²³² Because of these high costs, a report focusing on Texas recommended to bury power lines only when at least some of the following conditions are present: considerably many customers per line mile, a risk of frequent and severe storms, potential cost savings through economies of scale, and utility easements for underground lines are smaller than for overhead lines.²³³

But despite the advantage of buried transmission lines, Germany also needs to improve the weatherization of its power grid and consider the effects of climate change.²³⁴ Germany's average annual temperature rises faster than the world average.²³⁵ The International Energy Agency states that heavy precipitation and droughts put Germany's energy supply security at risk.²³⁶ Droughts and high temperatures lead to forced outages at thermal power plants.²³⁷ One mitigation strategy for these forced outages is to increase interconnection within the European power system.²³⁸

Germany's grid is struggling with heavy precipitation. In July 2021, extreme precipitation caused a dramatic flooding in Germany, mainly in the Ahr valley, that caused more

²²⁷ Michael Liedtke, *PG&E will spend at least \$15 billion burying power lines*, L.A. TIMES (July 21, 2021), <https://www.latimes.com/business/story/2021-07-21/pg-e-will-spend-up-to-30-billion-burying-power-lines> [https://perma.cc/8RM2-2T59].

²²⁸ Luz Moreno-Lozano, *After ice storm fiasco, Austin leaders study burying power lines, adding more generators*, AUSTIN AMERICAN-STATESMAN (Mar. 24, 2023), <https://www.statesman.com/story/news/2023/03/24/austin-city-council-study-burying-power-lines-generators-winter-ice-storm/70043387007/> [https://perma.cc/DC4X-CQ8K].

²²⁹ Kenneth L. Hall, *Out of Sight, Out of Mind 2012: An Updated Study on the Undergrounding of Overhead Power Lines*, EDISON ELECTRIC INSTITUTE, 31 (2013).

²³⁰ *Id.*

²³¹ Bob Sechler, *Experts say, burying Austin Energy's existing power lines would be costly, difficult*, AUSTIN AMERICAN-STATESMAN (Feb. 2, 2023), <https://www.statesman.com/story/news/local/2023/02/02/power-outage-austin-energy-expert-says-burying-existing-lines-difficult-costly/69867318007/> [https://perma.cc/R28V-G549].

²³² PUBLIC SERVICE COMMISSION OF WISCONSIN, UNDERGROUND ELECTRIC TRANSMISSION LINES 17 (n.d.), <https://psc.wi.gov/Documents/Brochures/Under%20Ground%20Transmission.pdf>.

²³³ Peter H. Larsen, *A Method to Estimate the Costs and Benefits of Undergrounding Electricity Transmission and Distribution Lines*, 60 *Energy Economics* 47, 60 (2016).

²³⁴ For the different climatic impacts on the power grid, see UMWELTBUNDESAMT, KLIMAWIRKUNGS-UND RISIKOANALYSE 2021 FÜR DEUTSCHLAND 117–119 (June 2021), https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2021-06-10_cc_23-2021_kwra2021_infrastruktur.pdf [https://perma.cc/8TJC-MGTW].

²³⁵ INTERNATIONAL ENERGY AGENCY, *Germany Climate Resilience Policy Indicator*, <https://www.iea.org/articles/germany-climate-resilience-policy-indicator> (last visited Oct. 24, 2023).

²³⁶ *Id.*

²³⁷ Alexander Golub, Kristina Govorukha, Philip Mayer & Dirk Ruebelke, *Climate Change and the Vulnerability of Germany's Power Sector to Heat and Drought*, 3 *ENERGY J.* 157, 166–67 (2022).

²³⁸ *See id.* at 172.

Fall 2023

than 200 deaths.²³⁹ Over 200,000 people experienced power outages.²⁴⁰ The flood damaged around 133 kilometers of natural gas pipelines as well as large numbers of gas meters and house pressure regulators.²⁴¹ It also damaged over 90 percent of all network connections in the region.²⁴² When rebuilding the power infrastructure, the local network operator improved weather resilience by building (even) more underground power lines,²⁴³ by relocating network connections from areas with a risk of flooding and by the enhanced use of digital grid management.²⁴⁴ As heavy precipitation becomes more frequent, all regions in Germany need to assess how to adequately prepare their infrastructure.

b. Continuous Climate Adaptation and Efficient Crisis Management

Another factor that contributes significantly to Germany's grid reliability is its well-coordinated regulatory measures. Germany and Texas both have a liberalized energy-only market. But unlike Texas, Germany (a) engages in continuous long-term planning to adapt its infrastructure to the effects of climate change and (b) has recently proven its ability to ensure energy security in the midst of an energy crisis.

i. Continuous Climate Adaptation

Germany ensures the climate change adaptation of its energy infrastructure through action plans and reports that monitor and evaluate progress.²⁴⁵ A very important instrument is the Adaption Action Plan (APA), which is updated every five years with the most recent APA (APA III) published in 2020.²⁴⁶ The APA III analyzes the effects of climate change on energy demand for cooling and heating, on cooling water for thermal power plants and on power lines and power

²³⁹ Alexander Fekete & Simone Sandholz, *Here Comes the Flood, but Not Failure? Lessons to Learn after the Heavy Rain and Pluvial Floods in Germany 2021*, 13 WATER 1 (2021).

²⁴⁰ Elco E. Koks, Kees C.H. Van Ginkel, Margreet J.E. Van Marle & Anne Lemnitzer, *Brief Communication: Critical Infrastructure Impacts of the 2021 Mid-July Western European Flood Event*, 22 NATURAL HAZARDS AND EARTH SYSTEM SCIENCES 1, 4 (2021).

²⁴¹ *Tausende in Bad Neuenahr-Ahrweiler im Winter ohne Heizung*, SWR (Aug. 25, 2021), <https://www.swr.de/swraktuell/rheinland-pfalz/koblenz/evm-gasversorgung-heizung-winter-bad-neuenahr-ahrweiler-hochwasser-100.html> [https://perma.cc/LZ8Y-ZRD8].

²⁴² *Id.*

²⁴³ *Wiederaufbau im Ahrtal: Erdkabel statt Freileitungen*, BLICK-AKTUELL (June 13, 2022), <https://www.blick-aktuell.de/Politik/Wiederaufbau-im-Ahrtal-Erdkabel-statt-Freileitungen-512522.html> [https://perma.cc/7T5B-RW7P].

²⁴⁴ Philip Akoto, *Eon: Flutgebiete als Modellregion für resiliente Verteilnetze*, ENERGATE MESSENGER (July 8, 2022), <https://www.energate-messenger.de/news/223801/eon-flutgebiete-als-modellregion-fuer-resiliente-verteilnetze> [https://perma.cc/C64B-QNC6].

²⁴⁵ International Energy Agency, *supra* note 235.

²⁴⁶ *Id.*; Umweltbundesamt, *Adaptation Action Plan*, <https://www.umweltbundesamt.de/en/topics/climate-energy/climate-impacts-adaptation/adaption-to-climate-change/adaptation-at-the-federal-levelnew/adaptation-action-plan> [https://perma.cc/62KB-EH6F] (last visited Oct. 24, 2023).

generation facilities.²⁴⁷ Another federal action plan, the Federal Climate Impact and Risk Assessment, similarly analyzes the climate change risks for different energy sources and addresses the changing energy demand in upcoming years and decades.²⁴⁸ Texas, on the other hand, has not developed a statewide adaptation plan and has therefore no cycles of monitoring and reporting on progress.²⁴⁹ This is particularly concerning as Texas' power infrastructure is "among the nation's most vulnerable to climate shocks and stresses."²⁵⁰

ii. Efficient Crisis Management

An evaluation of Germany's regulatory response to the halt of gas supply from Russia shows that Germany can manage crises successfully, thereby preventing actual blackouts.²⁵¹ In order to cover high energy demand in winter, Germany was historically reliant on continuous gas imports (from Russia) as well as sufficient supplies in its large gas reserves.²⁵² In the weeks leading up to Russia's invasion in Ukraine, the supply levels of Germany's gas reserves reached concerning lows.²⁵³ As a reaction, the German federal legislature enacted the gas storage act (*Gasspeicherungsgesetz*) in April 2022 that mandates fixed supply levels at various points of time.²⁵⁴ As Germany's gas reserves are operated by private actors, the gas storage act interferes with private economic decision making. While this might seem like an extreme step, the gas storage act successfully prevented serious gas shortages or power outages in winter 2022-2023²⁵⁵

²⁴⁷ DIE BUNDESREGIERUNG, SECOND PROGRESS REPORT ON THE GERMAN STRATEGY FOR ADAPTATION TO CLIMATE CHANGE (DAS), ANNEX 1, https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Klimaschutz/klimawandel_das_2_fortschrittsbericht_en_bf.pdf [<https://perma.cc/V873-E9M7>].

²⁴⁸ Maike Voss et. al., KLIMAWIRKUNGS-UND RISIKOANALYSE 2021 FÜR DEUTSCHLAND, TEILBERICHT 4: RISIKEN UND ANPASSUNG IM CLUSTER INFRASTRUKTUR, UMWELTBUNDESAMT (June 2021), https://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/kwra2021_teilbericht_4_cluster_infrastruktur_bf_211027_0.pdf [<https://perma.cc/53B4-V8DX>].

²⁴⁹ Georgetown Climate Center, *Preparing for Climate Change in Texas*, <https://www.georgetownclimate.org/adaptation/state-information/texas/overview.html> [<https://perma.cc/H8CR-2U97>] (last visited Oct. 24, 2023).

²⁵⁰ HOUSTON ADVANCED RESEARCH CENTER, POWERING THE FUTURE: TEXAS POWER SECTOR PIVOTING TO CLIMATE RESILIENCE 5 (2022), <https://harcresearch.org/wp-content/uploads/2023/05/Climate-Risk-and-Resilience-5.2.2022.pdf> [<https://perma.cc/3LZF-MHEJ>].

²⁵¹ Regarding the fear of blackouts in Germany in winter 2022/2023, see Jakob von Lindern, *Bundesamt für Katastrophenhilfe rechnet mit Stromausfällen im Winter*, DIE ZEIT (Nov. 19, 2022), <https://www.zeit.de/wirtschaft/2022-11/stromausfall-blackout-stromversorgung-katastrophenschutz> [<https://perma.cc/YNR8-2UCD>].

²⁵² DEUTSCHER BUNDESTAG, ENTWURF EINES GESETZES ZUR ÄNDERUNG DES ENERGIEWIRTSCHAFTSGESETZES ZUR EINFÜHRUNG VON FÜLLSTANDSVORGABEN FÜR GASSPEICHERANLAGEN 1 (Mar. 2022), <https://dserver.bundestag.de/btd/20/010/2001024.pdf> [<https://perma.cc/3E9B-YTAL>].

²⁵³ *Germany's gas reserves are at 'worrying' levels, admits government*, EURONEWS (Feb. 10, 2022), <https://www.euronews.com/2022/02/09/germany-s-gas-reserves-are-at-worrying-levels-admits-government> [<https://perma.cc/AZX4-N2S6>].

²⁵⁴ BUNDESGESETZBLATT, GESETZ ZUR ÄNDERUNG DES ENERGIEWIRTSCHAFTSGESETZES ZUR EINFÜHRUNG VON FÜLLSTANDSVORGABEN FÜR GASSPEICHERANLAGEN SOWIE ZUR ÄNDERUNG VON § 246 DES BAUGESETZBUCHS (Apr. 26, 2022), https://www.bgbl.de/xaver/bgbl/text.xav?SID=&tf=xaver.component.Text_0&toctf=&qmf=&hlf=xaver.component.Hitlist_0&bk=bgbl&start=%2F%2F%5B%40node_id%3D%271034646%27%5D&skin=pdf&tlevel=-2&nohist=1&sinst=E546CF3F [<https://perma.cc/MP3U-A7MN>].

²⁵⁵ BUNDESNETZAGENTUR, LAGEBERICHT GASVERSORGUNG (Apr. 20, 2023),

Fall 2023

which had been anticipated. This is one telling example of how Germany efficiently uses regulatory measures to ensure grid reliability even in times of crisis.

Texas' crisis management, on the other hand, is rather poor. Its power infrastructure was completely unprepared for Uri even though Texas had experienced similar weather-induced blackouts in 2011. And even after its 2021 power crisis, Texas did not adopt measures to adequately weatherize its energy infrastructure or reduce the state's power demand. Instead, it used the energy crisis to demonize renewables and step away from decarbonization.

E. Interconnectedness of the German Energy Grid

The final factor contributing to Germany's grid reliability is the high integration of its energy market.²⁵⁶ As mentioned above, it forms part of the "internal energy market" of the European Union. It has direct interconnections to nine neighboring countries: Austria, the Czech Republic, Denmark, France, Luxembourg, Poland, the Netherlands, Sweden (via submarine cable) and Switzerland.²⁵⁷ Due to its central geographical position in Europe, Germany serves as an important hub for European power flows exchanges.²⁵⁸ Germany's interconnected energy market improves its ability to balance its large and increasing share of intermittent wind and solar energy.²⁵⁹ Furthermore it fosters its resilience against extreme weather events as an interconnected energy grid is "significantly less vulnerable to single-point failures[]"²⁶⁰ Additionally, the recent energy crisis in Germany shows that an integrated power grid also protects from fuel import stops that are caused by political manipulation.²⁶¹

Furthermore, the German energy grid is not only highly integrated; Germany and its neighboring countries are legally bound to the European principle of energy solidarity.²⁶² This principle requires that member states of the European Union consider the energy interests of

https://www.bundesnetzagentur.de/DE/Gasversorgung/aktuelle_gasversorgung/_downloads/2023/04_April/230420_gaslage.pdf?__blob=publicationFile&v=2 [<https://perma.cc/5PT8-X3WE>]; Michael Bauchmüller, *Dieser Winter ist geschafft*, SÜDDEUTSCHE ZEITUNG (Feb. 28, 2023), <https://www.sueddeutsche.de/meinung/gas-strom-terminals-preisbremse-kommentar-energie-1.5759219?reduced=true> [<https://perma.cc/Q25N-6N6V>].

²⁵⁶ Peter Sopher, *Lessons Learned from Germany's Energiewende: The Political, Governance, Economic, Grid Reliability, and Grid Optimization Bedrock for a Transition to Renewables*, 6 RENEWABLE ENERGY L. & POL'Y REV. 99, 107 (2015).

²⁵⁷ Federal Ministry for Economic Affairs and Climate Action, *supra* note 180.

²⁵⁸ *Id.*

²⁵⁹ Stephanie Halbrügge, Hans Ulrich Buhl, Gilbert Fridgen, Paul Schott, Martin Weibelzahl & Jan Weissflog, *How Germany achieved a record share of renewables during the COVID-19 pandemic while relying on the European interconnected power network*, 246 ENERGY 1, 2 (2022); Eric Martinot, *Grid Integration of Renewable Energy: Flexibility, Innovation, and Experience*, 41 ANNUAL REVIEW OF ENVIRONMENT AND RESOURCES 223, 241–42 (2016).

²⁶⁰ Justinas Jasiūnas, Peter D. Lund & Jani Mikkola, *Energy system resilience – A review*, 150 RENEWABLE AND SUSTAINABLE ENERGY REVIEWS 111476, 10 (2021).

²⁶¹ See Gonzalo Escribano, *An energy union without interconnections? Public acceptance of cross-border interconnectors in four European countries*, 266 ENERGY 1 (2023).

²⁶² Charlotte Kreuter-Kirchhof, *Europäische Energiesolidarität – Wege zur Vorbeugung und Bewältigung schwerer Energieversorgungskrisen in der EU*, NVwZ 993 (2022).

other member states when making their own policy decisions.²⁶³ This applies in particular to decisions impacting energy security.²⁶⁴ Furthermore, the principle of energy solidarity obligates member states to provide energy to another member state in case of an extreme gas shortage.²⁶⁵ To prevent severe gas shortages and to comply with the principle of energy security, Germany has recently intensified its energy cooperation with France,²⁶⁶ Austria,²⁶⁷ and the Czech Republic.²⁶⁸

Quite to the contrary, Texas has a largely isolated grid and has no significant energy cooperation with another state. Section E of this article has already pointed out that interconnecting ERCOT would increase grid reliability. A comparison with the highly interconnected German power system and its impressive reliability supports this finding.

Conclusions

To conclude, Texas has introduced important measures to better prepare its energy grid for extreme weather events. Through the amendments to the Texas Administrative Code, it has become less likely that critical gas infrastructure is affected by load shedding. Another positive step is that Senate Bill 3 of the 87th Texas Legislature has made weatherization of power plants and transmission lines mandatory. Overall, however, the verdict on the measures taken in Texas is negative. Natural gas power plants are largely exempt from mandatory weatherization, and they are not required to maintain minimum gas reserves onsite. There are no endeavors to reduce the very high energy demand in Texas. The introduction of the so-called performance credit mechanism to reform Texas' energy market structure seems to be a costly gamble.²⁶⁹

²⁶³ *Id.*

²⁶⁴ *Id.*

²⁶⁵ *Id.* at 996–97.

²⁶⁶ DIE BUNDESREGIERUNG, POLITICAL DECLARATION FRANCO-GERMAN SOLIDARITY (Nov. 25, 2022), <https://www.bundesregierung.de/resource/blob/975228/2145790/cab95eaf6ef9e1a50baabb873766dafd/2022-11-25energiesolidaritaet-dt-fr-data.pdf?download=1> [<https://perma.cc/UXR8-33U4>]; Merlyn Thomas, *France sends Germany gas for first time amid Russia energy crisis*, BBC NEWS (Oct. 13, 2022), <https://www.bbc.com/news/world-europe-63246369> [<https://perma.cc/2UVE-H35D>]; Cyrielle Cabot, *France sends gas to Germany, another step towards energy solidarity*, FRANCE 24 (Oct. 20, 2022), <https://www.france24.com/en/europe/20221020-france-sends-gas-to-germany-another-step-towards-energy-solidarity> [<https://perma.cc/QU2D-VJYG>].

²⁶⁷ DER BUNDESMINISTER FÜR WIRTSCHAFT UND KLIMASCHUTZ DER BUNDESREPUBLIK DEUTSCHLAND UND DIE BUNDESMINISTERIN FÜR LIMASCHUTZ, UMWELT, ENERGIE, MOBILITÄT, INNOVATION UND TECHNOLOGIE DER REPUBLIK ÖSTERREICH, DIE GEWÄHRLEISTUNG DER GASVERSORGUNGSSICHERHEIT (July 12, 2022), https://www.bmwk.de/Redaktion/DE/Downloads/Energie/20220712-gemeinsame-erklarung-de-aut-gewahrleistung-der-gasversorgungssicherheit.pdf?__blob=publicationFile&v=1 [<https://perma.cc/3T2P-F6Z5>]; DIE BUNDESREGIERUNG, ÖSTERREICHISCH-DEUTSCHES ABKOMMEN ZU GASSPEICHERN–HAIDACH UND 7FIELDS GEMEINSAM NUTZEN (Feb. 17, 2023), <https://www.bundesregierung.de/breg-de/themen/klimaschutz/gasspeicher-deutschland-oesterreich-2166388> [<https://perma.cc/785E-D8NT>].

²⁶⁸ FEDERAL MINISTRY FOR ECONOMIC AFFAIRS AND CLIMATE ACTION, JOINT STATEMENT REGARDING ENERGY SECURITY (July 2022), https://www.bmwk.de/Redaktion/DE/Downloads/E/joint-statement-on-energy-security.pdf?__blob=publicationFile&v=1 [<https://perma.cc/Q5D5-QAR8>]; Nikolaus J. Kurmayer, *Deutschland und Tschechien wollen im Falle einer Gasmangellage solidarisch sein*, EURACTIV (July 11, 2022), <https://www.euractiv.de/section/energie/news/deutschland-und-tschechien-wollen-im-falle-einer-gasmangellage-solidarisch-sein/> [<https://perma.cc/8FR8-Z28C>].

²⁶⁹ Miranda Willson & Jason Plautz, *Could Texas lawmakers end the state's renewable boom?*, E&E NEWS (Apr. 24, 2023), <https://www.eenews.net/articles/could-texas-lawmakers-end-the-states-renewable-boom/> [<https://perma.cc/EC9N-NG3F>].

Fall 2023

Despite the broad consensus that interconnecting ERCOT would be highly beneficial, there are no realistic prospects that this will happen anytime soon. Interestingly, both Germany and Texas have recently faced an energy crisis in which natural gas played and still plays a key role. While Germany has used this crisis as an impetus to accelerate its transition to a carbon-free renewable energy market, politicians in Texas inhibit the further expansion of wind and solar energy and invest in natural gas power plants. Germany with its high share of renewables, experiences a significant amount of extreme weather events but still manages to keep its high grid reliability. This shows how mistaken it is to blame wind and solar energy for power outages. The following statement by Beth Garza, former director of ERCOT's Independent Market Monitor, emphasizes how worrying recent legislative developments in Texas are: "If I'm a wind or solar developer, there's been so much anti-renewable talk or actions contemplated in a wide variety of legislation, why would I come to Texas?"²⁷⁰

²⁷⁰ *Id.*