GRID RELIABILITY IN THE ELECTRIC ERA

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ABSTRACT. The United States has delegated the weighty responsibility of keeping the lights on to a self-regulatory organization called the North American Electric Reliability Corporation (NERC). Despite the fact that NERC is one of the largest and most important examples of industry-led governance—and regulates in an area that is central to our economy and basic human survival—this unusual institution has received scant attention from policymakers and scholars. Such attention is overdue. To respond to the challenge of climate change, the U.S. must enter a new "electric era," transitioning many sectors to run on electricity while also transforming the grid itself to run largely on clean but intermittent renewable resources. These new resources demand new approaches to grid reliability—approaches that the NERC model of reliability governance may be incapable of delivering.

This Article traces NERC's history, situates NERC in ongoing debates about climate change and grid reliability, and assesses the viability of reliability self-regulation in the coming electric era. It contends that it may have made sense to delegate the task of maintaining U.S. electric grid reliability to a self-regulatory organization in prior decades, when regulated monopolies managed nearly every segment of electricity production. But many of the criteria that NERC used to justify self-regulation earlier in its history—electric utilities' expertise, homogeneity, and alignment with public goals—no longer hold. The climate crisis creates a need for expertise beyond NERC's domain, while the introduction of competition to large parts of the electricity sector blurs lines of accountability for reliability failures. NERC's structure also perpetuates an incumbency bias at odds with public goals for the energy transition.

As we illustrate, these shifting conditions have caused NERC to fail to keep pace with the reliability challenges of the electric era. Worse still, outdated NERC standards often help entrench fossil fuel interests by justifying energy market rules poorly suited to accommodate renewable resources. We therefore suggest a suite of reforms that would increase direct government oversight and accountability in electricity reliability regulation.

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INTRODUCTION

Politicians and pundits rarely spoke of the North American Electric Reliability Corporation (NERC) until 2021, when Texas and other parts of the Midwestern and Southeastern United States experienced a deadly and wide-ranging grid blackout. Families jury-rigged diesel generators for heat, froze in their beds, and perished from carbon monoxide poisoning,[1] while politicians

[1] FED. ENERGY REG. COMMN., NORTH AM. ELECTR. RELIABILITY CORP., & REGIONAL ENTITIES, FERC-NERC-REGIONAL ENTITY STAFF REPORT: THE FEBRUARY 2021 COLD WEATHER OUTAGES IN TEXAS AND THE SOUTH CENTRAL UNITED STATES 9 (2021), https://ferc.gov/media/february-2021-cold-weather-outages-texas-and-south-central-united-states-ferc-nerc-and.

slung accusations about who was responsible.[2] As the entity responsible for grid reliability in the United States and much of Canada and Mexico, NERC made a brief appearance in news accounts and policy discussions.[3] But as memory of the blackout faded,[4] so too did public scrutiny of this peculiar institution.[5]

NERC operates as a self-regulatory organization that, since 2006, has been statutorily charged to act as the nation's "Electric Reliability Organization" (ERO) to ensure the reliability of the U.S. "bulk power system."[6] But NERC's

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[2] *Cf.* Letter from DeAnn T. Walker, Chairman, Public Utility Commission of Texas, to Governor Greg Abbott, Mar. 1, 2021, https://www.powermag.com/wp-content/uploads/2021/03/496558704-chairman-walker-resignation-letter.pdf (in resigning from the Texas Public Utility Commission after the 2021 blackout, arguing that all entities involved should accept responsibility and stating, "The gas companies, the Railroad Commission, the electric generators, the transmission and distribution utilities, the electric cooperatives, the municipally owned utilities, the Electric Reliability Council of Texas, and finally the Legislature all had responsibility to foresee what could have happened and failed to take the necessary steps for the past ten years to address issues that each of them could have addressed").

[3] *See, e.g.*, *U.S. wants natgas/power coordination to prevent another Feb freeze*, REUTERS, Nov. 16, 2021, https://www.reuters.com/business/energy/us-wants-natgaspower-coordination-prevent-another-feb-freeze-2021-11-16/ (noting the NERC-FERC report on the causes of the freeze); Jeremy Schwartz, Kiah Collier, and Vianna Davila, *"Power companies get exactly what they want": How Texas repeatedly failed to protect its power grid against extreme weather*, TEX. TRIBUNE, Feb. 22, 2021, https://www.texastribune.org/2021/02/22/texas-power-grid-extreme-weather/ (noting that NERC had "methodically laid out how power-generating equipment failed" during a 2014 southern cold snap but how Texas grid operators had ignored NERC's recommendations).

[4] Glenn Hegar, Tex. Comptroller of Publ. Accts., *Winter Storm Uri 2021* at 3, 5, FISCAL NOTES (Oct. 2021), https://comptroller.texas.gov/economy/fiscal-notes/2021/oct/docs/fn.pdf (estimating an economic toll of $80 to $130 billion from Winter Storm Uri and "at least 210 deaths")

[5] Scholars have also largely ignored NERC. The literature typically discussed NERC only in short snippets, exploring its public-private "hybridity" and potential non-delegation issues. *See* Emily Hammond, *Double Deference in Administrative Law*, 116 COLUM. L. REV. 1705 (2016) (describing NERC as an example of a self-regulatory organization to which the government has delegated regulatory authority); Hari M. Osofsky & Hannah J. Wiseman, *Hybrid Energy Governance*, 2014 U. Ill. L. Rev. 1, 31-45 (exploring NERC's role as an organization that integrates public and private actors and its innovation in some areas, such as cybersecurity). Some literature has begun to document NERC's role in modern grid reliability, but no sources of which we are aware have fully described or analyzed NERC's governance role. For more limited discussion of NERC's regulation of grid reliability, *see* Alexandra Klass, Joshua Macey, Shelley Welton & Hannah Wiseman, Grid Reliability Through Clean Energy, 74 STAN. L. REV. 969, 1043-53 (2022) (exploring NERC's failure to recognize how renewable energy can contribute to grid reliability, not just imperil it); Alexandra B. Klass, Expanding the U.S. Electric Transmission and Distribution System to Meet Deep Decarbonization Goals, 47 Envtl. L. Rep. News & Analysis 10749, 10750 (2017) (briefly describing NERC's role in maintaining a reliable grid).

[6] FERC Order No. 672 (2006); 16 U.S.C. §824o. Bulk power system is a technical term that essentially refers to electricity generation and transmission infrastructure. It explicitly excludes most small distribution lines that carry power to individual homes and businesses. For ease of readership, we often refer to the Bulk Power System as the "grid," recognizing that the grid as regulated by NERC does not include the distribution wires that lead to individual homes,

existence dates back far longer, to 1968, when electric utilities voluntarily formed the corporation to jointly establish grid reliability standards.[7] For decades, NERC did an admirable job of helping to minimize grid disruptions that lead to major blackouts. Yet climate change has rendered the tasks of maintaining grid reliability (providing adequate power all of the time) and resilience (regaining power quickly after blackouts and maintaining some power during grid emergencies) more difficult—creating a pressing need to reexamine the theory and practice of reliability governance in the United States.[8]

Climate change complicates grid reliability in two ways. The first relates to the imperative to transform and scale up the electricity sector to decarbonize the U.S. economy. One key climate mitigation strategy is to "electrify everything"—from vehicles to cooking and heating—thereby launching a new "electric era" of energy.[9] However, electrification will support deep decarbonization only if the electricity system itself is transformed to run on zero-carbon ("clean") energy sources instead of fossil fuels.[10] This transformation is well underway in the United States and will accelerate as a result of the Inflation Reduction Act of 2022.[11] But new electricity sources bring new reliability challenges, even as they reduce or eliminate others.[12]

Most notably, balancing the intermittency of renewable energy has emerged as a core reliability imperative for the electric era. This calls for diverse and flexible solutions such as battery storage, "reactive" power that can quickly turn on, and commitments from consumers to reduce consumption, all of which are important resources and strategies when renewable energy generation suddenly dips or demand peaks.[13] NERC, however, has tended to focus on more

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industries, and businesses. See Joseph H. Eto et al., *Distribution System versus Bulk Power System: Identifying the Source of Electric Service Interruptions in the U.S.*, 13 J. INSTIT. OF ENGIN. & TECH. 717 (2019) (noting that FERC's jurisdiction, since 2010, extends mostly to lines operating at over 100 kilovolts).

[7] David Nevius, The History of the North American Electric Reliability Corporation 3, https://www.nerc.com/AboutNERC/Resource%20Documents/NERCHistoryBook.pdf.

[8] *See infra* notes 9-13 and accompanying text.

[9] *See, e.g.*, Florian Knobloch et al., Net emission reductions from electric cars and heat pumps in 50 world regions over time, 3 NAT. SUSTAIN. 437 (2020) (noting that "[p]olicy-makers widely consider electrification a key measure for decarbonizing road transport and household heating").

[10] *See, e.g.*, Runsen Zhand and Shinichiro Fujimori, *The role of transport electrification in global climate change mitigation scenarios*, 2020 ENV'T RES. LETT. 15 at 9 (noting the necessary synergies between "transport electrification" and renewable energy).

[11] *See* OMB ANALYSIS: THE SOCIAL BENEFITS OF THE INFLATION REDUCTION ACT'S GREENHOUS GAS EMISSION REDUCTIONS at 1 (2022), https://www.whitehouse.gov/wp-content/uploads/2022/08/OMB-Analysis-Inflation-Reduction-Act.pdf (noting that the Act is "projected to yield significant reductions to GHG emissions . . . with total annual emissions reaching about a 40 percent drop below 2005 levels in the year 2030").

[12] *See infra* note 13 & Part III.C.

[13] Nestor Sepulveda, Jesse Jenkins, Fernando de Sisternes, Richard Lester, *The Role of Firm Low-Carbon Electricity Resources in Deep Decarbonization*, 2 JOULE 2403, 2403-04 (2018); Amy Stein, *Distributed Reliability*, 87 U. COLO. L. REV. 887, 891-96 (2016) (exploring the growth of

limited components of reliability that are not sufficient for modern grid reliability and resilience. These narrower foci include maintaining sufficient levels of "firm" capacity that are available to meet demand throughout the year and shoring up the strength of large-scale infrastructure, both physically and from a cyber-security perspective.[14]

The second reason NERC's job is becoming increasingly difficult stems from the *effects* of climate change on the U.S. grid. In California, it is increasingly common for utilities to stop the flow of electricity to customers' homes to reduce the use of transmission lines that heat up and cause wildfires in drought-ridden areas.[15] Across the West, hydroelectric dams have lowered or halted output as a result of drought, and power plants in the Missouri River Basin that rely on water for steam face drought-induced water scarcity.[16] And, to return to the Texas example, some scientists have linked unusually cold temperature snaps in the South—which incapacitate large swaths of energy infrastructure without expensive winterization measures—with climate-induced disruptions that "stretch[]" the polar vortex.[17]

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customer-owned (distributed) reliability resources and the complexities presented by the "growing separation between ownership and control of reliability resources within our grid," including jurisdictional challenges); Amy L. Stein, *Regulating Reliability*, 53 HOUSTON L. REV. 1191, 1194-95 (2017) (noting the growing importance of a range of "methods" and technologies to support reliability, such as "energy storage, electric vehicles, and demand response," and incentives to support distributed solar energy).

[14] These foci are important—cyber threats do appear to be increasing and to be increasingly difficult to ward off—yet they push out equally critical attention that should be devoted to reactive and flexible resources and practices. Additionally, although NERC is focusing more on extreme weather events exacerbated by climate change it has zeroed in on requiring weatherization of power plants and providing guidance for ensuring continued fuel supply (particularly natural gas supply) to power plants during these events. While important, this overlooks potentially equally important transitions to, for example, greater reliance on localized microgrids powered by renewable energy and battery and the importance of greater interregional connection of the transmission grid, thus allowing imports of electricity from regions without extreme weather. For NERC's and its regional entities' foci, *see, e.g.*, North Am. Electr. Reliability Corp., 2022 State of Reliability at vi (2022), https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2022.pdf (noting the adoption of three revised winter weatherization standards and fuel assurance guidelines and observing that "nation-state adversaries and organized cyber criminals have demonstrated that they have the ability and willingness to disrupt critical infrastructure"); North Am. Electr. Reliability Corp., 2021 State of Reliability at x (2021), https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2021.pdf (noting modern needs, including "the need for flexibility as conventional generation retirements are considered" and the need for "unserved energy metrics" to be "used alongside traditional capacity planning approaches" in light of the "transformation" of the electricity generation mix but not indicating adoption of standards to address these needs).

[15] Utility Public Safety Power Shutoff Plans (De-Energization), Cal. Pub. Util. Commn., https://www.cpuc.ca.gov/psps/.

[16] North Am. Electr. Reliability Corp., 2022 Summer, *supra* note 18, at 4.

[17] Judah Cohen et al., *Linking Arctic variability and change with extreme winter weather in the United States*, 373 SCIENCE 1116 (2021).

These reliability challenges are compounded by the aging nature of U.S. grid infrastructure and growing cyber threats and other security risks.[18] The United States has "more power outages than any other developed country" and has experienced a ten-fold increase in major outages between the mid-1980s and 2012.[19] Although most power outages occur on local distribution lines (such as a tree limb downing a line in a single neighborhood), when the larger system fails, the results are catastrophic—as illustrated by the 2021 Texas blackout. NERC itself has issued alarming reliability warnings, observing in November 2022, for example, that the "North American electric grid faces 'unprecedented' widespread risk this winter."[20]

As this admission from our primary grid reliability regulator suggests, U.S. reliability governance is increasingly fragile. Given these evolving challenges, it is time to fully theorize and scrutinize the decision to rely on a privatized self-regulatory model to ensure grid reliability. We argue that the NERC-centered model of grid reliability regulation requires updating toward a more public regime. As we trace, scholars of administration have coalesced around a set of criteria that allows self-regulation to function well, including technical expertise, incentives to self-police fairly, and alignment between the goals of industry and the goals of government regulators.[21] But several of these characteristics have broken down in grid reliability regulation.

This breakdown began in the 1990s with the weakening of the public utility model for generating electricity.[22] Before this time, there was regulatory consensus that baseload resources—resources that run constantly and have relatively low fuel costs—should provide a steady stream of power during ordinary conditions.[23] There was also consensus that "peaker" plants, which

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[18] North Am. Electr. Reliability Corp., 2022 Summer Reliability Assessment 5-6 (2022).

[19] Ula Chrobak, *The US has more power outages than any other developed country. Here's why.*, POP. SCI., Aug. 17, 2020, https://www.popsci.com/story/environment/why-us-lose-power-storms/; Douglas MacMillan and Will Englund, Longer, more frequent outages afflict the U.S. power grid as states fail to prepare for climate change, Wash. Post, Oct. 24, 2021, https://www.washingtonpost.com/business/2021/10/24/climate-change-power-outages/.

[20] Robert Walton, North American electric grid faces "unprecedented" widespread risk this winter: NERC, Utility Dive (Nov. 18, 2022; see also North Am. Electr. Reliability Corp., 2022 Summer Reliability Assessment, https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_SRA_2022.pdf.

[21] *See infra* Part I(B).

[22] David B. Spence, *Can Law Manage Competitive Energy Markets?*, 93 Cornell L. Rev. 765, 774-75 (2008).

[23] *See, e.g.*, Will McNamara, Sandia Natl. Labs., Issue Brief: Energy Storage to Replace Peaker Plants (2020), https://www.sandia.gov/app/uploads/sites/163/2022/04/Issue-Brief-2020-11-Peaker-Plants.pdf (describing changing circumstances of a system that previously relied primarily on baseload and peaker plants); Ed Smeloff, The End of the Era of Baseload Power Plants, Greentech Media, June 29, 2016, https://www.greentechmedia.com/articles/read/the-end-of-the-era-of-baseload-power-plants (noting the history of baseload plants and the breakdown of their predominance).

were generators with higher operating costs but lower fixed costs, should be called online during periods of peak electricity demand.[24]

NERC's private governance structure could be justified, at least theoretically, in those circumstances. Under this model, market participants--all regulated utilities--had incentives to invest in reliability solutions because they could recover the costs of such investments from their ratepayers, plus a generous rate of return. At the same time, utilities had incentives to check their interconnected neighbors, since serious reliability failures could create cascading blackouts and damaged equipment throughout an entire region.[25] And regulators knew who to blame when things went wrong: the utilities that failed to maintain reliable power and NERC, the industry-led entity charged with developing reliability standards. There were thus clear lines of accountability that led directly to NERC's governing body.

Even if those clear lines of accountability were never so neatly defined, that is the story market participants told when they lobbied for a private ERO governance model and resisted enhanced federal oversight over grid reliability. These theoretical arguments are, however, eroding in the face of changing industry players and climate change.

Industry expertise, the first widely recognized criterion for self-regulation, remains the strongest justification in NERC's favor. But although NERC leaders and members continue to have considerable expertise in *traditional* reliability solutions—shoring up baseload and peaker power plants—this knowledge does not as readily extend to the innovations necessary to address the reliability concerns raised by a shifting resource mix.[26]

Incentives to self-police have also eroded. Industry changes in the 1990s moved the United States largely to a model of competition within electricity generation, weakening the unity of interests among industry players.[27] In more recent years, the rapid ascendance of new competitors including renewable energy, energy storage, and demand management companies has only compounded this challenge. Utilities—still a dominant voice within NERC[28]—often view these entrants as threats. For these reasons, rather than re-writing NERC standards to accommodate these new entrants into the grid, NERC's membership has a financial incentive to decline to pursue useful reforms or enact reliability standards that actively impede technical changes needed to accommodate high levels of renewables.[29] And when reliability disasters do occur, industry members (and sometimes government agencies) can engage in

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[24] *See supra* note 23.
[25] *See infra* Part II.B (discussing regulatory reactions to blackouts during the utility era).
[26] *See infra* Part IV.A.
[27] Today, independently owned generators that invest in reliability cause their own costs to increase, which, for reasons explained below, causes them to be dispatched less frequently. *See infra* Part I; see also Industry Data, Overview, Edison Electric Institute, https://www.eei.org/en/resources-and-media/industry-data.
[28] *See infra* Part II.B.
[29] *See, e.g.*, infra notes 341345 and accompanying text.

intra-industry finger-pointing, rather than accept failures as a matter of collective responsibility.[30] This finger-pointing is in some ways understandable: the most significant reliability events are often now a compound mix of failures by many different market participants, including NERC, transmission operators, federal and state regulators, utilities, and independent power producers.

What is more, the bewildering array of players involved in ensuring grid reliability masks the fact that a small number of energy market participants have outsized control within many of these institutions. Most notably, major utilities play dominant roles within NERC, grid system operators, and the regional entities that implement many NERC standards. These unusual arrangements—a kind of nested and interwoven self-governance—allow dominant actors to implement their agendas across institutions in opaque and unaccountable ways.[31]

The final factor that often counsels in favor of self-regulation, alignment of interests between industry and regulators, is also crumbling in the reliability context. As we enter the electric era, operational flexibility and resiliency in the face of disasters, rather than consistent output and peak availability, are paramount. But as this Article documents, NERC has inadequately focused on these modern solutions, instead doubling down on traditional reliability standards that focus on factors such as firm generation capacity. This myopia cascades throughout the system, as other grid actors use outdated NERC standards to justify interventions that favor incumbent fossil interests and impede decarbonization efforts.[32]

These tensions create misalignment between the ERO model and publicly established goals for the electricity sector—most notably, the rapid decarbonization promoted for several decades now by dozens of states and, increasingly, by the federal government.[33] Although the Federal Energy Regulatory Commission (FERC) oversees NERC and has some ability to narrow gaps in alignment, it is limited by an unusually stringent deference regime that requires the agency to defer to NERC and other regional reliability entities.[34] FERC has taken steps recently to force NERC to adopt standards to better integrate renewable energy reliably and prepare for climate extremes,[35] but

[30] For example, in the wake of the Texas blackouts, gas companies, electric generators, transmission and distribution utilities, government agencies and the Texas Legislature engaged in an extensive and frequently inaccurate blame game targeting renewables. *See* Letter from DeAnn Walker, *supra* note 2; Klass et al., *supra* note 5, at 975 (describing initially inaccurate finger pointing toward wind farms as a primary culprit in the 2021 blackout).
[31] *See infra* Part III.D.
[32] *See infra* Part III.D.
[33] *See, e.g.*, Kirsten Engel & David Adelman, *Reorienting State Climate Change Policies to Induce Technological Change*, 50 ARIZ. L. REV. 835 (2008) (documenting state climate efforts); *supra* note 11 (showing anticipated federal progress on greenhouse gas emission reductions as a result of investments under the Inflation Reduction Act).
[34] See Hammond, *supra* note 5; John S. Moot, *When Should the FERC Defer to the NERC?*, 31 ENERGY L.J. 317, 317–19 [hereinafter Moot, Defer] (considering the puzzling features of FERC's standard of review for NERC's proposed reliability standards).
[35] See *infra* Part III.E.

improvements remain slow, piecemeal, and inadequate. To be sure, NERC is far from alone in shouldering blame for these inadequacies. Although NERC is, by name, *the* electric reliability organization, the title is in some ways a misnomer. In today's complex system, the reliability challenge has simply spilled over the banks of what NERC can realistically and legally accomplish via its self-regulatory, standard-setting model.[36] This dispersed culpability reinforces the need for substantial revision of the current self-regulatory model for grid reliability.

This Article advocates for a more public and comprehensive approach to grid reliability governance. Although we see a continued place for NERC,[37] we believe the organization should play a more cabined and embedded role within a largely public regime. Without fundamental changes to grid governance, we risk more frequent and severe grid reliability crises in the coming years. Our analysis of the fissures in grid reliability theory and practice unlocks a range of potential internal and external reforms, including a restructured NERC board and voting body, a reworked legal deference regime, and a FERC with more comprehensive jurisdiction over the many facets of grid reliability.[38]

The analysis necessary to build to these solutions is at times technical and dense, mirroring reliability regulation itself. Before diving in, we want to re-emphasize the stakes of plumbing NERC theory and practice at this moment. Journalist David Wallace-Wells has traced how the primary strategy for slowing progress on climate change has shifted in recent years from denial to delay, as climate impacts become impossible to ignore.[39] An emerging throughline in this dilatory rhetoric is to emphasize the threats that a rapid clean energy transition poses to grid reliability.[40] NERC itself engages in this rhetoric: after insisting that NERC supports the clean energy transition, John Moura, director of reliability assessment and performance analysis at NERC, was quoted in May 2022 as explaining, "'The pace of our grid transformation is a little out of synch' with the technical requirements for the system's operation."[41] In our estimation, it is precisely the other way around: our institution for developing technical grid requirements is out of synch with the necessary pace of system transformation.

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[36] *See infra* notes 154-159 and accompanying text.
[37] *See infra* note **Error! Bookmark not defined.** and accompanying text for discussion of the difficulties that FERC faces in attempting to hire engineers.
[38] See Part IV and Appendix B.
[39] David Wallace Wells, *What's Worse, Climate Denial or Climate Hypocrisy?*, N.Y. TIMES OP-ED (June 22, 2022).
[40] *See* Klass et al., *supra* note 5; Erin Douglas & Ross Ramsey, No, frozen wind turbines aren't the main culprit for Texas' power outages, Tex. Tribune, Feb. 16, 2021, https://www.texastribune.org/2021/02/16/texas-wind-turbines-frozen/ (quoting the Texas Agriculture Commissioner's Facebook statement after the Texas blackout: "We should never build another wind turbine in Texas.").
[41] Peter Behr & Jason Plautz, *Grid monitor warns of U.S. blackouts in "sobering report"*, Eenrgy Wire, May 19, 2022, https://www.eenews.net/articles/grid-monitor-warns-of-u-s-blackouts-in-sobering-report/

This Article proceeds in four parts. Part I introduces the theory of self-regulation and explores how NERC historically fashioned itself in this model. Part II analyzes NERC as a self-regulatory organization, exploring the largely private regime through which NERC and its subsidiaries govern grid reliability in the United States. Part III then critiques this model's ability to address modern grid reliability challenges. Part IV relates these failures to the theory of self-regulation, arguing that NERC no longer meets most of the theoretical conditions that support robust self-regulation and building the case for a more public governance regime in the context of grid reliability.

I. SELF-REGULATION IN THEORY AND PRACTICE

The fact that a private organization is primarily responsible for the reliability of the sprawling U.S. grid—a key backbone of the economy and a critical facet of human well-being—is likely surprising to those unfamiliar with grid governance. To understand how it came to be so, this Part synthesizes the theoretical conditions that justify self-governance and explores the history of NERC's attempts to regulate in this model.

A. The Theory of Self-Regulation

There is a sizeable academic literature on "self-regulation," including considerable typologizing of what is meant by the term.[42] Broadly speaking, legal scholars define self-regulation as "any system of regulation in which the regulatory target—either at the individual-firm level or sometimes through an industry association that represents targets—imposes commands and consequences upon itself."[43] Of course, self-regulation exists along a continuum. At one end, there is complete self-regulation at the firm level, which essentially converges with firm decision-making under political and legal constraints.[44] In the middle exist standard-setting or self-regulatory organizations (SROs), where an industry group might promulgate standards or rules, might also enforce them, and might serve a broader convening function within its industry.[45] At the other

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[42] Cary Coglianese & Evan Mendelson, *Meta-Regulation and Self*-Regulation, in THE OXFORD HANDBOOK OF REGULATION 147-48 (Robert Baldwin et al., eds., 2010); Saule T. Omarova, *Rethinking the Future of Self-Regulation in the Financial Industry*, 35 Brook. J. Int'l L. 662, 671 (2010) ("the meaning of the term 'self-regulation' defies simple definitions"); Anthony Ogus, *Rethinking Self-Regulation*, in REGULATION, ECONOMICS, & THE LAW 345 (Ogus, Anthony, ed., 2001).

[43] Coglianese & Mendelson, *supra* note 42, at 150.

[44] See William A. Birdthistle & M. Todd Henderson, *Becoming a Fifth Branch*, 99 CORNELL L. REV. 1, 6 (2013) ("If 'law' is simply the set of rules that regulate the actions of a community, then law is made by families, by firms, by universities, by private clubs, and by countless other nongovernmental authorities.").

[45] ROBERT BALDWIN, MARTIN CAVE, & MARTIN LODGE, UNDERSTANDING REGULATION: THEORY, STRATEGY, AND PRACTICE 138 (2012).

end, there is what scholars term "meta-regulation," a nested arrangement in which the state has some legal oversight authority of self-regulatory arrangements.[46] Under meta-regulation, also known as "enforced self-regulation," "mandated-self-regulation," and "co-regulation," state regulators "deliberately . . . seek to induce targets to develop their own internal, self-regulatory responses to public problems."[47] Meta-regulation might constrain self-regulation in several ways, including through substantive statutory and regulatory requirements, agency oversight, and public enforcement of rules developed through self-regulation.[48]

The obvious question then becomes, when is such an arrangement desirable? And more granularly, how can policymakers know where on the continuum of self-regulation an industry should fall?[49]

There are three core features that scholars widely identify as making self-regulation workable in a particular industry or setting. The first feature is **specialized industry expertise**. Self-regulation is particularly important where an industry is complex, dynamic, and not well understood by outside regulators.[50] In this circumstance, regulators may lack the knowledge or bandwidth to craft effective rules and standards, making industry participation a prerequisite to sound results.[51] Industry expertise may also help to make rules more cost-effective and reasonable, creating a greater likelihood that those in the industry will actually follow them.[52] And finally, harnessing industry expertise can allow for speedier adoption of rules and speedier adaptation to changing circumstances.[53] Financial markets are sometimes described as a quintessential

[46] Coglianese & Mendelson, *supra* note 42, at 147-48.
[47] *Id.*; see also BALDWIN, CAVE, & LODGE, *supra* note 45, at 146 (describing co-regulation); Omarova, *supra* note 42, at 677 (describing mandated self-regulation).
[48] BALDWIN, CAVE, & LODGE, *supra* note 45, at 138.
[49] The first question posed above is much better theorized than the second. *See* Coglianese & Mendelson, *supra* note 42, at 162 (noting that "much more research is needed" to understand "the circumstances under which meta-regulation can successful[l]y deliver public value").
[50] Coglianese & Mendelson, *supra* note 42, at 153; BALDWIN, CAVE, & LODGE, *supra* note 45, at 139; Benjamin P. Edwards, *The Dark Side of Self-Regulation*, 85 UNIV. CINCINNATI L. REV. 573 (2017); Hammond, *supra* note 5, at 1717; Birdthistle & Henderson, *supra* note 44, at 55.
[51] Omarova, *supra* note 42, at 670 (arguing for a continued role for self-regulation in the financial industry, despite challenges, because of "the industry's superior ability to access and assess, in a timely and efficient manner, the relevant market information").
[52] Coglianese & Mendelson, *supra* note 42, at 152; BALDWIN, CAVE, & LODGE, *supra* note 45, at 139; Omarova, *supra* note 42, at 674; Ogus at 97-98; Peter Grajzl & Peter Murrell, *Allocating Lawmaking Powers: Self-regulation vs. Government Regulation*, 35 J. COMP. ECON. 520, 521 (2007).
[53] BALDWIN, CAVE, & LODGE, *supra* note 45, at 140; Coglianese & Mendelson, *supra* note 42, at 153; Hammond, *supra* note 5, at 1717 ("[T]oday's major oversight agencies could not themselves assume the responsibilities of their SROs without extra-ordinary increases in their staffing and budgets."). *But see* Sidney A. Shapiro, *Outsourcing Government Regulation*, 53 DUKE L.J. 389, 391 (2003) ("[U]sing government employees will often be the least costly option because relying on private parties commonly involves incomplete contracts, opportunistic behavior, and hold-up problems, which significantly increase the government's transaction costs.").

example of an industry that embodies the industry expertise criterion, with the convoluted and ever-changing nature of securities trading often used as a strong justification for self-regulation.[54] The Internet—also a technically complex and dynamic beast—is also a common example.[55]

For self-regulation to work, industry members must also have **incentives to fairly self-police**—that is, industry members must believe they get something worthwhile out of a system of self-regulation.[56] This criterion tends to be met when an industry is "small, relatively homogeneous, and interconnected."[57] For example, nuclear power is often held up as an industry in which all members have an interest in ensuring the others act responsibly and avoid severe accidents, so as to stave off more intrusive federal regulation and ensure the continued viability of the industry.[58] These close-knit industry actors are, in essence, "hostages of each other," because "a single catastrophic accident (think of Chernobyl) would have ruinous consequences for the entire industry."[59] The securities industry also has this hostage-like element, because "good" securities brokers fear the taint of "bad" brokers and thus have internal motivations to police abusive practices.[60] In contrast, as Coglianese and Mendelson observe, "firms in a large, heterogeneous industry can probably defect more easily on any self-regulatory collective action."[61] Moreover, if firms differ too much in size, strength, and interests within an industry, then "[p]articular groups within self-regulatory organizations may also use their regulatory power in anticompetitive ways by crafting regulations that disproportionately burden their competitors."[62]

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[54] See Edwards, *supra* note 50, at 601; Omarova, *supra* note 42, at 669-70.
[55] *See, e.g.*, Llewellyn Joseph Gibbons, *No Regulation, Government Regulation, or Self-Regulation: Social Enforcement or Social Contracting for Governance in Cyberspace*, 6 CORNELL J. L. & PUBLIC POL'Y 475, 509 (1997); Philip J. Weiser, *Internet Governance, Standard Setting, and Self-Regulation*, 28 N. KY. L. REV. 822, 825-26 (2001).
[56] Birdthistle & Henderson, *supra* note 44; Hammond, *supra* note 5, at 1718.
[57] Coglianese & Mendelson, *supra* note 42, 154; Ogus, at 101-02 (explaining that self-regulation works best "where the affected group is relatively homogeneous and externalities are largely absent").
[58] See JOSEPH V. REES, HOSTAGES OF EACH OTHER 2 (1994); see also Coglianese & Mendelson, *supra* note 42, at 160-61.
[59] *Id.*
[60] Birdthistle & Henderson, *supra* note 44, at 8-9 (observing that in the financial industry, "[i]ndustry professionals have strong incentives to police their own, since many of the costs of misbehavior are born by all members of the profession while the benefits inure only to the misbehaving few").
[61] Coglianese & Mendelson, *supra* note 42, at 160-61; see also BALDWIN, CAVE, & LODGE, *supra* note 45, at 154 (discussing the challenges of deliberation in self-regulation among groups that have divergent interests).
[62] Edwards, *supra* note 50, at 605. See also Birdthistle & Henderson, *supra* note 44, at 26 (explaining that self-regulation works better when potential victims are not easily identified ex ante and are "central actors within the industry being regulated"); REES, *supra* note 58, at 49 (attributing nuclear self-regulation's success to its ability to create "close integration between regulator and regulated" and foster a communitarian spirit).

Third, from a public interest perspective, self-regulation is advisable only where there exists either **alignment between the goals of regulators and the goals of industry**, or accountability mechanisms to bring them into alignment.[63] For example, both nuclear regulators *and* the nuclear industry have a baseline goal of avoiding nuclear meltdowns, because a meltdown at a single reactor can dramatically change the regulatory environment for the entire industry.[64] But in some contexts, creating this alignment is a challenge. As Robert Baldwin, Martin Cave, and Martin Lodge recount, numerous studies have observed "the tendency of self-regulatory bodies to act anti-competitively on access requirements and prices, so that members' interests rather than those of the public are served."[65] Note, too, that alignment can be affected by governance constructs *within* an SRO: who initiates and participates in rules and standards drafting, who must approve them, how transparently, and under what parameters.[66]

When interests do not naturally align, **robust accountability mechanisms** are necessary to avoid cartelization and the lethargy that can arise from a self-regulatory organization's potential interest in "failing to address known problems."[67] In these situations, meta-regulation gains importance and appeal.[68] Embedding self-regulation within regulatory oversight can help pull the outcomes of self-regulation "closer to the overall public interest."[69] At times, industry itself may even lead the push for meta-regulation—perhaps after an accident that brings public scrutiny and the threat of losing industry control of

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[63] See BALDWIN, CAVE, & LODGE, *supra* note 45, at 141-43; *see also* CENTRE FOR FINANCIAL MARKET INTEGRITY, SELF-REGULATION IN TODAY'S SECURITIES MARKETS: OUTDATED SYSTEM OR WORK IN PROGRESS? 1 (2007) ("[T]he overarching purpose of any self-regulatory group is to keep industry interests aligned with the public interest so as to avoid government intervention and the possibility of more-restrictive regulation.); Shapiro, *supra* note 53, at 405 (noting the necessity either of natural alignment or the ability of the oversight agency to "create incentives to align its interests and the interests of the private actor.").

[64] See REES, *supra* note 58, at 72-73 (describing the "industrial morality" cultivated via nuclear self-regulation); see also Shapiro, *supra* note 53, at 429 (noting alignment of interests in the stock markets "[b]ecause consumer participation in stock markets is influenced by consumer confidence in the integrity of market operations").

[65] BALDWIN, CAVE, & LODGE, *supra* note 45, at 142; see also Edwards, *supra* note 50, at 605 ("One of self-regulation's major dangers is that it may give industry members 'the ability to reduce competition and to raise their own profits.'").

[66] Hammond, *supra* note 5, at 1715.

[67] Edwards, *supra* note 50, at 608. *See also* Birdthistle & Henderson, *supra* note 44, at 12 (describing the main debate in self-regulation as turning on the tension between "the efficiency of self-regulation versus the risk of cartelization").

[68] Coglianese & Mendelson, *supra* note 42, at 161 ("Meta-regulation seems to address some of the drawbacks of a purely self-regulatory approach."). But see Birdthistle & Henderson, *supra* note 44, at 5 (decrying the "governmentalization" of self-regulatory organizations in the financial space).

[69] Coglianese & Mendelson, *supra* note 42, at 163.

regulation, or when an industry finds itself no longer able to fully control its members.[70]

Meta-regulation's effectiveness in closing gaps in accountability between SROs and the public interest depends both on the nature of the industry and the oversight regime.[71] In particular, Baldwin et al. note that this oversight becomes more difficult "[w]hen an activity is regulated by a network or assemblage of regulators" and when activities cross international borders.[72] Similarly, Emily Hammond highlights the importance on focusing on how statutes construct deference within a self-regulatory regime, since these legal frameworks control the extent to which an agency can exercise meta-regulatory authority effectively.[73]

B. Self-Regulation of Grid Reliability: NERC and SRO Principles

The baseline conditions necessary for self-regulation provide a useful lens through which to evaluate the wisdom of NERC as the central actor in grid reliability.[74] Over the past fifty years, NERC has self-consciously used the classic SRO criteria to justify itself. For example, former NERC president Rick Sergel has reflected:

> When trying to explain who NERC is and what we do, I am often asked: 'How can an industry regulate itself? Isn't there a conflict of interest?' I answer them by explaining that the electric industry is different than others in that we are critically interconnected: the [bulk power system] is only as strong as its weakest link. Every asset owner has an interest in ensuring its neighbors keep reliability a priority—what happens on one system affects the next, and so on. In short, we are in a unique position to make the self-regulatory model work. The

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[70] See Coglianese & Mendelson, *supra* note 42, at at 163-64 (describing chemical industry's and nuclear industry's self-regulatory efforts); BALDWIN, CAVE, & LODGE, *supra* note 45, at 141 ("[W] where [incentives] are not fully effective, it is common for organizations to seek explicit recognition from the state and control to make membership compulsory.").

[71] Coglianese & Mendelson, *supra* note 42, at 163-64 (noting that meta-regulation still works best when gains for the regulator (in terms of publicly oriented changes) also align with private benefits to the firm); BALDWIN, CAVE, & LODGE, *supra* note 45, at 154 (describing the difficulty of developing meta-regulation "in a manner that produces coherence and harmony between corporate and social ends, rather than confusion and conflict").

[72] BALDWIN, CAVE, & LODGE, *supra* note 45, at 159-60; see also Omarova, *supra* note 42, at 670 (treating as an advantage SROs' "ability to monitor and regulate their own business operations on a truly global basis, without regard to national borders and jurisdictional limitations."); *see also* CENTRE FOR FINANCIAL MARKET INTEGRITY, *supra* note 63, at iv (noting challenges created by "dual or wasteful regulatory oversight conducted by multiple regulatory offices").

[73] *See* Hammond, *supra* note 5, at 1709.

[74] *Cf*. BALDWIN, CAVE, & LODGE, *supra* note 45, at 164 (noting the need to assess the appropriateness of self-regulation in context).

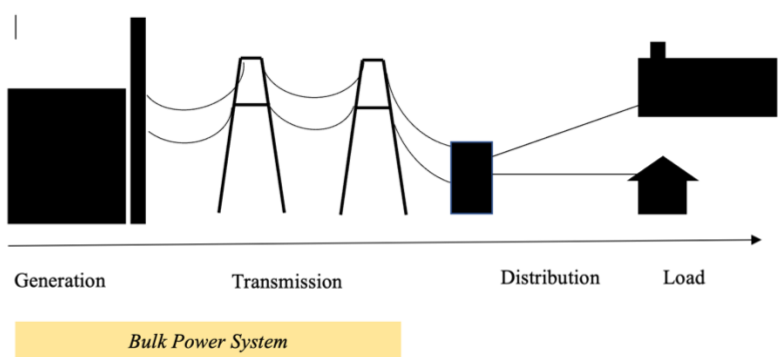
> incentives are in the right place, the experts are engaged. Mutual interest exceeds personal gain.[75]

This section probes this logic, exploring the historical conditions that led to an SRO model for grid reliability. To do so, it reconstructs the story of how grid reliability regulation in the United States morphed from a matter of loose intra-industry collaboration into the more legally formalized regime of today. It also sketches many of the important changes in the electricity industry that are foundational to assessing the viability of the SRO model in the electric era.

1. The Early Shape of Grid Reliability Regulation and the Breakdown of Industry Uniformity

The U.S. grid consists of all entities that build, own, operate, or use electricity generation (power plants); transmission lines that transport electricity, typically over long distances; distribution lines that deliver electricity to households, businesses, and industry; and all of the equipment in between, such as transformers that increase or decrease (step up or step down) the voltage of electricity when it is being transferred between power plants, transmission lines, and distribution lines. (See Figure 1). The generation and transmission components of this system comprise the "bulk power system" that NERC evolved to regulate.

Figure 1. Key Elements of U.S. Grid



Historically, electric utilities operated as "vertically integrated" regulated monopolies, charged with supplying all the necessary generation,

[75] Quoted in NERC History, at 94-95.

transmission, and distribution infrastructure within their territories.[76] But even in electricity's early days, regulators and utilities understood that sharing power across utilities could enhance the ability of each system to respond to plant outages, downed lines, or other emergencies. As early as 1892, electric generating units began to interconnect with each other so that each could provide backup power to the other in case one utility's power plants went offline.[77] As utilities grew throughout the early part of the twentieth century, they increasingly began to share power among themselves when necessary to balance the system and prevent blackouts.[78] The Pennsylvania-New Jersey Interconnection became the first official "power pool"—where regional utilities formalized a generation-sharing arrangement—in 1927.[79]

Numerous additional pools, interconnections, and ties formed and expanded in the following decades among U.S. utilities and some Canadian counterparts as well.[80] Alongside these changes came expanded federal regulation of the electricity system: after the Supreme Court case *Public Utilities Commission of Rhode Island v. Attleboro Steam & Electric Company* famously exposed the unconstitutionality of intrastate control of interstate transactions and the lack of interstate electricity regulation,[81] Congress in 1935 passed the Federal Power Act (FPA). That Act maintained state jurisdiction over the distribution system and electricity generation but gave the Federal Power Commission (FPC, now FERC) authority over interstate "wholesale sales" of electricity and interstate transmission.[82]

Despite these jurisdictional shifts, industry self-management of reliability remained the norm for several decades.[83] There is a reasonable argument that such self-management was justified under prevailing conditions. Individual utilities had a monopoly over their service territories.[84] When people lost power, they knew exactly whom to blame—as did the regulators who oversaw utilities' rates and practices. Utilities also had financial incentives to

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[76] Spence, *supra* note 22, at 769.
[77] NERC History, Appendix, at 147 (describing "the first recorded implementation of economic dispatch").
[78] *Id.*; *see also* Fed. Power Commn. v. Florida Power & Light Co., 404 U.S. 453, 457 (1972) (describing "pool" of "national interlocking . . . utilities that automatically provides power in case of emergencies.").
[79] NERC History at 148.
[80] *Id.* At 148-50.
[81] 273 U.S. 83, 84 (1927).
[82] See 16 U.S.C. § 824.
[83] Some early formalization came with the creation of the North American Power System Interconnection Committee (NAPSIC) in April 1962, which promulgated "operating guidelines" for the reliable operation of interconnected systems across the United States and Canada. https://www.nerc.com/AboutNERC/Resource%20Documents/NERCHistoryBook.pdf, viii.
[84] Fed. Energy Reg. Comm'n, Transforming the Nation's Electricity System: The Second Installment of the QER, Appendix at A-11, https://www.energy.gov/sites/prod/files/2017/02/f34/Appendix--Electricity%20System%20Overview.pdf.

invest in infrastructure needed to support grid reliability, because they earned a profit off such capital expenditures.[85]

A major blackout in 1965, however, exposed the weaknesses of this arrangement. The 1965 Northeast Blackout lasted approximately 13 hours and "was the most significant disruption in the supply of electricity at that point in the history of the electric industry."[86] Following this blackout, President Johnson and Congress began to consider whether there was a need for greater federal oversight of electric reliability. The proposed Electric Power Reliability Act of 1967 would have expanded the Federal Power Commission's (FPC's) authority and jurisdiction over interconnection and reliability and mandated communication standards between utilities.[87] However, utilities opposed the bill, arguing that "the diversity of the industry . . . could provide more informed expertise, more informed opinions, and an environment in which electric utilities could be their own critics than could be provided by the proposed Act."[88]

Based on this logic—and to forestall federal regulation—the electricity industry instead proposed its own reliability council. Following negotiations, the FPC ultimately agreed, and in June 1968, twelve regional and area utility organizations signed an agreement creating NERC.[89] NERC's early mission included encouraging inter-regional collaboration on reliability, facilitating information exchange, reviewing regional and interregional reliability activities, and providing information to the FPC.[90] NERC also created a "Technical Advisory Committee" to develop voluntary reliability criteria for the industry.[91]

Over the next decade, NERC conducted numerous reviews and reports on various pressing matters of reliability. Its board chairs appeared periodically before Congress.[92] Things hummed along at this pace until Congress began to shake up the electricity industry in the late 1970s through passage of the Public Utilities Regulatory Policy Act (PURPA).[93] Among other things, PURPA sought

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[85] Utility regulators review capital expenses and authorize cost recovery and an administratively determined rate of return. Utilities have an incentive to make reliability-enhancing investments since they earn a return on those investments. See Paul L. Joskow & Richard Schmalensee, *Incentive Regulation for Electric Utilities*, 4 YALE J. ON REG. 1, 4-6 (1986) (describing a cost of service ratemaking process that still applies in states that have not restructured their retail electricity structures).

[86] Nevius, *supra* note 7, at 3.

[87] The Federal Power Commission is the predecessor organization to FERC.
http://abacus.bates.edu/muskie-archives/ajcr/1967/Reliable%20Power.shtml – discussion of the proposed Electric Power Reliability Act of 1967.

[88] IEE, You Only Miss It When It's Not There [Establishment of North American Electric Reliability Council] 22, https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=587539.

[89] Nevius, *supra* note 7, at 5-6.

[90] *Id.* at 9.

[91] *Id.* at 10-11.

[92] *Id.* at 11-18.

[93] Pub. Util. Reg. Policies Act (1978).

to inject more competition into the industry by requiring utilities to purchase the output of certain small renewable or efficient energy generators.[94]

NERC then undertook a study scrutinizing its own role and functions in light of the changing system, but ultimately recommended few changes.[95] Nevertheless, the shifts "revealed tension between reliability and the introduction of new players and new uses of the [bulk power system]," with utilities worrying that "new non-utility players would not play by the reliability rules."[96] To translate this into SRO theory-speak, the industry worried that its internal alignment and incentives to self-police might be weakening.

These tensions came to a head in the 1990s. It is impossible to understand the drama that roiled NERC and electric reliability after this time without a grasp on the broader changes taking place in the industry. In the early 1990s—following on the heels of deregulation in several other industries—Congress and FERC became interested in facilitating more competition in electricity. Through the Energy Policy Act of 1992 and several subsequent orders at FERC, they began to require utilities to offer "open access" to their transmission lines to all comers at fair rates.[97] This change allowed independent power producers—generators not owned by regulated utilities—to sell into the system. By the end of the 1990s, FERC moved to open the system even further, encouraging utilities to join "Regional Transmission Organizations" (RTOs) to jointly manage transmission lines at a regional level and to administer markets for electricity.[98] Ultimately, utilities in two-thirds of the U.S. (as measured by population) joined an RTO.[99]

While many celebrated these shifts for their potential to improve competition and efficiency, the moves to open access and more competitive electricity generation posed new risks for grid reliability. Whereas monopoly utilities tended to operate their systems within their own silos, with controlled exchanges of electricity among themselves, the new system was much more dynamic.[100] A federal task force convened in 1997 to examine these issues concluded that the new, unbundled system meant that "the old institutions for reliability are no longer sufficient."[101] As it noted, NERC's traditional "peer-reviewed standards coupled with voluntary cooperation" worked well when

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[94] *Id*.
[95] Nevius, *supra* note 7, 21-22.
[96] *Id*. at 24.
[97] Energy Policy Act of 1992, Pub. L. 102-486 (allowing the Federal Energy Regulatory Commission to order utility-owned and operated transmission to "wheel" (transport) competitors' electricity); FERC Order No. 888 (1996) (requiring all transmission lines over which FERC had jurisdiction to be open access); FERC Order No. 890 (2007) (strengthening Order 888 open access and prohibiting price and service discrimination on transmission lines).
[98] FERC Order No. 2000 (1999).
[99] Electric Power Markets, Fed. Energy Reg. Commn., https://www.ferc.gov/electric-power-markets.
[100] Sec'y of Energy Advisory Bd. Task Force on Electric System Reliability, Reliability in a Competitive U.S. Electric Industry ix, 19 (1998) (hereinafter "Advisory Board Task Force").
[101] *Id*. at vii.

"costs associated with maintaining reliability could be recovered through rates."[102] However, restructuring removed the possibility of rate recovery for reliability-related expenses in some parts of the country, rendering the voluntary system "clearly unsustainable."[103] The increasing interconnectedness of the grid also meant that "isolated, local [disturbances] . . . [could] almost instantaneously propagate through the system as a whole," creating greater risks of system-wide outages.[104] A 1996 blackout across the Western system reinforced these risks, as a local transmission outage in Idaho ballooned into a power loss that affected 2 million people in 14 states as well as Canada and Mexico.[105]

This federal task force also voiced concerns about NERC's governance. In particular, it worried about the potential for intra-industry rent-seeking via private reliability regulation, observing that pre-existing reliability arrangements might not manage reliability in the shifting industry "in a competitively neutral fashion, without favoring one or another set of market participants."[106] For these reasons, the task force indicated that it was "especially interested in seeing the reliability institutions becoming truly independent of commercial interests" to avoid any actual or apparent bias. It thus recommended assigning primary reliability responsibility to FERC, which until this time had exercised no control over reliability.[107] FERC itself was simultaneously exploring such changes, including through a 1998 inquiry and technical conference on reliability.[108]

This task force analysis suggests that even in the 1990s, the conditions justifying reliability self-regulation were disintegrating. NERC, however, wanted to preserve its authority and autonomy in this new system and therefore pushed back. As early as 1991, NERC's president wrote several letters to Congressional representatives and staffers expressing concern about proposals to assign responsibility for reliability to FERC.[109] Instead, NERC's president proposed a "NERC Amendment" that would keep reliability oversight with NERC and the NERC-recognized regional councils.[110] This "NERC Amendment" was ultimately not included in the Energy Policy Act of 1992, leaving questions over reliability under competition unresolved. NERC persevered in its advocacy for self-regulation, forming its own task force to examine the "future of NERC."[111]

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[102] *Id*. at xi.
[103] *Id*. at xi, 1.
[104] *Id*. at xiii.
[105] FERC Primer at 31; Advisory Board Task Force; at 13, Nevius, *supra* note 7, at 35.
[106] Advisory Board Task Force, at x. The Task Force proceeded to detail a 1997 complaint filed by power marketers against NERC, which claimed that certain "tagging" requirements imposed by NERC allowed utilities to discriminate against competitive power. *Id.* at 26.
[107] Advisory Board Task Force, at xv, 10.
[108] Cited in Advisory Board Task Force, at 38.
[109] Nevius, *supra* note 7, at 29.
[110] Nevius, *supra* note7, at 30.
[111] *Id*. at 31.

By the time the federal task force described above convened in 1997, NERC appeared to have largely cemented its future role in the system: although voicing the concerns documented above, the task force ultimately recommended that FERC act as the oversight agent for a "self-regulating reliability organization . . . such as a reformed NERC."[112] It further noted that NERC needed enhanced enforcement authority to effectively take on this role.[113] NERC shared this view, recognizing that it could no longer persist as a "confederation of reliability groups that worked toward common reliability goals in a collegial, mutual interest, self-help atmosphere." What the shifting system demanded was "more detailed, uniform standards and more uniform compliance."[114] Yet NERC was emphatic that a self-regulating organization remained superior to a government body in terms of flexibility, technical competence, and innovation.[115]

In 1999, NERC led a group of industry stakeholders that agreed on draft legislative language that would establish mandatory reliability standards and an officially designated ERO (that they presumed would, in due course, be NERC). At the same time, NERC independently undertook governance changes to transform its stakeholder board into an independent one, in anticipation of legislative changes.[116] Thus, while concerns about the regulation of grid reliability initially reflected apprehension about the continued viability of a self-regulatory model, by the turn of the century, industry had successfully convinced important policymakers and stakeholders to entrench the self-regulatory model—advocating for increasing NERC's enforcement power but largely preserving the privatized model of grid reliability regulation. It remained only to codify this model into law—a move that would be aided by policymakers' increased interest in grid reliability following the largest blackout in the history of the North American power grid.[117]

2. The 2003 Blackout and the 'Governmentalization' of Reliability Regulation

Because of the complex interconnections of the electric grid, a single misstep on one small piece of equipment can cause cascading outages that flow for hundreds or even thousands of miles. The consequences of such a misstep were on dramatic display in August 2003, when cascading failures caused power outages for 52 million people in the U.S. Northeast and parts of Canada. Nearly

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[112] Advisory Board Task Force, at 25.
[113] Advisory Board Task Force, at 25; NERC History at 34 (describing NERC's position that "peer pressure" would no longer be sufficient).
[114] Nevius, *supra* note 7, at 36 (quoting speech by NERC Board vice chair Erle Nye).
[115] *Id*. at 44 (describing the conclusions of a NERC Blue Ribbon Panel report).
[116] *Id*. at 47.
[117] FERC Primer at 31-32.

100 people died in New York City alone.[118] The causes of death were numerous and wide-ranging, including individuals trapped in subways and elevators or experiencing heart failure as they walked up numerous flights of stairs; a lack of access to safe drinking water and life-sustaining medicine from closed pharmacies and food stores; slow ambulance response rates and difficulty reaching emergency services due to failed cellular service; direct health impacts from a lack of air-conditioning and heat-exacerbated air pollution; the loss of power to home medical equipment such as ventilators; and hospital power outages and overcrowding as people sought access to medical equipment.[119]

The 2003 blackout also had extensive economic impacts. Numerous motor vehicle manufacturing and assembly plants, steel mills, chemical and food plants ground to a halt, thus affecting supply chains for critical goods, causing losses of worker income, and leading to food spoilage and other loss of valuable products. Consulting groups and the Department of Energy estimated impacts of the two-day blackout at $4.2 to $10 billion.[120]

The events leading to this catastrophe started in two portions of the grid in Ohio that were at the time called "control areas." A grid control area was "a geographic area within which a single entity . . . balances electricity generation and loads in real time to maintain reliable operation."[121] In lay terms, the organization that oversaw a control area continuously controlled the flow of power through the grid, drawing from generation sources to exactly match the amount of electricity demanded (electrical load) on an instantaneous basis. Transmission "tie lines" connect different control areas to each other, allowing them to exchange electricity with each other.[122] In Ohio, the two operators of

[118] G. Brooke Anderson & Michelle L. Bell, *Lights Out: Impact of the 2003 Power Outage on Mortality in New York, NY*, 23 EPIDEMIOLOGY 189, 191 (2012).
[119] *Id*. at 191-2.
[120] Electricity Consumers Resource Council, The Economic Impacts of the August 2003 Blackout at 1 (2004), https://elcon.org/wp-content/uploads/Economic20Impacts20of20August20200320Blackout1.pdf. In parts of Ontario, there were rolling blackouts (in which the power would come on for short periods and then shut down again) for more than a week. *Id.*
[121] U.S.-CANADA POWER SYSTEM OUTAGE TASK FORCE, FINAL REPORT ON THE AUGUST 14, 2003 BLACKOUT IN THE UNITED STATES AND CANADA: CAUSES AND RECOMMENDATIONS 11 (2004), https://www.energy.gov/sites/default/files/oeprod/DocumentsandMedia/BlackoutFinal-Web.pdf.. NERC has abandoned the term "control area operators" and now defines entities functionally; there are a variety of entities that now perform what was once the "control area operator" function of balancing power in real time, including utilities, independent system operators, and regional transmission organizations. North Am. Electric Reliability Corp., Reliability Functional Model: Function Definitions and Functional Entities Version 5.1 at 5 (2018), https://www.nerc.com/pa/Stand/Functional%20Model%20Advisory%20Group%20DL/Functional_Model_V5.1_clean_10082019.pdf. Reliability coordinators remain as a designated NERC entity with specific NERC responsibilities for reliability oversight. North Am. Electr. Reliability Corp., Reliability Coordinators, https://www.nerc.com/pa/rrm/TLR/Pages/Reliability-Coordinators.aspx.
[122] U.S.-Canada Power System Outage Task Force, *supra* note xx, at 11.

adjacent control areas, FirstEnergy failed to properly trim trees around their transmission lines, and both FirstEnergy and American Electric Power, operator of a neighboring control areas, failed to manage the flow of power through their transmission lines and properly balance generation and load.[123] After a tree (too close to a transmission line due to inadequate tree trimming) brushed against a wire, that wire "shut down," forcing electricity to flow through other, overcrowded wires.[124] The effect of too much electricity flowing through a transmission line is similar to a traffic jam on a highway. Everything grinds to a halt; that wire, too, shuts down, causing even more electricity to flow through the wires that are still operational and also overtaxing those wires.

A variety of technologies and human interventions can prevent cascading outages; including, for example, better technologies to sense changes in voltages and current caused by a single fault versus cascading, prior generators or lines tripping. [125]But in Ohio, a combination of faulty equipment (a failure of an alarm to sound), inadequate employee training in detection and response to transmission line problems, and inadequate availability of "reactive power"—generators that can be quickly ramped up to maintain needed voltage in wires—and management of that power in both FirstEnergy and AEP's areas caused an initially small outage to cascade through the Northeast.[126]

In addition to these technical problems, the 2003 Blackout also resulted from more fundamental challenges related to governing institutions and fractured decisionmaking processes that blurred lines of accountability. Government investigations faulted not just the operators of the control areas but also NERC and its lack of federal oversight. With respect to NERC itself, reviewers cited unclear NERC reliability standards, standards that failed to require adequate training of personnel who operate the grid, and the lack of a "well-defined" process for auditing control areas for their ability to supply reliable electricity.[127] The reviewers concluded, however, that many of the problems were not related to NERC's substantive "rules" (standards) for reliability but rather its structure and status, highlighting that NERC at the time had "no structural independence from the industry it represents" and had "no authority to develop strong reliability standards and to enforce compliance with

[123] *Id*. at 12, 17-21.
[124] J.R. Minkel, The 2003 Northeast Blackout–Five Years Later, Aug. 13, 2008, https://www.scientificamerican.com/article/2003-blackout-five-years-later/.
[125] Electric Power Res. Inst., Mitigating Cascading Power Outages on Power Systems: Recent Research Approaches and Emerging Method at 1-1 (2005), file:///C:/Users/Hannah/Downloads/1010701_Mitigating%20Cascading%20Outages%20on%20Power%20Systems_%20Recent%20Research%20Approaches%20and%20Emerging%20Methods.pdf.
[126] U.S.-Canada Power System Outage Task Force, supra note xx, at 17-23.
[127] *Id*. at 19-21.

those standards."[128] Collectively, these findings pointed to a need for rethinking the tools and systems in place for managing reliability.[129]

The 2003 blackout reveals that the original justification for self-regulation was already breaking down in the early 2000s. As the Final Report on the 2003 blackout observed, the grid had become a single, integrated system in which a variety of actors play a crucial role in maintaining the reliability of the bulk power system.[130] Responsible parties included RTOs that operate transmission lines, vertically integrated utilities that own (but do not operate) transmission lines and own some generation assets, independent power producers that sell energy in competitive markets, and a variety of other reliability regulators, including NERC and regional entities, that all have some role in regulating grid reliability.[131]

Perhaps for those reasons, the Task Force that investigated the causes of the 2003 found that the diffusion of responsibility contributed to the scale and magnitude of the 2003 blackout. Some of the notable violations included utilities' failure to "notify other reliability coordinators of potential system problems," RTOs failure to develop "procedures or guidelines between their respective organizations regarding the coordination of actions to address an operating security limit violation observed by one of them in the other's area due to a contingency near their common boundary," MISO's "lack of authority" to act as the "reliability coordinator for FE [FirstEnergy]," and utilities' inability to "adequately communicate its emergency operating conditions to neighboring systems."[132] The highlighting of these diverse actors responsible for grid reliability shows the extent to which one principle of effective self-regulation—a relatively homogenous industry with incentives to fairly police—had broken down by this time.

The 2003 blackout provided an opening for major reliability reform—and this post-mortem might have counseled in favor of more public, comprehensive governance. But NERC savvily argued instead for enhanced meta-regulation,[133] pushing to become embedded within FERC and to be given enforcement authority. The organization clearly had sway with relevant policymakers: the Task Force on the 2003 blackout ultimately recommended that Congress establish a legislatively recognized ERO to develop and enforce mandatory reliability standards.[134] Although the joint task force's 2004 report did not entirely presuppose that this ERO would be NERC, it noted that "[i]f the proposed U.S. reliability legislation passes, the North American Electric Reliability Council (NERC) may undertake various organizational changes and

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[128] *Id*. at 21.
[129] FERC Primer at 31-32.
[130] U.S.-Canada Power System Outage Task Force, supra note @, at 11.
[131] *Id*.
[132] *Id*. at 20-21.
[133] Nevius, *supra* note 7, at 72.
[134] US-Canadian Power System Outage Task Force at 140.

seek recognition as the electric reliability organization (ERO)"—and then proceeded to reference NERC as the ERO for the remainder of its report.[135]

Congress obliged, adopting these changes in the Energy Policy Act of 2005 (EPAct 2005).[136] The Act added Section 215 to the FPA, giving FERC authority to certify an entity to act as an ERO to develop and enforce mandatory reliability standards for the bulk power system, subject to FERC oversight.[137] EPAct 2005 further specified certain characteristics for this ERO, including an independent governing board and fair stakeholder representation and public participation in its governance.[138] FERC implemented these requirements in two orders focused on the rules for ERO certification and reliability standards.[139]

There was never really any doubt that NERC would become the nation's designated ERO. Although a few parties raised concerns about whether the "kind, gentle, and voluntary consensus-building" NERC of the 20th century could "transform itself into a steel-fisted czar that would enforce mandatory standards," NERC's president and CEO retorted, "If you want us to be a dictator, we can be a dictator."[140]

The path to a NERC 'dictatorship' was short: After revising its bylaws to accord with EPAct's ERO requirements, NERC filed its application with FERC to be named the ERO in April 2006.[141] Just a few months later, in July 2006, FERC certified NERC as the nation's ERO.[142] It also approved most of NERC's previously voluntary reliability standards as mandatory and enforceable reliability standards under the new statutory framework.[143]

II. NERC's Modern Position, Structure, and Functions

With NERC's evolution away from a full SRO model established, this Part turns to exploring the modern landscape of grid reliability governance and

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[135] US-Canadian Power System Outage Task Force at 142 and throughout.
[136] Energy Policy Act of 2005, Pub. L. 109-58.
[137] FERC Primer at 37; Fed. Power Act § 215.
[138] Fed. Power Act § 215.
[139] *Rules Concerning Certification of the Electric Reliability Organization; Procedures for the Establishment, Approval and Enforcement of Electric Reliability Standards*, Order No. 672, FERC Stats. & Regs. ¶ 31,204 (2006), *order on reh'g*, Order No. 672-A, FERC Stats. & Regs. ¶ 31,212 (2006)
[140] Richard Stavros, *NERC Knows Best?*, Public Utilities Fortnightly 4 (Jan. 2006) (quoting Richard P. Sergel, then-president and CEO of NERC).
[141] Nevius, *supra* note 7, at 88. See Order Certifying North American Electric Reliability Corporation as the Electric Reliability Organization and Ordering Compliance Filing, 116 FERC ¶ 61,062 (July 20, 2006); NERC History, at 88.
[142] Nevius, *supra* note 7.
[143] Order Certifying North American Electric Reliability Corporation As the Electric Reliability Organizations and Ordering Compliance Filing (2006), https://www.ferc.gov/sites/default/files/2020-04/E-5_12.pdf.

NERC's central role within it. This sets the stage for our argument in Parts III and IV that grid reliability governance falls within a sphere far broader than NERC's jurisdiction and calls for public governance. Subpart A maps the complex ways in which NERC carries out its responsibilities alongside, under, and above other grid reliability actors. Subpart B turns inward, considering how NERC conducts its internal governance.

A. Situating NERC: The Legal Tapestry of Grid Reliability

At a basic level, grid reliability depends upon having available necessary physical infrastructure to match electricity supply (generation resources) with electricity use (load) at all times, under all conditions.[144] The practice of instantaneous matching of supply and demand is often referred to as "load-resource balancing" and is a central focus of NERC. Successful balancing, however, also requires systematic thinking to develop and deploy the necessary infrastructure. Three practices are central in this regard. First, entities associated with the grid must plan for the construction of physical grid components. They must ensure that there will be enough power plants to generate electricity used by customers, adequate transmission lines to carry the electricity over long distances without allowing too much congestion, and adequate distribution lines to carry the electricity to users.[145] Next, entities that control the grid must ensure that this infrastructure is actually built and maintained. Finally, grid-associated entities must operate the built infrastructure in ways that ensure reliability—providing power when needed to meet peak demand, rerouting congestion in transmission lines or drawing from different power plants in less congested areas, following proper procedures before conducting maintenance work on wires, avoiding cyberattacks on grid infrastructure, and so on.

A variety of private and public actors at different levels of government are responsible for load balancing, grid planning, infrastructure development, and infrastructure operation. Under the legal framework of FPA section 215, NERC has regulatory authority to "enforce[e] compliance with mandatory reliability standards."[146] NERC's authority in this regard extends to all entities listed on a "Compliance Registry" of actors associated with the bulk power

[144] Natl. Renewable Energy Lab., Balancing Area Coordination: Effectively Integrating Renewable Energy Into the Grid at 1 (2015), https://www.nrel.gov/docs/fy15osti/63037.pdf.
[145] *See, e.g.*, FED. ENERGY REG. COMMN., RELIABILITY PRIMER 22-29 (2020), https://www.ferc.gov/sites/default/files/2020-04/reliability-primer_1.pdf (describing physical infrastructure, short- and long-term planning, grid operation, and other factors as central to grid reliability).
[146] North Am. Electr. Reliability Corp., Frequently Asked Questions (Aug. 2013) at 2, https://www.nerc.com/AboutNERC/Documents/NERC%20FAQs%20AUG13.pdf.

system and thus required to comply with NERC standards.[147] But NERC also views itself as a "catalyst for positive change—including shedding light on system weaknesses, helping industry participants operate and plan to the highest possible level, and communicating lessons learned throughout the industry."[148] Thus, the modern NERC is on the one hand a traditional regulatory entity (albeit a private one that operates under federal governmental oversight), and on the other hand a self-regulatory entity that tries to keep its members in line through softer governance.

NERC further delegates many of its grid reliability governance functions to regional institutions called "regional entities." These entities, like NERC, are private corporations, and they, in turn, delegate their duties to sub-regional institutions, individual electric utilities, and groups of utilities, as summarized in Part II.[149]

Other regulatory actors also have significant roles in grid reliability. FERC is at least nominally given ultimate authority, as section 215 of the FPA—the section establishing an ERO model—provides:

> The Commission shall have jurisdiction, within the United States, over the ERO certified by the Commission . . . any regional entities, and all users, owners and operators of the bulk-power system . . . for purposes of approving reliability standards established under this section and enforcing compliance with this section.[150]

Section 215 goes on to instruct FERC to approve NERC-proposed reliability standards as "just, reasonable, not unduly discriminatory or preferential, and in the public interest" before they can take effect.[151] Note, however, the complex deference regime that the FPA establishes between FERC and NERC, as the certified ERO: FERC is instructed to "give due weight to the technical expertise" of NERC in evaluating proposed standards for approval. NERC, in turn, is instructed to "rebuttably presume" that standards proposed by regional entities

[147] See North Am. Electric Reliability Corp., Statement of Compliance Registry Criteria (Revision 5.2), https://www.nerc.com/pa/Stand/Resources/Documents/Appendix_5b_of_the_Rules_of_Procedure_Statement_of_Compliance_Registry_Criteria.pdf., at 2. FERC regulations require that "all users, owners, and operators of the Bulk-Power System . . . shall be subject to the jurisdiction" of FERC and must comply with any "applicable Reliability Standards" and "Regional Entity Rules." 18 C.F.R. § 39.2.

[148] *Id*. at 2.

[149] See 16 U.S.C. § 824o(e)(4).

[150] 16 U.S.C. § 824o.

[151] 16 U.S.C. § 824o(d).

under its supervision are "just and reasonable."[152] Legally, this creates a type of *triple* deference regime, the effects of which we explore later.[153]

The picture gets more complicated from here. NERC supervision is far from FERC's only role in grid reliability. FERC also oversees transmission system planning and the design and operation of regional electricity markets.[154] But FERC's ability to fully control the system is legally limited, again by the contours of the FPA. The Act assigns *states* central control over "facilities used for the generation of electric energy or over facilities used in local distribution."[155] Thus, as Amy Stein notes, "federal reliability standards have traditionally ended at the edge of the bulk energy grid, leaving states to regulate reliability as they see fit within their exclusive distribution sphere."[156] States also maintain control over siting—though not planning or distributing the costs of—new transmission infrastructure.[157] That means that essentially no physical grid infrastructure can be constructed without state approval. States also regulate the natural gas wells that provide the fuel for the bulk of U.S. power plants.[158] And finally, regional transmission organizations (RTOs) control the flow of electricity through the portions of the North American grid that serve two-thirds of U.S. customers.[159] This operational control of the system makes RTOs central actors in ensuring real-time reliability and making key decisions about how to keep the system online under emergency conditions.

Because of this split in jurisdiction, NERC's work as a standard-setter for the industry has radiating effects. Today, NERC reliability standards affect load (demand) and resource (generation) balancing and the three stages of grid infrastructure essential to reliability: planning, development, and operation, irrespective of who is responsible for carrying out a particular stage. Below we explore how NERC standards interrelate with other grid actors' responsibilities to affect grid infrastructure development and operation across the United States.

1. The Core Reliability Function: Balancing Electricity Supplied with Electricity Used

The most important function of grid reliability—and one that requires extensive planning—is called "load-resource" balance. This involves exactly matching: 1) the demand for and use of electricity (load), with 2) the amount of

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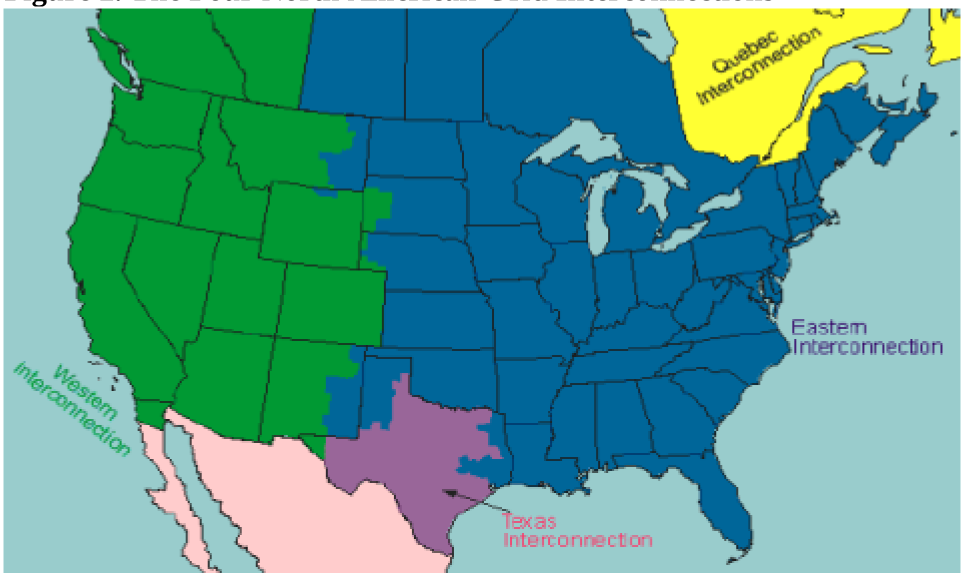
[152] 16 U.S.C. § 824o(d).
[153] *See infra* Part II.
[154] See 16 U.S.C. § 824(a).
[155] 16 U.S.C. § 824(b).
[156] Stein, *Regulating Reliability*, *supra* note xx, at 1193-94.
[157] See Alexandra B. Klass & Elizabeth J. Wilson, I*nterstate Transmission Challenges for Renewable Energy: A Federalism Mismatch*, 65 VAND. L REV. 1801 (2012).
[158] *See* Michael Burger, *Fracking and Federalism Choice*, 161 U. Pa. L. Rev. 431 (2013) (describing state dominance of oil and gas production regulation).
[159] *See infra* text accompanying notes 165-167 (on RTOs' role in balancing supply and demand).

electricity "injected" into the grid (dispatched) from generators, which are also called resources.[160] This matching must occur within a specific geographic area of the grid. "Interconnections" are the geographic portions of the North American grid that contain large numbers of connected wires. There are also limited "ties" (wires) that connect each interconnection to its neighboring interconnections (see Figure 2).

Figure 2. The Four North American Grid Interconnections[161]



The entity responsible for balancing generation and load within a given portion of each interconnection is called a "balancing authority." As NERC explains, "[e]very generator, transmission facility and End-use customer is in a Balancing Authority Area."[162] Matching generation with load instantaneously, and constantly, is necessary to maintain a specific "frequency" within the wires controlled by the Balancing Authority, measured in cycles per second or Hertz (Hz). If frequency deviates too far from the target value of 60 Hz, grid stability is thrown into jeopardy.[163] To maintain regular frequency, balancing authorities obtain information from utilities that serve end-use customers regarding how much electricity they will need, and then dispatch generation to meet that load. Many balancing authorities use a process called "economic dispatch," in which

[160] Natl. Renewable Energy Lab., *supra* note 144, at 1.

[161] North Am. Electric Reliability Corp., Balancing and Frequency Control: A Technical Document Prepared by the NERC Resources Committee 5 (2011), https://www.nerc.com/comm/OC/BAL0031_Supporting_Documents_2017_DL/NERC%20Balancing%20and%20Frequency%20Control%20040520111.pdf.

[162] Reliability Functional Model, *supra* note xx, at 8.

[163] *Id.*

they dispatch the least-cost generation first, then the slightly more expensive generation and so on, until they meet load.[164]

In most parts of the country, RTOs or "independent system operators" (ISOs) fill the role of balancing authorities.[165] Like NERC, they are non-profit 501(c)(6) organizations, run by boards of directors, that control the actual operation of a web of connected transmission lines and that determine how much electricity may flow through these lines, and when. Interestingly, this structure makes RTOs themselves a species of self-regulatory organization, wherein electricity industry members (many of whom *also* make up the membership of NERC) establish rules and protocols for transmission and market operations under FERC oversight.[166] Utilities that own transmission lines voluntarily choose—or are sometimes required by state electricity regulators—to transfer control over the operation of their lines to an RTO or ISO. Entities called "Interchange Coordinator Authorities" control the flow of electricity between Balancing Authorities.[167]

Overseeing this balancing is a larger authority—the Reliability Coordinator. The Reliability Coordinator is the "highest operating authority" of the grid, with the responsibility to ensure balancing of electricity over a broad area.[168] Balancing Authorities send "schedules" and "commitments" to the Reliability Coordinator, showing which generators they plan to dispatch and when. Balancing Authorities also review Interchange Schedules to determine how exchanges of electricity between Balancing Authorities and interconnections will affect power flow within the Reliability Coordinator's territory.[169]

Numerous NERC standards undergird this constant balancing of generation and load. For example, NERC enforces a reliability standard that measures the difference between balancing authorities' scheduled interchanges of electricity and the interchanges that actually occur (Actual Net Interchange).[170] The difference between what the balancing authority expected to happen and what actually happened represents error, since deviations from the schedule mean slight imbalance in the grid. This error is called "Area Control

[164] *Id*.
[165] We call these RTOs for short, as they are essentially identical types of organizations. In the Southeast and West, no RTO/ISO exists and utilities or other entities fill these roles. *Cf.* Natl. Renewable Energy Lab., *supra* note 144, at 3 (noting bilateral exchanges used as an alternative to energy imbalance markets that balance load and resources); U.S. Energy Info. Admin., U.S. electric system is made up of interconnections and balancing authorities, July 20, 2016.
[166] See Fed. Power Act §§ 205, 206; Shelley Welton, *Rethinking Grid Governance for the Climate Change Era*, 109 CAL. L. REV. 209 (2021).
[167] Reliability Functional Model, *supra* note xx, at 9.
[168] *Id*. at 6.
[169] *Id*.
[170] North Am. Electr. Reliability Corp., Calculating the Using Reporting AC Ein a Tie Line Bias Control Program, https://www.nerc.com/pa/Stand/Project%2020101421%20Phase%202%20DL/White_Paper_on_the_Calculation_of_Reporting_ACE-D3-20150518.pdf

Error," or ACE, and the standard for maximum allowed ACE, entitled "Real Power Balancing Control Performance, BAL-001-2," reads as follows (in part):

> Each Balancing Authority shall operate such that its clock-minute average of Reporting ACE [Area Control Error] does not exceed its clock-minute Balancing Authority ACE Limit (BAAL) for more than 30 consecutive clock-minutes, calculated in accordance with Attachment 2, for the applicable interconnection in which the Balancing Authority operates.[171]

NERC's Attachment 2 contains an algebraic equation for calculating Actual Net Interchange and the other components of Area Control Error. NERC has nine other active reliability standards that relate to resource and demand balancing, and many other "buckets" of standards, as explored further in the following section.[172]

2. Planning, Developing, and Operating a Reliable Grid

NERC standards also influence—but do not fully dictate—grid planning, development, and operations. On the **planning** front, NERC standards require various grid actors to plan for: 1) adequate "reserve" generation capacity to supply load during periods of peak demand or unexpected unavailability of some generation, and 2) adequate transmission lines to carry electricity from power plants to load centers. For example, NERC reliability standards for "Modeling, Data, and Analysis" require grid operators to calculate and report information such as available transmission system capability and transmission reliability margins, which relate to the ability of transmission lines to accommodate unusual flows of electrons through the wires, variations in generation dispatch, and uncertain customer loads.[173] FERC, in turn, requires all transmission grid operators to plan for new transmission lines that connect more generation within a region (such as a balancing authority region) and make interregional connections to enhance reliability and address state policy requirements such as increased renewable energy generation.[174] And many states require their utilities

[171] Standard BAL-001-02 – Real Power Balancing Control Performance, https://www.nerc.com/pa/Stand/Reliability%20Standards/BAL-001-2.pdf
[172] North Am. Electr. Reliability Corp., Standards, https://www.nerc.com/pa/Stand/Pages/ReliabilityStandards.aspx.
[173] Standard MOD-008-1—TRM [Transmission Reliability Margin] Calculation Methodology, https://www.nerc.com/pa/Stand/Reliability%20Standards/MOD-008-1.pdf.
[174] FERC Order No. 1000 (2011).

to engage in "integrated resource planning" that looks ahead to projected future demand and evaluates options to meet it cost-effectively and reliably.[175]

But planning alone does not guarantee construction of generation capacity, reserves, or transmission lines. NERC's influence on resource **development** occurs behind the scenes, as states and RTOs (guided by FERC) have most of the control. States determine whether and where power plants and transmission and distribution lines may be built,[176] even in the case of interstate transmission lines.[177] States frequently block the construction of interstate transmission lines, particularly when those lines merely cross over the state and do not deliver electricity to consumers within the state.[178] And state decisions on transmission infrastructure have reverberating consequences, as new renewable energy entrants are frequently constrained by an inability to access transmission. NERC and FERC explicitly lack authority to force states to build anything against their will.[179]

Despite this formal role of the states in directly influencing the construction of generation capacity and transmission, NERC standards wield quiet yet powerful force within this area. NERC does not have direct mandates for "resource adequacy"—the ability of project [generation] capacity resources to meet projected demand.[180] However, in weighty decisions about new generation needed to support reliability, NERC standards dictate calculation and reporting methods that directly influence states' and RTOs' numerical floors for generation capacity.[181] For example, a primary input into RTOs' determination of how much capacity utilities must purchase in an RTO-designed and FERC-approved capacity market is a measurement of which generating units

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[175] *See, e.g.*, Integrated Resources Planning, Ct. Dept of Energy & Env't Prot., https://portal.ct.gov/DEEP/Energy/Integrated-Resource-Planning/Integrated-Resource-Planning (describing the process); Pac. Northwest Natl. Lab., Integrated Resource Planning in the U.S. Overview (2021), https://eta-publications.lbl.gov/sites/default/files/sc_commission_day_1_irps_in_us_review_of_requirements_final.pdf (noting that 35 states require IRPs).

[176] The exception is nuclear energy, over which the Nuclear Regulatory Commission wields licensing and siting authority. States may still reject nuclear plant construction on economic grounds, however. *See* Entergy Nuclear Vt. Yankee LLC v. Shumlin, 737 F.3d 228 (2d. Cir. 2013).

[177] Klass & Wilson, *supra* note 157.

[178] *See, e.g.*, Alexandra B. Klass, Takings and Transmission, 91 N.C. L. Rev. 1079, 1127-31 (2013) (describing states' denial of eminent domain authority for some interstate transmission lines).

[179] See 16 U.S.C. § 824o(i)(2) ("This section does not authorize the ERO or the Commission to order the construction of additional generation or transmission capacity or to set and enforce compliance with standards for adequacy or safety of electric facilities or services.").

[180] Andrew Reimers et al., The Impact of Planning Reserve Margins in Long-Term Planning Models of the Electricity Sector, Sci. Direct (2018).

[181] *See, e.g.*, *id*. (noting that "historical reserve margins have often exceeded tbe NERC-recommended levels).

experienced forced outages—and how often.[182] NERC sets the calculation procedures for identifying these forced outages and runs the database—relied upon by RTOs—that tracks forced outages.[183] In other words, capacity markets rely on numbers calculated in a fashion dictated by NERC. RTOs also obtain data on load (demand) that must be met through generation from NERC's regional entities.[184] Capacity markets, in turn, substantially affect state decisions on new generation approved to be built. Indeed, when states try to change capacity requirements up or down—questioning the adequacy of FERC-approved RTO capacity markets—they sometimes find themselves preempted by the Federal Power Act.[185]

Federal and regional organizations also increasingly play critical roles in transmission line development. Despite states' formal role in determining where (and thus whether) transmission lines—including interstate lines—may be constructed, FERC and RTOs sometimes push for the construction of new transmission lines, particularly through their role in approving cost-sharing arrangements. With FERC approval, RTOs such as MISO in the Midwest have developed plans to charge all users of transmission lines a higher fee to cover the construction of new lines that connect utilities throughout the Midwest to cheaper (usually renewable) generation.[186] Spreading the costs of lines throughout the region has helped to ensure that the lines get built, and FERC now encourages this type of transmission pricing in its transmission planning principles.[187] Thus, NERC standards regarding transmission capacity influence both federal and state decision-making regarding transmission development.

Once grid infrastructure is built, it must be **operated** properly to protect grid reliability. Power plant, transmission line, and distribution line operators must use quality software that is not vulnerable to cyber attacks, train their personnel to communicate with various grid actors before shutting down equipment for repair, weatherize power plants to withstand growing weather extremes, trim vegetation around transmission and distribution lines, and monitor and response to rapid changes in generation and load.[188] NERC plays a central role in ensuring

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[182] PJM Manual 18: PJM Capacity Market 58, https://www.pjm.com/-/media/documents/manuals/m18.ashx.

[183] NERC maintains the Generating Availability Data System, which is used in EFOR calculations and reporting. Generating Availability Data System (GADS), North Am. Electr. Reliability Corp., https://www.nerc.com/pa/RAPA/gads/Pages/GeneratingAvailabilityDataSystem-(GADS).aspx; North Am. Electr. Reliability Corp., GADS Data Reported to NERC, https://www.nerc.com/pa/RAPA/gads/Training/Why%20GADS.pdf.

[184] PJM Manual 20: PJM Resource Adequacy Analysis at 20 (2021), https://pjm.com/~/media/documents/manuals/m20.ashx.

[185] Hughes v. Talen Energy Marketing LLC, 578 U.S. 150 (2016).

[186] For a discussion of MISO's efforts, *see* Hannah J. Wiseman, *Regional Cooperative Federalism and the U.S. Electric Grid*, 90 GEO. WASH. L. REV. 147, 181-84 (2021).

[187] FERC Order No. 1000 (2011).

[188] *See, e.g.*, NERC Standard FAC-003-2 Vegetation Management Standard; CIP-003-08 – Security Management Controls (showing requirements to protect against cyber attacks, such as

reliable operations for all generators and transmission line operators, administering numerous reliability standards that address the safe operation of the grid.[189]

States, too, centrally influence grid operations because they regulate *distribution* reliability and electric utilities' expenditures. When an electric utility wants to do anything—build new infrastructure, enhance tree trimming around wires, or implement a new cybersecurity program—state public utility commissioners must approve these actions before utilities can charge ratepayers for the costs incurred. FERC, too, has a role in transmission line operation through its regulation of the rates that line operators may charge for use of the lines. Transmission line operators often apply to FERC to increase rates to address reliability concerns, either based on NERC standards or in some cases exceeding them.[190]

Another important facet of grid operation is ensuring fuel supply. Here again, states play a central role. States, federal-regional commissions, or federal agencies such as the Bureau of Reclamation regulate in-stream flow and water use that affects the availability of hydropower.[191] States regulate natural gas wells and determine whether these wells must be winterized to withstand extreme cold.[192] The federal Pipeline and Hazardous Materials Safety Administration regulates the safety and operations of interstate gas pipelines, while states, under delegation agreements from PHMSA, regulate intrastate gas pipeline safety and operations.[193] These pipeline-centered regulations are thus beyond the authority of FERC, NERC, and Regional Entities, who have all

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anti-virus software, for software that is part of the bulk power system); COM-002-4 Operating Personnel Communications Protocols (requiring standard communication procedures and training in communication for all operating personnel associated with the bulk power system).

[189] *See supra* note 188.

[190] For example, in 2019 Duke Energy received approval from FERC to implement cybersecurity standards of the National Institute of Standards and Technology (NIST)—another private standards-setting organization. Duke Energy indicated that these standards were more stringent than NERC's and would better ensure reliability. See Fed. Energy Reg. Commn., Order Granting Accounting Request, Docket No. AC19-75-000, https://www.ferc.gov/sites/default/files/2020-07/12-2019-E-15.pdf

[191] *See* Hydrology/Flow Mgmt., Del. River Basin Commn., https://www.state.nj.us/drbc/programs/flow/ (noting that while there are no dams on the Delaware River, the DRBC controls flow to reservoirs used for dirnking water and other purposes); Regulations, Susquehanna River Basin Commn., https://www.srbc.net/regulatory/regulations/ ("Water withdrawals of 100,000 gallons per day (gpd) or more over a 30-day average from any source or combination of sources within the Basin are regulated"); Overview of Lake Mead, Natl. Park Svc., https://www.nps.gov/lake/learn/nature/overview-of-lake-mead.htm (noting that "The U.S. Bureau of Reclamation manages water and power deliveries, which includes control of lake discharge, operation, and maintenance of Hoover Dam and power plant.").

[192] *See, e.g.*, RRC's Commissioners Approve Final Rule to Weatherize Natural Gas Supply for Emergencies, Aug. 30, 2022, https://www.rrc.texas.gov/news/083022-rrc-weatherization-standards/ (showing new Texas natural gas weatherization requirements).

[193] State Programs Overview, Pipeline and Hazardous Materials Safety Administration, https://www.phmsa.dot.gov/working-phmsa/state-programs/state-programs-overview.

pressured the national private standards-setting organization to update private standards to ensure the continued operation of natural gas wells and pipelines even during extreme weather events.[194] FERC also has some direct authority in this area, regulating construction of, rates, and operations of interstate gas pipelines—sometimes expressly for reliability.[195]

In summary, numerous actors have disparate and overlapping authority over the reliability of the grid.[196] NERC and FERC regulate planning for new transmission lines and assessment of the adequacy of these lines. States regulate the siting of these lines, and FERC and RTOs design rates to finance the construction of new interstate transmission lines. FERC, NERC, RTOs, and states all influence the amount of generation capacity planned for and built. And all of these entities also regulate, to varying degrees, the reliable operation of generation infrastructure.

This structure bears little resemblance to the idealized SRO described in Part I—a point we will return to in Part IV, where we consider whether the theory elucidated there still makes sense in this evolving regulatory landscape.

B. Exploring NERC: Governance and Reliability Standards Development

Whereas the previous subsection explored NERC's external landscape, this part explores NERC's internal structure and workings. When Congress developed the ERO scheme in 2005,[197] it also authorized the continuation of NERC's pre-existing private federalist scheme. Under this scheme, NERC delegates much of the work of writing reliability standards to Regional Entities, which propose reliability standards to NERC and help to enforce approved standards.[198] Congress gave these regional entities relatively strong authority, requiring the ERO and FERC to "rebuttably presume" that reliability standards proposed by regional entities, or modifications to these standards, are "just, reasonable . . . and in the public interest."[199] NERC regional entities cover all portions of the continental United States and Canada (Figure 3).

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[194] *See, e.g.*, FERC, NERC Encourage NAESB to Convene Gas-Electric Forum to Address Reliability Challenges, July 29, 2022, https://www.ferc.gov/news-events/news/ferc-nerc-encourage-naesb-convene-gas-electric-forum-address-reliability.

[195] For example, when gas markets and electricity markets operated on different timelines each day, this threatened electric grid reliability because power plant operators sometimes had trouble verifying how much gas would be available on a given day. During some parts of the day, electricity markets were open, but gas markets were closed due to conflicting hours of operation. A FERC order required the harmonization of the markets to enhance reliability. FERC Order No. 809 (2015).

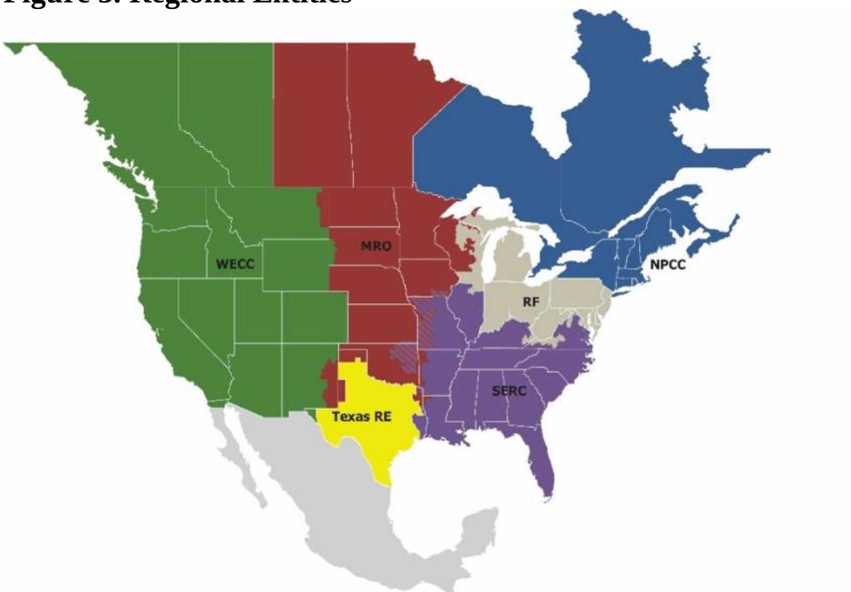
[196] *See, e.g.*, Stein, Regulating Reliability, *supra* note 13, at 1194 (observing that "utilities, states, regional actors, and federal actors have engaged in a variety of methods to maintain reliability").

[197] See supra Part I.

[198] 16 U.S.C. § 824o (e)(4) (authorizing this delegation).

[199] 16 U.S.C. § 824*o*(d)(3).

Figure 3. Regional Entities[200]



NERC's and Regional Entities' primary job is to write and enforce reliability standards. NERC and regional entities (sometimes working with FERC) also write regular reports assessing reliability risks and lessons learned from grid interruptions and must fulfill a variety of other duties prescribed by FERC, such as auditing its Regional Entities. As shown by Figure 4, NERC also plays these roles for the Canadian provinces and portions of Mexico. When the United States was in the process of designating NERC as its ERO, a bilateral working group comprised of agency representatives from Canada and the United States prepared principles for an internationally functioning ERO, including, for example, board membership from both countries, fair allocation of ERO costs, and consultation of the ERO with authorities in each country during reliability standards development.[201] Between 2006 and 2018, NERC and the relevant Regional Entities that extend into Canada signed memoranda of understanding with all Canadian provincial utility regulators.[202] All provinces recognize NERC reliability standards as legally binding but have different processes for approving the standards and enforcing them.[203] Mexico's energy regulator also

[200] North Am. Electr. Reliability Corp., ERO Enterprise Regional Entities, https://www.nerc.com/AboutNERC/keyplayers/Pages/default.aspx.
[201] Bilateral Electric Reliability Oversight Grp., Principles for an Electric Reliability Organization That Can Function on an International Basis (2005), https://www.nerc.com/FilingsOrders/ca/Canadian%20mous%20DL/BEROG%20Principles%20for%20ERO%2008032005.pdf.
[202] MOUS, NERC, https://www.nerc.com/FilingsOrders/ca/Canadian%20mous%20DL/Canada%20MOUs%20(2020).pdf.
[203] Canada, NERC, https://www.nerc.com/AboutNERC/keyplayers/Pages/Canada.aspx.

incorporated NERC's reliability standards into its "Grid Code," and NERC's western regional entity has some standards that apply to Mexico's government-owned utility in Baja California Norte.[204]

Both NERC and its regional entities are 501(c)(6) not-for-profit corporations.[205] NERC is governed by a twelve-member Board of Trustees,[206] including former engineers and CEOs of electric and water utilities, a former executive vice president of the federal Tennessee Valley Authority, former consultants from firms such as Deloitte and Irving, Inc, and a former president of one of NERC's regional entities.[207]

NERC's Member Representatives Committee elects the trustees.[208] The Member Representatives Committee, in turn, is comprised of two representatives from each member sector, with the exception of two sectors (government representatives and NERC's regional entities).[209] A "sector" is a "group of members of the Corporation that are bulk power system owners, operators, or users or other persons and entities with substantially similar interests . . . ."[210] NERC's members are grouped into twelve sectors, which include: 1) investor-owned utilities, 2) state- and municipally-owned and operated utilities, 3) cooperative utilities (electric cooperatives owned by groups of consumers), 4) federal or (Canadian) provincial utilities or power marketing administrations, 5) transmission-dependent utilities (those that own and operate generation but not transmission); 6) merchant electricity generators (generators that only operate generating units, not transmission or distribution), 7) electricity marketers, 8) electricity consumers that use large amounts of electricity, 9) electricity consumers that use small amounts of electricity, 10) regional transmission organizations, 11) NERC's regional entities, and 12) government representatives.[211]

NERC's Registered Ballot Body is a different set of actors primarily responsible for voting on reliability standards recommended to the Board of Trustees. This body is comprised of *segments* that mirror the sectors listed above but lump state- and municipally-owned utilities and cooperative utilities with investor-owned utilities in a larger segment called "load-serving entities"—any utilities that serve retail customer use (load).[212] Corporations with characteristics

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[204] *Id.*
[205] Business Leagues, Internal Rev. Svc., https://www.irs.gov/charities-non-profits/other-non-profits/business-leagues#:~:text=Section%20501(c)(6,of%20any%20private%20shareholder%20or (explaining that 501(c)(6) exempts, *inter alia*, business leagues and boards of trade); 26 U.S.C. § 501(c)(6).
[206] North Am. Electr. Reliability Corp., Board of Trustees.
[207] *Id.*
[208] Member Representatives Committee, North Am. Electr. Reliability Corp., https://www.nerc.com/gov/bot/MRC/Pages/default.aspx; NERC Bylaws Art. VIII.
[209] NERC Bylaws, Art. VIII, section 2.
[210] NERC Bylaws, Art. I section 1.
[211] NERC Bylaws, Art. II section 4.
[212] Registered Ballot Body Criteria, *supra* note 215, at 2.

that meet several different Segments' criteria—for example, utilities that own and operate generation, transmission, and distribution—may "belong to each of the Segments in which they qualify," provided they have a different representative from their company within each of the Segments.[213] Entities that elect to define themselves as small electricity users, however, may not participate in multiple segments.[214]

Just as NERC's Board of Trustees—elected by the Member Representatives Committee—includes many trustees with backgrounds working for large, vertically integrated utilities, NERC's Regional Entities' Boards of Directors are similarly comprised largely of individuals who previously worked for utilities. (See Appendix A).

Proposed reliability standards originate from NERC's Standards Committee. This committee includes two representatives elected by members from the ten segments of the Registered Ballot Body noted above.[215] Most of the current Standards Committee members are from large utilities; others are from state utility regulatory commission, regional transmission organizations, and regional entities.[216]

Any member of NERC, including a Regional Entity Member, may request the development, modification, or withdrawal of a reliability standard.[217] NERC's Standards Committee is responsible for drafting reliability standards if it deems a request for a new standard to be worthwhile or self-initiates a drafting process.[218] The Committee's meetings must be open "to all interested parties" but may include "preregistration requirements," and notice of the meetings need only be provided to Committee members in writing.[219] Committee actions for approving standards are taken by majority vote of the present members.[220]

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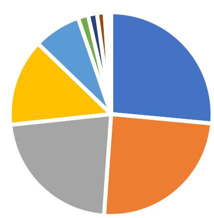
[213] Registered Ballot Body Criteria, *supra* note 215, at 1.
[214] *Id*.
[215] North Am. Electr. Reliability Corp., Procedure for Election of Members of the Standards Committee 1 (2022), https://www.nerc.com/AboutNERC/RulesOfProcedure/ROP%20App%203B%20eff%2020220825%20clean.pdf; North Am. Electr. Reliability Corp., Appendix 3D Registered Ballot Body Criteria 2-3 (2018), https://www.nerc.com/FilingsOrders/us/RuleOfProcedureDL/Appendix_3D_BallotBodyCriteria_20180309.pdf. Small electricity users take service below 50 kilovolts and have an average aggregated load of less than 50,000 megawatt-hours annually.
[216] North Am. Electr. Reliability Corp., Standards Committee 2022 Segment Representatives, https://www.nerc.com/comm/SC/Documents/2022_SC_Roster.pdf.
[217] North Am. Electr. Reliability Corp., Reliability Standards Development Procedure Version 7 at 12, https://www.nerc.com/pa/Stand/Standard%20Process%20Manual%20DL/RSDP-V7_Clean_2009June9.pdf.
[218] North Am. Electr. Reliability Corp., Standards Committee, https://www.nerc.com/comm/SC/Pages/default.aspx.
[219] *Id*. at 11.
[220] *Id*.

After the Standards Committee develops a proposed standard, NERC's Registered Ballot Body votes and comments on it.[221] The ballot body consists of over 400 registered ballot voters, including 130 transmission owner voters, 121 electric generators, 109 load-serving entity (utility) voters, 68 electricity brokers, aggregators, and marketers, 37 transmission-dependent utilities that solely distributed electricity to end users, 8 RTOs, 7 regional reliability organizations and regional entities, 6 large electricity end users, 3 small electricity end users, and 3 federal, state, and provincial or other government entities (see Figure 4).[222] NERC uses a formula that allocates each industry segment equal weight in voting on proposed standards (except those segments with fewer than 10 voters), with approval requiring a two-thirds majority of the weighted segment votes.[223]

Figure 4. Registered Ballot Voters in NERC: Percentage Votes



Given the composition of NERC's registered ballot body (Figure 4), weighted sectoral voting creates the potential for a subset of industry—incumbent rate regulated utilities—to wield outsized influence in NERC. New entrants, such as renewable energy producers, typically fall into a single sector—most often the largest sector, generation. Vertically integrated utilities also have a vote in this sector because they own generating units. But vertically integrated utilities have additional votes as transmission owners and load-serving entities. Skewing the ballot body yet further, RTOs and Regional Entities are *themselves*

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[221] North Am. Electr. Reliability Corp., ERO Enterprise Regional Entities, https://www.nerc.com/AboutNERC/keyplayers/Pages/default.aspx.
[222] NERC Balloting Tool, Registered Ballot Body, https://sbs.nerc.net/Users/VotersBallotBody.
[223] See NERC Rules of Procedure, https://www.nerc.com/AboutNERC/RulesOfProcedure/NERC%20ROP%20effective%2020220825_with%20appendicies.pdf; Standards Processes Manual, https://www.nerc.com/comm/SC/Documents/Appendix_3A_StandardsProcessesManual.pdf, at 19. If a segment has fewer than 10 voters, its weight is adjusted downward. *Id.*

membership groups in which these same utilities frequently hold outsized sway.[224] Add it all up, the major utilities have voting power in as many as five of the ten NERC sectors—making their voices critical to any potential reforms and giving them functional veto power.

If a standard makes it through the ballot body gauntlet, it goes on to the NERC Board of Trustees.[225] NERC's Member Representatives Committee advises the Board of Trustees on whether the standard should be adopted, and the Board of Trustees, if it adopts the standard, forwards it to FERC for approval under the extensive standards for deference noted in Part I. [226]

There are two types of NERC reliability standards: continent-wide standards that apply to all registered entities or to a segment of them (such as transmission-related standards that apply to all transmission owners and operators), and regional standards that apply only to registered entities that are located within of one of NERC's six Regional Entities.[227] Regional standards are proposed by Regional Entities and approved by FERC and NERC. They must be more stringent than continent-wide standards and must address a regional difference not addressed by a continent-wide standard or a "physical difference in the bulk power system."[228] Five of the six regional entities have their own individual manuals describing the process for development standards.[229] These processes generally exactly mirror the process followed for continent-wide reliability standards.[230]

To complicate this picture still further, there are additional private standard-setting organizations that operate alongside NERC and establish criteria related to grid reliability. For example, many entities subject to NERC compliance also voluntarily comply with North American Energy Standards Board (NAESB) standards. NAESB is an SRO, supported by the U.S. Department of Energy, that develops private standards for the operation of wholesale and retail power and wholesale and retail natural gas.[231] NAESB therefore bridges jurisdictional divides: while NERC lacks jurisdictional control over the delivery of natural gas

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[224] *See infra* discussion of SERC; see also Welton, *supra* note 166.

[225] North Am. Electr. Reliability Corp., Reliability Standards Development Procedure Version 7, *supra* note xx, at 12.

[226] *Id*.. On deference, *see supra* note @ and accompanying text. The Board can approve or reject but not modify proposed standards. https://www.nerc.com/comm/SC/Documents/Appendix_3A_StandardsProcessesManual.pdf, at 19.

[227] North Am. Electr. Reliability Corp., Regional Standards Development, https://www.nerc.com/pa/Stand/Pages/RegionalStandardsDevelopment.aspx (noting that regional reliability standards "shall be enforced upon all applicable bulk power system owners, operators, and users within the applicable Regional Entity's region, regardless of membership in the region").

[228] North Am. Electr. Reliability Corp., Regional Standards Development, *supra* note 227.

[229] *Id*.

[230] Appendix A describes in more detail the voting requirements and structures of Regional Entities.

[231] North Am. Energy Standards Bd., NAESB 101 Webinar (2021).

to power plants, NAESB—a private organization—covers both of these sectors. Indeed, NAESB has a Gas-Electric Harmonization Committee.[232] NERC and FERC therefore sometimes formally ask NAESB to write standards to improve coordination between the gas and electric industries. For example, after the 2021 Southern blackout, FERC and NERC wrote a letter to NAESB asking the organization to convene a forum addressing the reliable delivery of gas to power plants—particularly during periods of extreme cold.[233] NERC and NAESB also sometimes jointly write standards—particularly in the areas of transfer of electricity among different transmission line operators and relief of high loads on transmission lines.[234] When NERC drafts reliability standards, it endeavors to harmonize these standards with those of NAESB and other SROs operating in this space.[235]

NERC itself also subscribes to another meta-SRO, the American National Standards Institute (ANSI), which "provides a framework for fair standards development."[236] ANSI standards focus on achieving consensus and a balance of interest representation in the setting of private standards, thus creating a private version of due process.[237] These rules—in addition to FERC requirements—drive the composition and rules governing NERC standard-setting and board elections.[238]

III. NERC'S PERFORMANCE AS THE NATION'S ELECTRIC RELIABILITY ORGANIZATION

The previous parts have focused on historicizing, situating, and unpacking NERC and its central role within the broader reliability governance landscape. This part turns to assess NERC's performance as the nation's ERO. In many respects, NERC has been reasonably successful in maintaining grid

[232] Letter from Richard Glick, FERC Chairman & Jim Robb, NERC President and CEO, to Michael Desselle, Chairman and Jonathan Booe, Executive Vice President & Chief Operating Officer, North Am. Energy Standards Bd., July 25, 2022, https://www.naesb.org/pdf4/FERC_NERC_Letter_072922_to_NAESB.pdf.
[233] *Id*.
[234] North Am. Electr. Reliability Corp., NAESB Coordination Efforts, https://www.nerc.com/pa/Stand/Pages/NAESB.aspx.
[235] See North Am. Electr. Reliability Corp., Standard Processes Manual 2 (2019), https://www.nerc.com/comm/SC/Documents/Appendix_3A_StandardsProcessesManual.pdf.
[236] Am. Natl. Stds. Inst., https://www.ansi.org/about/introduction.
[237] ANSI, Essential Requirements Sections, https://www.ansi.org/american-national-standards/ans-introduction/essential-requirements.
[238] *See, e.g.*, Letter from James Thompson, ANSI, to Mark G. Lauby, NERC Vice President and Director of Standards, https://www.nerc.com/pa/Stand/ANSI%20Home%20Page%20Comm/Notice%20of%20NERC%20Reaccreditation%20from%20ANSI%20May%2017,%202013.pdf (reaccrediting NERC on the basis of its compliance with ANSI procedures).

reliability, both historically and under modern conditions, yields reasonable grades. Although the United States experiences more power failures than other developed countries, some research suggests that reliability is on par with or stronger than the among of reliability that consumers are willing to pay for. With several major exceptions, such as the deaths and economic losses caused by the major 2003 and 2021 blackouts, the recent history of the U.S. grid is not one of repeated disasters despite the growing challenges posed by intermittent generation, extreme weather, and cyber threats. Yet this surface-level assessment masks a darker pattern occurring in the technical standard-setting weeds: many of NERC's standards are perpetuating—even if inadvertently—a regime that will worsen climate change and thus increase the climate impacts that now pose major threats to the grid. This subsection collates and analyzes evidence of NERC's outdated response to grid reliability.

A. NERC's Early Days as the ERO, 2005-2014: Growing Pains

It was widely recognized—even in NERC's early days as the nation's ERO—that the complicated web of actors involved in reliability regulation made for an "unusual" relationship between FERC and NERC. Section 215's deference regime from FERC *to* NERC put FERC in an "awkward" position, "powerless to make things happen, yet still liable for failure, especially in the eyes of Congress."[239]

Many early complaints about NERC focused on the slow speed of its standard-setting. NERC's stakeholder-driven standard-setting process—its "great strength" in many eyes[240]—proved sclerotic: as of 2010, it took around 21.7 months for a standard to work its way through NERC's process, creating a significant backlog of standards that FERC had identified as in need of revision.[241]

Other early concerns centered on "confusion over the individual roles of FERC, NERC and regional entities in the process . . . . as Section 215 of the Federal Power Act creates a fair amount of overlap."[242] These concerns mounted to outright tension in 2010. That year, in what was hyperbolically called the "March Massacre," FERC issued several orders in a single day that collectively evidenced sizeable disappointment in NERC's performance.[243] Industry reacted

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239 Radford, B. W. (2007). The rush to reliability. *Public Utilities Fortnightly, 145*(2), 35-37.

240 Schneider, J. D. (2013). NERC on a wire. *Public Utilities Fortnightly, 151*(2), 32-38

241 Zhang, Z., & Stern, M. (2010). NERC today and tomorrow. *Public Utilities Fortnightly, 148*(3), 32-37. There was also a backlog in enforcement cases: by 2010, 3,000 of a documented 5,500 possible NERC standards violations remained open and unprocessed. Radford, B. W. (2011). Too much reliability. *Public Utilities Fortnightly, 149*(1), 28-31.

242 Zhang, Z., & Stern, M. (2010). NERC today and tomorrow. *Public Utilities Fortnightly, 148*(3), 32-37

243 See 130 FERC ¶ 61,208 (transmission planning); 130 FERC ¶61,202 (contingency reserves); 130 FERC ¶61,218 (frequency response standards); 133 FERC ¶61,150 (bulk electric system definition); 130 FERC ¶61,203 (voting rules).

particularly strongly to a FERC order on frequency response, which the head of the American Public Power Association described as having "a real unfortunate ready, fire, aim dynamic."[244]

The frequency response order instructed NERC to submit within six months a new standard on how to manage swings in operating frequency on the grid—and did so in language that condemned NERC's delay in doing so.[245] The order followed comments from FERC Commissioners concerned about whether NERC was adequately responding to the trend of rising intermittent (renewable) resources—a trend that Commissioner Moeller had worried a year earlier "can perhaps swamp us."[246] NERC itself was well aware of these changes, having convened a task force a year earlier that published a report on NERC's role in "Accommodating High Levels of Renewable Generation."[247] But FERC did not view NERC as moving fast enough to address these concerns through its standard-setting and guidelines authority. This problem, as we shall see, has reoccurred in recent years.

Yet NERC continued to insist at this time that there remained strong justifications for self-regulation. NERC representatives emphasized that NERC—not FERC—remained the expert in how to assess and achieve reliability.[248] Consequently—and in an assurance of unity of interests—NERC pleaded that "there should be never, ever any major surprises between NERC, FERC and the industry as occurred on March 18th . . . We all want to improve reliability."[249] This assurance of mutual interest was echoed by many in the industry, one of whom suggested that a "CEO level discussion of what's really important" would resolve "99 percent or better" of "harder issues."[250] Only Commissioner Wellinghoff seemed skeptical, asking whether there might not be a difference between "technical disputes and disagreements . . . over very arcane and complex matters," and "the stalemate [that] comes from a policy dispute."[251]

In the ensuing years, as renewable energy penetration continued to grow and climate change concerns to mount, new questions emerged about NERC's

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244 2010 Tech Conf Transcript at 178-79.

245 Mandatory Reliability Standards for the Bulk Power Sys., 130 FERC ¶ 61,218, 61,991 (2010)

246 B. W. Radford, *The rush to reliability*, 145 Public Utilities Fortnightly __, 35-37 (2007). At this point in time, most thinking around intermittency, resource adequacy, and reliability was being done at the ISO/RTO and state level—with regions developing "their own methodology for incorporating these resources into their resource adequacy and reserve-margin calculations." L. Risman & J. Ward, *Winds of change freshen resource adequacy*, 145 Public Utilities Fortnightly __, 14-18,78 (2007).

247 NORTH AMERICAN ELEC. RELIABILITY CORP., ACCOMMODATING HIGH LEVELS OF VARIABLE GENERATION (2009). The report generated several recommendations regarding potential standards to help integrate variable energy resources (renewables), including revisiting balancing area size and standardizing basic reliability requirements.

248 See, e.g., Transcript at XX ("FERC will never be able to, nor should it try to duplicate the depth of the industry's expertise.").

249 P. 107 Transcript.

250 Transcript at 170.

251 Transcript at XX.

role in the evolving grid. As one FERC Commissioner pointedly asked in 2014, "Do we need a different set of standards . . . for a different kind of system?"[252] This question was prompted by two observations: first, most severe BPS disruptions—at least 8 of 10 between 2009 and 2014—had been caused by "severe and unusual weather, including thunderstorms, tornadoes, and hurricanes - not by the sorts of systemic operational miscues that NERC's reliability standards are designed to prevent."[253] That meant that perhaps NERC was missing key facets of the modern reliability challenge in its standard-setting process.

Second, it was increasingly clear that renewable energy was creating a need for new and different reliability performance standards to ensure that intermittency did not threaten reliability. Industry, however, remained wary of adopting new standards based on these considerations, worried about accountability gaps between standards imposed on balancing authorities and the authorities' ability to control resources accordingly.[254]

B. Modern Grid Reliability Failures: Two Portraits of the Challenges

These tensions have only increased since 2015. This subsection explores these rising concerns, beginning with an in-depth look at the 2021 Texas blackout and the 2022 California near-miss as windows into modern reliability crises.

2021 had the dubious distinction of hosting a widespread electricity outage with some of the largest-ever damages. This blackout, affecting 10 million individuals in Texas and more people in neighboring states, unfolded when extremely cold weather (Winter Storm Uri) blanketed the Southern United States.[255] In Texas alone, at least 246 people died from the storm.[256] Most of these deaths were attributable to loss of power.[257] Causes included hypothermia and frostbite, exacerbation of pre-existing illnesses due to failed medical equipment such as dialysis or oxygen treatment, and carbon monoxide exposure and fires from unsafe attempts to find alternative ways to heat homes.[258] forty-

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[252] B.W. Radford, Reliability vs. resiliency, 152 Public Utilities Fortnightly __4-4,6 (quoting LaFleur at tech conference).
[253] Radford, *supra* note 246.
[254] *Id*.
[255] Joshua W. Busby, Kyri Baker, Morgan D. Bazilian, Alex Q. Gilbert, Emily Grubert, Varun Rai, Joshua D. Rhodes, Sarang Shidore, Caitlin A. Smith, and Michael E. Webber, *Cascading Risks: Understanding the 2021 Winter Blackout in Texas*, 77 ENERGY RES. & SOC. SCI. 102106 (2021).
[256] Tex. Health and Human Services, February 2021 Winter Storm-Related Deaths at 3,7 (2021), https://www.dshs.texas.gov/news/updates/SMOC_FebWinterStorm_MortalitySurvReport_12-30-21.pdf.
[257] *Id*.
[258] Hegar, *supra* note 4.

nine percent of Texans lost water as pump stations lost power, with the average water outage lasting fifty-two hours.[259]

The blackout also caused tremendous economic damage, including major supply chain disruptions ranging from disinfectants to plastic bottles, fertilizers, and packaging; a 20 percent inflation-adjusted decline in Texas's exports, and damage to homes as water pipes froze and burst.[260] Total economic damages from the storm are estimated at $80 billion to $130 billion."

The Texas blackout was almost much, much worse. Experts believe that if the entire grid had failed—which would have required a weeks-long "blackstart" of all power plants to get them running and reconnected to the grid—Texas would have been economically and socially devastated.[261] Managers at ERCOT, the operator that controls the Texas grid and follows NERC regulations, avoided this catastrophe only by creating controlled blackouts, thus balancing the small amount of electricity generation that was still operating with the "load" (demand). The ERCOT CEO reported that at its worst point, the grid was only minutes away from complete failure.[262]

The primary cause of the outage in Texas and neighboring states (accounting for 53% of plant outages or reduced generation) was the failure of equipment at power plants as a direct result of the cold—most importantly, natural gas plants.[263] Water lines carrying water for steam or cooling to power plants froze, and ice accumulated on wind turbines.[264] Additional factors included reduction in fuel supply to natural gas power plants—the leading source of power in Texas—as natural gas wells and pipelines stopped operating.[265] A lack of electricity flowing to the equipment that powered wells and pipelines interrupted these operations, as did frozen equipment at wells and pipelines. Scheduled outages—power plant downtime that had been scheduled prior to the emergency, such as regular shutoff (mothballing) of plants during certain seasons and temporary shutoffs for maintenance, contributed to approximately fifteen percent of outages, and other equipment issues not directly related to cold played

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[259] *Id*. at 4.
[260] *Id*. at 5.
[261] *Id*.
[262] Catherine Morehouse, ERCOT Narrowly Avoided "Much More Devastating" Impacts as Nearly Hal of Generation Went Offline: CEO, Utility Dive, Feb. 25, 2021, https://www.utilitydive.com/news/ercot-narrowly-avoided-much-more-devastating-impacts-as-nearly-half-of-ge/595701/ ; Bill Magness, ERCOT CEO, Review of February 2021 Extreme Cold Weather Event – ERCOT Presentation at 12 (2021), https://www.ercot.com/files/docs/2021/03/03/Texas_Legislature_Hearings_2-25-2021.pdf (showing more than four minutes during which the frequency of the Texas grid was below 59.4 hertz—the level, if sustained for nine minutes, at which complete grid failure occurs).
[263] ERCOT, Update to April 6, 2021 Preliminary Report on Causes of Generator Outages and Derates During the February 2021 Extreme Cold Weather Event at 8 (2021), https://www.ercot.com/files/docs/2021/04/28/ERCOT_Winter_Storm_Generator_Outages_By_Cause_Updated_Report_4.27.21.pdf.
[264] *Id*. at 9.
[265] *Id*. at 8.

a similarly-sized role.[266] Texas's long-standing decision not to interconnect its grid with neighboring states (so as to avoid FERC jurisdiction) also contributed: regional grid operators in neighboring states that had more transmission interconnections with other, non-weather-impacted areas experienced fewer outages than Texas.[267]

Over a year later, California narrowly missed a similarly devastating outage. As wildfires ranged at both ends of California, a devastating heatwave descended upon the state in August 2022. Both temperatures and energy usage statistics shattered records, putting significant strain on California's rapidly transforming grid.[268] These record-high temperatures caused particular grid stress as the sun set, when demand remained high due to air-conditioning usage but solar output declined.[269] California's grid operator was only able to avoid blackouts through the successful issuance of "Flex Alerts" to customers via Twitter and text message, begging them to conserve power during these periods by reducing non-essential uses. A grid operator report on the incident from November 2022 found that consumers conserved up to 1500 megawatts on these flex alert days, significantly contributing to system stability.[270] In many ways, this story is a heartening one of collective sacrifice and action. That said, appealing to consumers' better angels is far from a sustainable, sure-fire strategy for avoiding catastrophic outages under ever-more-frequent extreme weather conditions.

The examples of crises and near-misses from Texas and California highlight the dual challenges facing the grid today due to climate change. The climate crisis is no longer distant or theoretical – it is here and wreaking direct, measurable havoc on grid infrastructure across the country. NERC's response, however, has not kept pace with these emerging challenges.

C. NERC Understands the Challenges

On paper, NERC recognizes the modern reliability challenges that this Article explores.[271] Over and over again, in summer and winter reliability

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[266] *Id.*
[267] *See* FED. ENERGY REGUL. COMM'N, N. AM. ELEC. RELIABILITY CORP. & REG'L ENTITY JOINT STAFF, FEBRUARY 2021 COLD WEATHER GRID OPERATIONS: PRELIMINARY FINDINGS AND RECOMMENDATIONS 10 (2021).
[268] https://www.nytimes.com/2022/09/06/us/california-heat-wave-energy-crisis.html
[269] CAISO Report, at 12-13.
[270] CAISO at 43, http://www.caiso.com/Documents/SummerMarketPerformanceReportforSeptember2022.pdf.
[271] See also North American Electric Reliability Corporation, Essential Reliability Services Task Force Measures Framework Report (2015). http://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/ERSTF%20Framework%20Report%20-%20Final.pdf; Importance of T&D Grid Modernization to Mitigate Impacts from and Adapt to Climate Change, https://www.nerc.com/news/Pages/Industry-Experts-Author-Paper-on-Climate-Change-Impacts-to-the-Grid.aspx.

assessments, in annual employee retreats, and in official reports following major blackouts or near-misses, NERC has highlighted the opportunities and challenges posed by renewable energy and the climate crisis that renewable energy addresses.

Take, for example, the Summer 2022 reliability assessment, in which NERC identified numerous climate-related trends that threaten the grid, including continuing "widespread" drought and "below-normal snowpack" conditions that limit hydropower and the water needed for thermal power plants.[272] The agency also warned of continued drought in the West, with "above-normal wildfire risk," which can negatively impact transmission lines and generate extensive smoke that can cause "diminished output from solar PV resources."[273] NERC further acknowledged both the challenges and opportunities associated within increased renewable generation, identifying "widespread solar PV loss events" in Texas as photovoltaic panels tripped and went offline during grid disturbances, impacting many parts of the system—even localized (distributed) energy resources.[274] Further, NERC noted extreme heat in Texas increasing demand and threatening inadequate supply of generation—a gap largely filled by additions of solar energy and some wind in recent years.[275] Similarly, in brainstorming sessions, NERC staff has emphasized the importance of "dynamic resource adequacy," batteries, better data awareness to understand daily and seasonal generation trends from renewables, "flexible grid operations," and visualization of "long-term grid architecture," among other needs.[276]

These assessments suggest that NERC is, on one level, aware of the grid changes that must happen for renewable energy to become a reliable dominant energy source. Whereas traditional reliability has tended to focus on ensuring adequate generation reserves—back-ups or "spare tires" available during seasonal spikes in demand, for example[277]—the new approach to grid reliability requires more instantaneous flexibility. A grid operator facing a sudden shortage of solar electricity when clouds roll in needs to be able to draw from wind or solar in another location, rely on electricity users to quickly decrease their consumption or turn to their own storage, or draw upon resources that can quickly ramp-up to address shortfalls, including aggregated localized resources such as home batteries or microgrids powered by hydrogen fuel cells. These tools

[272] North Am. Electr. Reliability Corp., 2022 Summer Reliability Assessment at 4.
[273] *Id*. at 6.
[274] *Id*. at 5.
[275] *Id*. at 4.
[276] North Am. Electr. Reliability Corp., 2021 ERO Reliability Risk Priorities Report 14 (2021), https://www.nerc.com/comm/RISC/Documents/RISC%20ERO%20Priorities%20Report_Final_RISC_Approved_July_8_2021_Board_Submitted_Copy.pdf.
[277] Reserves, PJM, https://learn.pjm.com/three-priorities/buying-and-selling-energy/ancillary-services-market/reserves.

form the core of the "dynamic resource adequacy" paradigm recognized by NERC staff as critical to reliability in the electric era.[278]

Flexible, reactive grid resources are also increasingly important given climate extremes, from wildfires to storms. Fully "hardening" the grid against weather extremes is costly, although a great deal of hardening is now deemed essential in light of extreme weather and other modern grid realities.[279] Transmission lines can only be so "hard," and it is costly to bury them or repeatedly rebuild them after storms.[280] Beyond the need for some critical hardening, there is growing recognition of the importance of *resilient* resources—those that that can continue operating during storms and provide power when extreme weather or wildfires cause larger grid outages.[281] More localized resources, such as microgrids powered by fuel cells or solar panels and batteries, are critical to resilience. Microgrids are relatively small generation sources, often with back-up storage in the form of batteries, that power a small cluster of buildings, such as a hospital, university campus, or critical buildings within a neighborhood such as gas stations, grocery stores, emergency shelters, and schools.[282] These microgrids can generate power during normal grid conditions and even feed excess power back into the grid. During emergencies, they can also be "islanded" (disconnected) from the larger grid, meaning that they can continue producing power for the small cluster of buildings to which they are connected.[283]

NERC is actively considering the potential deployment these resources—most notably, distributed energy resources (DER). But while doing so, NERC has largely treated these as a reliability *risk*, not a potential boon—

[278] Fed. Energy Reg. Commn., Order on Compliance Filings, Docket No. RR19-7-001 at 10 (Jan. 19, 2021).

[279] *See, e.g.*, Ellen Meyers, Fla. investor-owned utilities propose investing $19.4B in grid hardening, S&P Global, Apr. 16, 2020, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/fla-investor-owned-utilities-propose-investing-19-4b-in-grid-hardening-58051086; Stephanie Eyocko, Utilities need to harden the grid as they green it. Consumers aren't ready for the cost, Utility Dive, Feb. 26, 2021, https://www.utilitydive.com/news/utilities-need-to-harden-the-grid-as-they-green-it-consumers-arent-ready/595719/. There are ongoing debates over people's willingness to pay for reliability. A 1975 study suggested that the one outage in ten year standard is too stringent of a reliability standard and that a five-day outage every ten years may be more reasonable from a cost-benefit perspective. Michael L. Telson, The Economics of Alternative Levels of Reliability for Electric Generation Systems, 6 Bell J. Econ. (1975).

[280] Peter H. Larsen, Lawrence Berkeley Natl. Lab., A Method to Estimate the Costs and Benefits of Undergrounding Electricity Transmission and Distribution Lines 6-7 (2016), https://eta-publications.lbl.gov/sites/default/files/lbnl-1006394_pre-publication.pdf.

[281] Hirsch et al., *supra* note @.

[282] Microgrids 101, Better Buildings U.S. Dept. of Energy, https://dg.resilienceguide.ornl.gov/microgrids; Lili Francklyn, Community Energized: Hartford, Connecticut, Powers Up Fuel Cell Microgrid, Apr. 25, 2017, Homer Microgrid News, https://microgridnews.com/connecticut-powers-up-hartford-fuel-cell-microgrid/.

[283] Islanding a Microgrid, U.S. Dept. of Energy, https://www.energy.gov/eere/femp/articles/islanding-microgrid.

even as it has been slow to adopt standards that might help instill confidence in DER as a grid reliability solution.[284] An additional proactive role that NERC has taken to address growing grid reliability threats—particularly cybersecurity—is to secure more coordination and communication between a system that collects and records real-time information on bulk power system security incidents (physical and cyber threats) and NERC Standards personnel.[285] The goal is for those at NERC who draft reliability standards to better understand the physical threats and cyber incidents that are occurring and to conduct a "reliability gap analysis" to identify weaknesses or holes in standards that need fixing.[286] Furthermore, NERC's Electricity Information Sharing and Analysis Center periodically organizes, with U.S. government agencies and its registered entities, a simulation in which the U.S. electric grid experiences a simultaneous cyber and physical attack; all registered entities participating in the exercise must respond in real-time and analyze the effectiveness and gaps in the response.[287]

On the whole, however, NERC's forward-looking reports and assessments do not consistently translate to modern standards or recommendations. NERC has a two-faced approach to modern grid reliability: talking a good talk, on the one hand, about the changing grid, but failing to do much about it, on the other. This inaction is not benign. On the contrary, as the next subpart shows, it has reverberating consequences that not only weaken grid reliability but impede the clean energy transition.

D. NERC Performance Under Pressure: Entrenchment, Not Innovation

Recall that NERC is a central player in a wider web of reliability governance. The standards it sets—for load-resource balance and grid planning, development, and operations—filter into decisions made by FERC, RTOs, states, balancing authorities, regional entities, utilities, and beyond.[288] This subsection explores how NERC's standards and reports—developed by private actors, and used by these same private actors in other reliability settings—perpetuate large, centralized fossil fuel-fired generation. These actions, which impede decarbonization efforts and thus contribute to greater climate impacts that threaten grid infrastructure, also appear to cause underinvestment in modern reliability needs, such as reactive and flexible power. These biases manifest in

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[284] North Am. Electr. Reliability Corp., Distributed Energy Resources: Connection Modeling and Reliability Considerations (2017). This task force report recommended the publication of a set of guidelines to help bulk power system owners and operators "account for the impact of DER" in their modeling; further evaluating requirements for sharing information about DER at the transmission-distribution interface, and other improvements to modeling. *Id.* at 6, 26.

[285] Order on Compliance Filings 10, 174 FERC ¶ 61,030, https://cms.ferc.gov/sites/default/files/2021-01/E-4-RR19-7-001.pdf.

[286] *Id*.

[287] North Am. Electr. Reliability Corp. & Electr. Info. Sharing and Analysis Ctr, *supra* note xx, at iv..

[288] See supra Part II.

four patterns: (1) NERC's preference for baseload resources, (2) anti-renewables reliability standards, (3) NERC's influence over resource adequacy interventions; and (4) self-serving reliability reports.

1. NERC's Preference for Baseload Resources

In numerous reports, NERC has expressed concern about the reliability challenges that are arising because of the retirement of baseload generators that can provide electricity when called on.[289] These are generators that run nearly all of the time to cover the base level of electricity demand that is present all of the time. According to NERC, additional reliability challenges exist in regions that do not have large numbers of resources capable of storing fuel (gas or coal) onsite.[290] When severe weather disrupts pipeline service or creates supply shortfalls, generators that store fuel onsite can provide crucial reliability services,[291] since they can draw on reserves when they are unable to purchase fuel in real-time markets. Similarly, power plants that enter into firm contracts for gas receive uninterruptible (guaranteed) service from gas pipelines and are therefore more likely to be able to receive fuel during emergency conditions. And dual-fuel resources, which are electricity generating units that can switch from one fuel type (gas) to another (petroleum), can support reliability because

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[289] *See, e.g.*, N. Am. Electr. Rel. Corp., Generation Retirement Scenario: Special Reliability Assessment Report, at v. (Dec. 18, 2018), https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_Retirements_Report_2018_Final.pdf ("The key conclusion is that generator retirements are occurring, disproportionately affecting large baseload, solid-fuel generation (coal and nuclear). If these retirements happen faster than the system can respond with replacement generation, including any necessary transmission facilities or replacement fuel infrastructure, significant reliability problems could occur."). We agree that the retirement of fuel secure generation assets is creating reliability challenges, especially in New England, but disagree that the only solution to fuel security issues is to intervene to ensure that fossil resources continue to operate. *See also* N. Am. Elec. Reliability Corp., Potential Reliability Impacts of EPA's Proposed Clean Power Plan: Initial Reliability Review (2014), http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/Potential_Reliability_Impacts_of_EPA_Proposed_CPP_Final.pdf (expressing concerns about coal plant retirements under the EPA's proposal to regulate greenhouse gas emissions from existing power plants); K.K. DuVivier et al., *Transmission and Transport of Energy in the Western U.S. and Canada*, 52 Idaho L. Rev. 387, 422 (2016) (characterizing NERC's concerns as being "premised on the understanding that baseload resources inherently promote grid reliability and stability by providing stable energy output to satisfy consumer energy demand").

[290] See N. Am. Electr. Rel. Corp., Reliability Guideline Fuel Assurance and Fuel-Related Reliability Risk Analysis for the Bulk Power System (Mar. 2020), https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Fuel_Assurance_and_Fuel-Related_Reliability_Risk_Analysis_for_the_Bulk_Power_System.pdf.

[291] Caveat that this has not always worked.

they can operate if their primary fuel type becomes unavailable.[292] In recent years, these capabilities have provided crucial reliability services.[293]

Perhaps for these reasons, NERC has urged states, RTOs, and vertically integrated utilities to make sure that these resources continue to play a role in the future resource mix.[294] It has repeatedly observed that accelerated retirements of baseload resources, lack of firm fuel service contracts, and insufficient levels of dual-fuel resources have left the grid vulnerable to severe blackouts. To address these issues, it has suggested "market (e.g., capacity market reforms) or out-of-market solutions. . . to maintain or enhance fuel delivery contracts."[295] In so doing, NERC seems to embrace a dated view that baseload resources capable of storing fuel onsite are to the primarily solution needed to maintain reliability. These, of course, are the types of reliability interventions that have historically been used to meet the country's energy needs. NERC's proposals therefore follow this questionable logic: "The reliability challenges caused by a changing generation portfolio exist because the portfolio is changing; the solution to this changing portfolio is to keep gas and coal plants online, and to make sure that they have sufficient supplies of gas and coal."

NERC's responses to recent reliability crises perpetuate this logic. The joint FERC-NERC-regional entity report retroactively assessing the causes of the 2021 Texas blackout and recommending solutions (28 of them, to be exact) focuses almost entirely on shoring up traditional generation resources and fuel supplies rather than the transformative grid solutions that NERC has identified as essential for a decarbonized and climate-vulnerable grid.[296] One might assume that because NERC has limited jurisdiction over many of the aspects of a modernized grid—the need for expanded transmission lines, increased reliance on distributed energy and storage, and greater demand response, for example—it had a reasonable excuse for such a traditional focus. But NERC is rarely

[292] See Energy Information Admin., Natural Gas-Burning Power Plant Operations Vary During Periods of Cold Weather (Jan. 14, 2019), https://www.eia.gov/todayinenergy/detail.php?id=37992 (observing benefits of dual-fuel resources during cold snaps).
[293] Id.
[294] Id. at 2 ("RTOs/ISOs that have not already done so could consider additional mechanisms for generators to meet their obligations during reserve shortages—these could be market (e.g., capacity market reforms) or out-of-market solution. . . . Such market rules and mechanisms would incentivize generators to maintain or enhance fuel delivery contracts.")
[295] *Id*.
[296] Fed. Energy Reg. Commn. & North Am. Electr. Reliability Corp., The February 2021 Cold Weather Outages in Texas and the South Central United States (2021), https://www.ferc.gov/media/february-2021-cold-weather-outages-texas-and-south-central-united-states-ferc-nerc-and.

bashful about suggesting what entities beyond its jurisdiction should do within traditional reliability contexts.[297]

The NERC-FERC-regional entity report on the 2021 blackout expressly recommends a variety of specific steps to be taken by other actors. It proposes that states and RTOs should modify markets and rates to ensure that generators can recover the costs of winterization, and that state oil and gas commissions should require weatherization of wells, for instance.[298] This report embodies NERC's continued view that natural gas is the essential 'fuel that keeps that lights on" in the face of variable resources and growing weather extremes.[299]

There are two problems with NERC's preferred solutions: the first is that there is considerable evidence that alternative solutions may be more effective at supporting reliability in a grid based primarily on inverter-based resources (i.e., renewables); the second is that additional inverter-based resources create new reliability challenges that cannot be met by continuing to rely on the old paradigm of baseload and peaker generation.

As multiple studies have shown, a variety of resources and market interventions can support reliability.[300] Increased battery storage, non-carbon intensive firm resources like hydro and geothermal power, real-time electricity pricing that incentivizes consumers to use less electricity during periods of high demand (load), and demand response programs that pay consumers for these load reductions are just some tools that can improve the grid's performance.[301] As traced above, NERC has acknowledged the need for more diverse reliability solutions, pointing out, for example, that additional electricity transmission capacity would make the grid more reliable and more resilient, that storage can provide ramping services, and that emerging technologies have the potential to provide additional reliability benefits.[302] Nevertheless, NERC's reports typically

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[297] *See, e.g.*, *id*. (recommending the formation of a natural gas-electricity reliability forum); Reliability Guideline at 3, https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Gas_Electric_Guideline.pdf (recommending face-to-face meetings between natural gas operators—beyond NERC's jurisdiction—and power plant operators).

[298] Fed. Energy Reg. Commn. & North Am. Electr. Reliability Corp., *supra* note 305, at xx.

[299] Comments of the North American Electric Reliability Corporation, Docket No. AD21-13-000, https://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/NERC_Comments_AD21-13%20Extreme%20Weather.pdf. NERC insists that there is no way around this conclusion "unless or until very large-scale battery deployments are feasible or an alternative flexible fuel such as hydrogen can be developed." *Id.*

[300] Collect.

[301] *See* Stein, *Distributed Reliability*, *supra* note xx.

[302] *See, e.g.*, North Am. Electr. Reliability Corp., Impacts of Electrochemical Utility-Scale Battery Energy Storage Systems on the Bulk Power System (2021), https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/Master_ESAT_Report.pdf; Testimony of James B. Robb, President and Chief Executive Officer, North Am. Electr. Reliability Corp., Reliability, Resiliency, and Affordability of Electric Service in the United

treat baseload, fuel-secure resources as the preferred reliability solution and often directly advocate for market interventions that give special treatment to these resources.[303]

Because of its expertise, meta-regulatory status, and criticality, NERC's interventions carry real weight. When the organization pushes recommendations that favor certain resources over others, the grid follows—even if these aims are contrary to decarbonization goals advanced by federal and state legislatures. When NERC pushes for reforms that require the use of energy produced from coal, gas, and nuclear, it gives a justification for rules that make it impossible for these other resources to displace fossil resources in the future.

Moreover, NERC's support for baseload resources runs counter to the demands of the modern grid—demands that the organization has itself acknowledged. Emerging reliability challenges simply cannot be resolved by doubling down on baseload and fuel-secure resources. High levels of renewables change the characteristics of the grid. There is increased need for flexibility, including for fast-ramping resources, demand flexibility, and resources that provide inertia support (energy that continues being generated even after a plant temporarily halts, as with a spinning turbine in a generator, and that provides the few seconds needed for equipment at the plant to correct the failure and get the plant back online).[304] Baseload resources do not necessarily possess any of these characteristics, such that many of NERC's proposals do not appear to respond to the actual reliability challenges that renewables introduce. And instances where NERC does recognize the need for flexibility, it defaults to natural gas as the

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States Amid the Changing Energy Mix and Extreme Weather Events 9 (2021), https://www.nerc.com/news/Headlines%20DL/NERC%20Reliability%20Hearing%20Testimony%203-11-21%20-%20Final.pdf (noting that "[e]lectric transmission investment must keep pace with the increase in utility scale wind and solar resources, which are generally located outside of major load centers" and transmission investment can improve grid resilience).

303 *See, e.g.*, *supra* note @; North Am. Electr. Reliability Corp.. 2022 State of Reliability at 26-27,
https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2022.pdf ("Until storage technology is fully developed and deployed at scale, natural-gas-fired generation will remain a necessary balancing resource to provide increasing flexibility needs. . . . [Intermittent baseload resources and distributed energy resources increase variability and uncertainty in demand, so they require careful attention in planning for resource adequacy . . . .").

304 *See, e.g.*, Shakir D. Ahmed et al., *Grid Integration Challenges of Wind: A Review*, 8 IEEE ACCESS 10857, 10861 (2020) (noting the importance of "load control" (demand reduction) and storage when large amounts of intermittent wind energy are interconnected with the grid); Adam Hirsch, Yael Parag, and Josep Guerrero, *Microgrids: A review of technologies, key drivers, and outstanding issues*, 90 RENEWABLE AND SUSTAINABLE ENERGY REVS. 402 (2018) (noting that microgrids maximize "reliability and resilience in the face of natural disasters, physical and cyber attacks and cascading power failures"); Congr. Res. Svc., Maintaining Electric Reliability with Wind and Solar Sources: Background and Issues for Congress 10-11 (2022) (listing key factors for reliability with higher penetration of renewables).

obvious answer—despite evidence that natural gas itself may lack the flexibility NERC reflexively imbues it with.[305]

2. Anti-Renewable Reliability Standards

NERC's apparent preference for traditional fossil generators extends to specific reliability standards that (a) do not address today's reliability challenges and (b) ensure that fossil resources will continue to address reliability needs even when alternatives are available.

Some NERC standards directly favor traditional baseload resources. For example, NERC assigns reserve margins that establish a target amount of unused capacity that should be available in an electric power system.[306] Typically, NERC sets a goal of fifteen percent reserve margins.[307] That means that, when the grid is operating, NERC targets fifteen percent excess capacity that is available but not producing energy. Reserve margin is a concept that was designed for markets that rely primarily on baseload and peaker power plants. When demand increases or certain suppliers are unavailable, the excess capacity procured to comply with NERC target reserve margins could be counted on to provide energy.[308]

That approach to resource adequacy no longer makes sense. Recent blackouts have revealed that the risks associated with extreme events are correlated. It is unlikely that only a few gas pipelines and generators freeze during periods of extreme cold. Instead, if gas prices go up or extreme cold causes some gas lines to go down, it is likely that many of them will be unavailable.[309] Similarly, when weather patterns reduce output from some solar

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[305] For example, far from keeping the lights on during Winter Storm Uri, over-reliance on (unweatherized) natural gas infrastructure was a key cause of Texas's 2021 blackout. *See supra* note @. Sometimes NERC itself recognizes these risks, even as it continues to push gas as a solution. *See, e.g.*, Comments of the North American Electric Reliability Corporation, *supra* note @ ("High reliance on natural gas-fired generation and limited natural gas infrastructure elevates reliability risk .in some . . . areas.").

[306] N. Am. Electr. Rel. Corp., M-1 Reserve Margin, https://www.nerc.com/pa/RAPA/ri/Pages/PlanningReserveMargin.aspx#:~:text=If%20not%20provided%2C%20NERC%20assigned,percent%20for%20predominately%20hydro%20systems.

[307] *See id*. ("If not provided, NERC assigned 15 percent Reserve Margin for predominately thermal systems and 10 percent for predominately hydro systems.").

[308] Recent blackouts have suggested those resources are not as reliable as regulators once thought, however, as exemplified by the failure of more than half of all generation capacity in Texas during the winter freeze of 2021—a failure that could not have been fixed by a reasonable capacity reserve margin. Univ. of Tex. at Austin Energy Institute, The Timeline and Events of the February 2021 Texas Electric Grid Blackouts 9, https://www.puc.texas.gov/agency/resources/reports/utaustin_(2021)_eventsfebruary2021texasblackout_(002)final_07_12_21.pdf.

[309] *Cf.* ERCOT, *supra* note 263, at 8-9 (showing that twelve percent of all generation outages in the ERCOT (Texas) region in 2021 were caused by fuel limitations and that 53 percent were

arrays or wind turbines, they cause all such resources to reduce output in the region that is adversely affected by the weather event.

Correlated generator failures mean that the concept of a reserve margin is a relatively blunt instrument for ensuring that a region's capacity is capable of supporting its reliability needs. For that reason, academics and some policymakers have consistently pushed for a more systems-based approach in which regulators consider how the various parts of the energy system work in tandem to support reliability.[310] If all the resources that meet NERC's reserve margins face correlated risks, then even regions with excess reserve margins will struggle to maintain reliable power during extreme weather events.

The challenge of a reserve-margin-based approach to reliability became apparent during blackout events in the past few years, where a significant percentage of regions' reserves were unavailable. It is therefore necessary to diversify the resource mix and stress test the grid to make sure it can withstand the actual reliability issues it will face. Certain types of capacity may be much more valuable than others under the stresses of climate change. For example, increased transmission capacity can reduce the extent to which risks are correlated because it allows regions to import power from non-supply constrained regions. If one part of the country faces a cold snap that prevents gas-fired generators from operating, reserves that come from other regions that are not supply constrained will be better able to support reliability.

At the same time, reserve margins also have essentially no bearing on the flexibility of a region's grid. If a region struggles—as California does—with managing significant *ramps* of energy, rather than with managing total peak energy demand, then a reserve margin measurement of reliability has little to offer it.

When regions implement rules based on NERC's target reserve margins, they ensure the continued operation of resources that do not meet today's changing reliability needs. Out-of-market payments to baseload and peaker power plants keep those units online, often for years. Those interventions are justified on the ground that those resources will help meet the region's reliability needs. But if those resources are being paid to provide reliability services they do not in fact provide, or if it was possible for renewables or less carbon-intensive resources to meet those reliability needs, then resource adequacy interventions that are based on NERC reserve margins provide a windfall for fossil generators.

Other NERC standards seem problematic for the climate transition because NERC appears to be playing catch-up to the reliability challenges

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caused by the direct impacts of cold on power plants, such as frozen valves or water lines at the power plants).

[310] *See, e.g.*, Stein, *Regulating Reliability*, *supra* note 13; Klass et al., *supra* note 5.

created by inverter resources. Inverter resources—including wind and solar—are "asynchronously connected to the electric grid and are either completely or partially interfaced with the BPS through power electronics."[311] Inverter resources pose a challenge for NERC's traditional thinking about frequency response—that is, the need to maintain consistent electrical frequency on the grid to prevent cascading outages.[312] If transmission lines go down, some generators need to reduce output or shut down to avoid overloading the lines that continue to function. A common way to manage small frequency disruptions is by relying on spinning reserves—reserves provided by units that operate at partial capacity and can increase or decrease output to maintain proper frequency. But wind and solar resources cannot control their output,[313] so these units are programmed to disconnect from the grid—to "trip"—if the frequency declines past a certain point. Otherwise, their continued operation might overload a disrupted system and potentially cause cascading failures.

NERC standards that do not consider the distinct challenges inverters pose for frequency regulation are another example of how NERC is not managing some of the technical challenges associated with the energy transition. For example, two California fires showed that NERC standards have prevented renewables from providing reliability services that they are capable of providing. In 2016, two fires in Southern California created multiple transmission line faults.[314] As required by NERC standards, the transmission failures caused 1,200 MW of solar PV generation to stop generating power. Those additional losses significantly exacerbated the scale of the California's outages.[315]

However, there was no need for the solar to trip. It turned out that the NERC standard was written unnecessarily broadly such that solar would trip whenever frequency of a nearby line fell below a certain level.[316] Thus, thousands of Californians lost power because solar tripped even though the grid was capable of using energy generated from those resources. Here, NERC's standard was harmful both to renewables' financial performance and to made the grid less reliable.

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[311] See Orange & Rockland, Inverter-Based Resources Performance Requirements (2020), https://www.pjm.com/-/media/planning/planning-criteria/oru-inverter-based-resources-performance-requirements.ashx, at 4.
[312] See *supra* note @ and accompanying text.
[313] At least, if not connected to battery devices.
[314] N. Am. Electr. Rel. Corp., 1,200 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report: Southern California 8/16/2016 Event (June 2017), https://www.nerc.com/pa/rrm/ea/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_Interruption_Final.pdf
[315] *Id*.
[316] FERC, Reliability Standards to Address Inverter-Based Resources 28-29 (2022) (noting unexpected tripping and "momentary cessation" of inverter-based resources under NERC's old standard).

3. NERC's Influence Over Resource Adequacy Interventions

The recommendations contained in NERC reliability reports have a robust afterlife. Oftentimes, NERC's findings support market interventions by other actors that ensure that carbon-intensive resources will continue to be a part of the United States' energy mix. For example, in 2017, the Department of Energy (DOE) became concerned about the retirement of baseload generation. DOE proposed that FERC adopt a rule to remove baseload resources such as coal and nuclear from energy markets and guarantee them rate recovery. In support of this intervention, DOE mentioned NERC documents *161 times*—observing again and again that "NERC is concerned with the trend of [baseload] retirements as it relates to reliability and resilience."[317] In particular, DOE cited NERC documents that discussed gas deliverability challenges,[318] that emphasized the need for baseload generators,[319] and that expressed concern about the "impact of premature retirements" of conventional units such as coal plants [that] provide frequency response services."[320]

DOE's proposed fuel security rule was a striking, and likely politically motivated, attempt to support coal, which had experienced poor financial performance for years. And while FERC declined to implement DOE's proposal, in other cases, NERC's defense of traditional baseload generation has been used to justify market interventions that favor those types of resources. For example, after NERC announced that accelerated retirements of baseload resources had left MISO—the Midwestern RTO—vulnerable to blackouts, MISO used that announcement to justify the development of market interventions that would ensure that gas-fired resources would be exempted from many of the competitive pressure other resources face.[321]

Utilities also use NERC standards to justify out-of-market payments to fossil resources. An important example of this is the use of reliability-must-run agreements that guarantee certain generators cost recovery. Grid operators use reliability-must-run agreements to prevent resources that provide essential services from retiring. When these resources cannot recover their costs from energy and capacity market revenues, they will retire. RTOs guarantee cost recovery to prevent such resources from retiring when a unit's retirement would result in the violation of a NERC standard.[322] In all regions, therefore, grid

[317] U.S. Dep't of Energy, Staff Report to the Secretary on Electricity Markets and Reliability 8 (Aug. 2017), https://www.energy.gov/sites/default/files/2017/08/f36/Staff%20Report%20on%20Electricity%20Markets%20and%20Reliability_0.pdf.
[318] *Id*. at 12.
[319] *Id*. at 14.
[320] *Id*. at 64.
[321] CITE and add detail to new MISO capacity market stuff.
[322] *See* MISO, Improvements to the Attachment Y Retirement Process PAC-2022-1,

operators review announced retirements and ensure that resources that provide crucial reliability services remain online.

It is common for units to receive cost recovery through reliability-must-run agreements when their retirement would cause the region to fall out of compliance with a NERC reliability standard. For example, the potential retirement of the Mystic Exelon Power Station in Massachusetts, a six-unit, 1,413 MW gas-fired generation facility in Everett, Massachusetts, prompted ISO-NE to guarantee the power plant $400 million in revenue over a two-year period.[323] The decision to grant cost recovery was justified in large part because the plant's retirement would cause lead to reliability issues.

Another recent reliability-must-run agreement in Michigan's Northern Peninsula highlights the extent to which sophisticated players can take advantage of multiple seemingly neutral NERC standards to benefit their own financial interests. One of NERC's responsibilities is to certify balancing authorities, which are the entities that make sure that supply and demand are perfectly matched in real time. To certify a balancing authority, NERC performs technical assessments designed to ensure that the balancing authority is able to match physical power flows to system needs.[324] NERC does not consider whether utilities are creating the balancing authority to engage in anticompetitive behavior. FERC and state PUCs have jurisdiction over market power issues.

MISO Plant Retirements, https://www.misoenergy.org/stakeholder-engagement/MISO-Dashboard/improvements-to-the-attachment-y-retirement-process/ (first file under Documents/Whitepapers tab) (detailing criteria for system support resources, including the "presence of unresolved reliability violations"); Cal. Ind. Sys. Op., Clarifications to the Reliability Must Run Designation Process (Sept. 22, 2021), http://www.caiso.com/InitiativeDocuments/StrawProposal-ClarificationstoReliabilityMustRunDesignationProcess.pdf (describing region's Reliability Must Run contracts designed to "maintain reliability compliance . . .with all NERC, WECC, and ISO reliability standards"); New York Ind. Sys. Op., Manual 12: Transmission and Dispatch Operations Manual, SPP, Study Estimate Design Guide (Jul. 22, 2011), https://www.spp.org/documents/17128/spp%20study%20estimate%20design%20guide%20dbp pctf%20final%2020110722.pdf ("Criteria for employing protection and control principles in the design and construction of new substations must adhere to NERC Reliability Standards and SPP Criteria, as well as individual TO standards."); ERCOT, Reliability-Must-Run Procedures, https://www.ercot.com/files/docs/2016/06/03/OnePager_RMR_May2016_FINAL.pdf (describing Texas's reliability must run agreements, based on "reliability criteria set forth by the North American Electric Reliability Corporation (NERC) and relevant guidelines in ERCOT's protocols and operating guides").

[323] *Mystic Generating Station*, Constellation Energy, https://www.constellationenergy.com/our-company/locations/location-sites/mystic-generating-station.html; Josh Resnik, Exelon battling environmental realities to keep Mystic Generating Station Open, EVERETT LEADER HERALD, June 17, 2020, https://everettleader.com/2020/06/17/exelon-battling-environmental-realities-to-keep-mystic-generating-station-open/.

[324] NERC Certification Review Summary Report at 2 (2023) (explaining balancing authority responsibilities and relevant NERC requirements).

In 2014, NERC certified a balancing authority for the Michigan Upper Peninsula.[325] It did so in response to a petition from Wisconsin Electric to split the Wisconsin Electric Balancing Authority into two separate balancing authority—one for Wisconsin and the other for the Michigan Upper Peninsula.[326] When NERC reviewed Wisconsin Electric's petition, it sought to evaluate whether the new balancing authority had "the necessary processes, procedures, tools, training, facilities, and personnel to perform the function as a NERC-certified BA"[327] After finding that it did, NERC certified the new balancing authority.[328]

It seems possible that Wisconsin Electric's motivation for this petition was rooted in a desire to pass costs onto other utilities, as the change allowed the company to recover the costs of a coal unit it owned from utilities that served the Upper Michigan Peninsula.[329] It turned out that, once NERC certified the new balancing authority, the retirement of one of Wisconsin Electric's coal-fired power plants would have caused the newly certified Upper Michigan Balancing Authority to fall out of compliance with NERC frequency standards. As a result, under NERC rules, two of Wisconsin Electric's coal-fired power plants were automatically entitled to system-wide cost recovery as system support resources (MISO's term for reliability-must-run agreements).

In these examples, NERC standards that appear to be facially neutral—for example, standards that require frequency regulation or the designation of a balancing authority—empower other market actors to make investment decisions that protect their own resources.

4. Drafting Reliability Reports

Our final example of NERC's problematic approach to reliability regulation in the electric era stems from its interrelationship with its sub-entities. One of the confusing aspects of NERC regulation is that, although NERC is nominally the nation's primary reliability regulator, in reality, NERC delegates many of its substantive responsibilities to regional entities. These entities often

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[325] N. Am. Electr. Rel. Corp., NERC Balancing Authority Certification Final Report Michigan Upper Peninsula (MIUP) (Aug. 28, 2014), https://www.nerc.com/pa/comp/Organization%20Certification%20DL/BA%20Certification%20of%20Michigan%20Upper%20Peninsula%20(MIUP).pdf.

[326] 150 FERC ¶ 61,105, at 2 (Feb. 19, 2015).

[327] N. Am. Electr. Rel. Corp., NERC Balancing Authority Certification Final Report Michigan Upper Peninsula (MIUP), at 4 (Aug. 28, 2014), https://www.nerc.com/pa/comp/Organization%20Certification%20DL/BA%20Certification%20of%20Michigan%20Upper%20Peninsula%20(MIUP).pdf.

[328] *See id*.

[329] Neighboring utilities directly alleged as much. Utilities objected that Wisconsin Electric used the NERC process for designating balancing authorities "to gerrymander its LBA for the sole purpose of significantly shifting costs" to utilities that operated on the Upper Peninsula of Michigan. See 150 FERC ¶ 61,105, at 13 (Feb. 19, 2015).

draft reports and perform research about their own regions' vulnerability to extreme weather events and other reliability challenges.[330] This arrangement creates confusing and misleading lines of accountability that allow utilities to essentially bolster self-serving takes on regional reliability under the guise of NERC's expertise.

For example, NERC performs seasonal reliability assessments in which it "reports on areas of concern regarding the reliability of the North American [bulk power system]."[331] These reports often follow the pattern described above, where NERC emphasizes the need for baseload resources and resources that can store fuel onsite.[332] The irony of these reports, however, is that in many situations, the regional entity that manages a particular region drafts the sections for that region. Thus, for example, when NERC says that SERC, the regional entity for the southeast, is "projected to maintain sufficient capacity to meet the reliability PRM during the assessment time frame,"[333] it is actually drawing from regional entity assessments.

From an accountability standpoint, this produces perverse results. To trace this example all the way down: SERC—NERC's regional entity for the southeast—contributed these conclusions to NERC. SERC, in turn, is

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330 *See, e.g.*, 2021 SPP Loss of Load Expectation Study Report 5, https://www.spp.org/documents/67465/2021%20spp%20lole%20study%20report.pdf (reporting results of required biannual study on whether region had adequate reserves to meet its "one [electricity outage] day in ten years" standards); MISO's Response to the Reliability Imperative 2 (2022) (highlighting reliability challenges of renewables, including that "[w]ind and solar resources are not always available to provide energy during times of need," "renewables must sometimes be curtailed due to transmission constraints," and "[t]he region's penetration of distribution-level and behind-the-meter resources is increasing, yet MISO does not have functional control or visibility into how these resources may affect the larger grid system"), Some regional entity reports provide valuable assessments of underexplored impacts of distributed renewable resources, such as displacement of large-scale solar and wind. WECC, Impact of High Distributed Energy Resources, https://www.wecc.org/Administrative/Executive%20Summary%20-%20Impact%20of%20High%20Distributed%20Energy%20Resources%20Study%20Assessment.pdf (noting the reliability challenges posed by DERs and the fact that they caused curtailment of solar and wind). Other regional entity reports on reliability may create a false sense of adequate standards when in fact there is a need for updating. *See infra* note @ and accompanying text (re: weatherization standards).

331 NERC, 2022–2023 Winter Reliability Assessment 3, https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_WRA_2022.pdf.

332 *Id.* at 4 (emphasizing consequences of nuclear and coal-fired generation retirements on declining reserves); *id.* ("Reliable operation of the thermal generating fleet is critical to winter reliability, and assured fuel supplies is an ongoing winter reliability concern. . . . Low fuel storage levels coupled with a range of potential fuel resupply challenges are creating additional risks for winter regional BPS reliability.").

333 NERC, 2021 Long-Term Reliability Assessment, at 99 (Dec. 2021), https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2021.pdf.

predominantly governed by the Southeast utilities that are building the resources needed to support reliability in the Southeast. NERC, in turn, is governed by many of the same utilities that make up SERC's governing board. Thus, southeast utilities wrote a report saying that those utilities had made investments needed to keep the lights on in their region—but laundered these conclusions up through a putatively neutral NERC assessment. This is a far cry from the independence, alignment of interests, and public-oriented incentives needed for a successful SRO.

E. FERC's Role in Filling Modern Reliability Gaps

Thus far, we have built a case that NERC's approach to the reliability challenges of the electric era falls short of what is needed, and indeed may retrench a cascading and perverse reliance on fossil fuels. But is the SRO really to blame, or should responsibility lie with FERC? In this final subsection assessing NERC's modern performance, we explain why—for legal and jurisdictional reasons—FERC has not been able to close the gaps created by NERC.

In some respects, FERC has been more aggressive than NERC in identifying and attempting to address changing risks to grid reliability and reliability "gaps" (in FERC's words).[334] In 2021, FERC commenced a proceeding entitled "Climate Change and Extreme Weather," designed to address the threats to grid reliability that extend far beyond the Southern cold snap of 2021.[335] As its name suggests, this proceeding aimed to require NERC to do more to address grid risks posed by climate and extreme weather—the very risks that NERC has spoken about in reliability assessments but largely ignored in its standard-drafting process. FERC proposed to require transmission providers to study extreme weather conditions and the generation resources available to them during such conditions and to implement actual solutions where the grid failed to perform as needed during extreme events.[336] These proposed rules are in stark contrast to current NERC approaches, which do not mandate corrective actions—only general planning for weather extremes—and do not require planning for extreme weather than can "affect wide geographical areas simultaneously over several days."[337]

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[334] *See, e.g.*, Fed. Energy Reg. Commn., FERC Moves to Close Gap in Reliability Standards for Electric Grid Cyber Systems, Jan. 20, 2022, https://www.ferc.gov/news-events/news/ferc-moves-close-gap-reliability-standards-electric-grid-cyber-systems.

[335] Fed. Energy Reg. Commn., FERC Acts to Boost Grid Reliability Against Extreme Weather Conditions, June 16, 2022, https://cms.ferc.gov/news-events/news/ferc-acts-boost-grid-reliability-against-extreme-weather-conditions.

[336] One-Time Informational Reports on Extreme Weather Vulnerability Assessments; Climate Change, Extreme Weather, and Electric System Reliability 87 Fed. Reg. 39414 (proposed rule, July 1, 2022).

[337] Fed. Energy Reg. Commn.,Staff Presentation I NOPR on Transmission System Planning Performance Requirements for Extreme Weather, June 16, 2022, https://www.ferc.gov/news-events/news/staff-presentation-nopr-transmission-system-planning-performance-requirements/.

FERC does other gap filling by writing its own rules when NERC rules lapse or expire. For example, when NERC guidance on calculating available space in transmission lines was set to retire, FERC proposed and finalized rules requiring transmission lines operators to accurately rate their lines for available space.[338] This is a key consideration for avoiding overcrowding (congestion) of the wires, thereby mitigating the risk of blackouts. These ratings also help lower prices for consumers and inform new generation where to locate on the system.[339] Indeed, FERC justified its jurisdiction in this area by noting that transmission line congestion directly affects wholesale electricity rates.[340]

Similarly, FERC has had to force NERC into an adequate response to the reliability issues posed by inverter-based resources (IBRs, which are mostly renewables).[341] As FERC noted in a series of November 2022 actions on these resources, NERC has taken numerous steps to identify the challenges related to inverter-based resources—including a task force, incident reports, technical reports, and a strategy document.[342] FERC found, however, that NERC's "actions to date have not successfully addressed the most common reliability issues posed by IBRs."[343] Consequently, FERC ordered NERC to act—and to act expeditiously. In a Notice of Proposed Rulemaking, FERC required NERC to develop, within 90 days, a plan to develop reliability standards "addressing four reliability gaps pertaining to IBRs: (1) data sharing; (2) model validation; (3) planning and operational studies; and (4) performance requirements." [344] In forcing NERC to set necessary standards, FERC took note of the fact that NERC had already described the integration of IBRs as "the most significant driver of grid transformation."[345]

The slow implementation of mandatory weatherization standards for generators offers another example of foot dragging. Following several cold snaps in the South, FERC repeatedly recommended mandatory weatherization standards. However, regional entities and NERC demurred.[346]

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[338] FERC Order No. 881, Final Order Regarding Managing Transmission Line Ratings (2021).
[339] *Id*.
[340]JDSUPRA, FERC Issues Proposed Rulemaking on Transmission Line Ratings, Dec. 11, 2020, https://www.jdsupra.com/legalnews/ferc-issues-proposed-rulemaking-on-24323/.
[341] See supra note @ and accompanying text introducing inverter-based resources.
[342] Registration of Inverter-Based Resources, 181 FERC ¶ 61,124 at PP. 28-29 (Nov. 17, 2022).
[343] *Id.* at P.29. NERC did itself propose one change to its reliability standards in response to its work studying IBRs, but this was a fairly minor definitional shift. *See* Order Approving Reliability Standards FAC-001-4 and FAC-002-4, 181 FERC ¶ 61,126 (Nov. 17, 2022).
[344] See Notice of Proposed Rulemaking, Reliability Standards to Address Inverter-Based Resources, 181 FERC ¶ 61,125 (Nov. 17, 2022).
[345] *Id.*
[346] For regional entity reports recommending but not mandating winterization measures, *see, e.g.*, Reliability First, Reliability First's Review of Winter Preparedness Following the Polar Vortex 7 (2018), https://rfirst.org/about/publicreports/Public%20Reports/RF%20Review%20of%20Winter%20Preparedness%20Following%20the%20Polar%20Vortex.pdf (providing that "entities *should*

It was only after the 2021 reliability crisis in the South, coupled with by pressure from FERC's chairman to implement mandatory winterization standards, that NERC finally commenced a standard-review and standard-setting process for reliability during extreme cold weather events and ultimately mandated that utilities prepare weatherization plans.[347]

FERC's ability to force NERC into action on these issues has proven slow and piecemeal under FERC's existing legal and policy tools. The agency is allowed to (deferentially) approve or reject NERC standards—and to solicit NERC's development of new standards—but not to develop its own standards, modify proposed standards, manage NERC's messaging, or control how NERC standards infiltrate myriad areas of grid decision-making. These dynamics leave FERC nominally in charge of grid reliability, but without the jurisdictional tools necessary to manage modern grid challenges.

IV. Assessing NERC's Structure in Light of the Evidence: Solutions for Grid Reliability in the Electric ERA

As our analysis demonstrates, a sizeable gap has emerged between the nature of reliability challenges today and the strategies NERC is pursuing to address them. This gap, in turn, provokes the question of whether the institutional structure we have for managing grid reliability remains up to the task. In this section, we return to self-regulatory theory to suggest several reasons to believe it does not. We then propose a range of structural and procedural changes that would move grid reliability governance away from an SRO-dominant approach to better address the challenges explored in this Article.

A. The Gap Between SRO Theory and NERC reality

In Part I.A., we presented three conditions that counsel in favor of industry self-regulation: expertise, incentives to self-police, and alignment of interests between the industry and its regulators. Throughout its existence, NERC has justified and defended its SRO status on precisely these grounds. But given the evidence amassed above—and the many changes to the electricity sector in recent decades—does this logic still hold? This part develops our contention that it does not, working factor by factor.

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review their power plant weatherization programs" (emphasis added)); Klass et al., *supra* note 5, at 1047-8 (describing NERC's failure to mandate winterization measure for several years).

[347] North Am. Electr. Reliability Corp., Project 2021-07 Extreme Cold Weather, https://www.nerc.com/pa/Stand/Pages/Project-2021-07-ExtremeColdWeather.aspxl; Robert Walton, FERC Chair Glick wants mandatory winterization standards for power plants following Texas grid failure, Utility Div., Sept. 24, 2021, https://www.utilitydive.com/news/ferc-chair-glick-wants-mandatory-winterization-standards-for-power-plants/607111/; Fed. Energy Reg. Commn., Order Approving Cold Weather Reliability Standards, https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20210824-3085&optimized=false.

1. Expertise

The strongest factor still supporting SRO governance in the grid reliability context is NERC's technical expertise. Grid reliability regulation is perhaps one of the most technically complex areas of the law, given the challenge of balancing massive quantities of generation and load in real time and maintaining a relatively constant and precise frequency within transmission lines. As we transition to more intermittent renewable technologies that will require more storage and flexible response, we still need generation reserves (the traditional hallmark of reliability) as a bridge.[348] And until storage expands dramatically, grid operators will still have to operate the incredibly complex system of balancing generation and load to maintain the 60 Hertz frequency in the wires.

NERC's expertise here is paramount; with members consisting of generators and transmission owners and operators, among others, it benefits from the on-the-ground knowledge of utility engineers.[349] In some evolving areas of grid reliability, however, such as at the distributed (small) energy resource level in the form of rooftop solar panels or small battery storage, NERC has less experience. Here, its expertise falters: While NERC members appear to be highly technical in managing a reliable power system based primarily on baseload resources, it has proven less competent at adapting to the reliability challenges posed by renewables. Some of its recent actions suggest that it lacks the expertise to respond to a fast-changing grid: for example, its frequency regulations simply failed to recognize the distinct technical challenges posed by inverters.[350]

Thus, industry expertise at least provides a less thoroughgoing reason for industry self-regulation in the electric era—even if enduring channels of knowledge counsel for preserving NERC in some form.[351]

2. Incentives to Self-Police

In the early years of NERC, when the industry was primarily comprised of a small group of vertically-integrated public utilities, NERC could compellingly argue that there were strong incentives to self-police. A failure at one generating plant, transformer, transmission line, or distribution line can quickly cascade

[348] Letter from Kenneth W. DeFontes, Chair, NERC Bd. of Trustees to Roy Jones, Chair, NERC Member Representatives Committee, July 13, 2022, https://www.nerc.com/gov/bot/Agenda%20highlights%20and%20Mintues%202013/Policy-Input-Package-August-2022-PUBLIC-POSTING.pdf.

[349] It has proven difficult for FERC to pay engineers a competitive rate that lures them away from industry opportunities. *See, e.g.*, Miranda Willson, FERC policy chief frets about agency's staff openings, E&E News Energy Wire, https://www.eenews.net/articles/ferc-policy-chief-frets-about-agencys-staff-openings/.

[350] *See supra* notes @@ and accompanying text.

[351] *See infra* Part IV.B.

through an interconnected system, as shown by the Northeast blackout of 2003[352]—making electric utilities "hostages of each other."[353]

However, the introduction of competition into the electric industry already began to erode this rationale for self-regulation. Recall that NERC *itself* begged Congress in the 1990s for legislation giving it official recognition and enforcement authority—largely because it worried that incentives to self-police were not present for independent generators entering the system.[354]

More recently, incentives to self-police have continued to diminish. The industry today is far more dynamic than it was even a decade ago. Renewable energy installations have soared. Distributed energy resources such as rooftop solar power, demand response (temporary reduction of energy use in lieu of generation), microgrids, and small batteries have all grown.

These changes break down industry unity in two ways. First, in modern energy markets, the existence of multiple actors makes it extremely difficult to assign responsibility for reliability issues. In the face of reliability crises, the industry splinters, devolving into a blame game rather than assuming that either NERC failed to properly write standards, or utilities failed to properly follow them. This breakdown is not NERC's fault—perhaps more than anything, it is the doing of state and federal policies in favor of both electricity restructuring and decarbonization. Nevertheless, the complex modern reliability landscape erodes a core justification for the ERO model. Today, our nation's ERO is simply incapable of managing many of the most pressing challenges in the field.

Even so, you might imagine an idealized NERC actively voicing these challenges and pushing larger reforms needed to empower a fresh approach to reliability in these changing times. But a second dynamic impedes such efforts: many of the entities charged with designing and implementing reliability standards, including NERC members, RTO members, regional entities' members, and investor-owned utilities—*all largely the same set of companies*, shuffled into different governance arrangements—have a financial interest in impeding decarbonization goals. Consequently—given their prominent role in NERC governance—we see NERC cling to outdated reliability paradigms, as traced in Part III.C. And we see these market actors use NERC standards strategically to draft energy market rules or make investment decisions that favor their own resources—as traced in Part III.D.

In sum, while the electric grid remains highly interconnected, the electricity industry has moved from relative unity into a rather pitched battle for market share and political power—eroding any self-policing tendencies that might have previously justified self-regulation.

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[352] See *supra* notes 118-123 and accompanying text.
[353] *See supra* note 59.
[354] *See supra* Part I.B.

3. Alignment of Interests/Accountability Mechanisms

Many of the same dynamics that erode electricity industry incentives to self-police also erode any accountability regime that once existed between NERC, its members, and public regulators.

In brief, the key mistake here is one of pretending that FERC and NERC, as presently constituted, have a plausible handle on grid reliability under current jurisdictional and legal arrangements. As we have traced, the multi-faceted nature and demands of grid reliability today mean that a complex array of actors contribute to the stability—or the instability—of the grid.[355] NERC's traditional focus on reliability standards is necessary but woefully insufficient to guarantee the success of the grid in the electric era—even if it were focused on innovative solutions. NERC can set reliability-related standards for the bulk power system—but it cannot single-handedly guarantee that system's success. In addition, RTOs must cooperate with FERC and utilities to plan a more robust transmission grid and fairly allocate its costs. RTOs' electricity market design must adjust to the changing resource mix. States must agree to site these transmission lines, weighing such approvals against the possibility of instead or additionally building new generation—a decision that NERC standards can influence but not force. And states must decide what *type* of generation this should be: large or small, renewable or fossil, utility-owned or competitive.

We have presented evidence that despite NERC's limited jurisdiction, it is not doing all it can to mandate, push, and cajole a more modern approach to reliability.[356] Even as NERC remains slow to update standards, many of its older standards are used by other grid actors to justify interventions that slow the clean energy transition and lock in outdated modes of ensuring reliability.[357] This reality puts NERC out of alignment with the public interest, as expressed through amassing state and federal laws in favor of rapid decarbonization.

In response to our critiques, NERC might reasonably explain that it is simply not fair to expect it to fix the reliability challenges facing the grid today. It can only do so much through its standard-setting and report-making. We agree in principle with this point—but believe it cuts in favor of our argument. NERC's inability to manage grid reliability in the modern era is perhaps the largest reason to shift reliance away from self-regulation, toward a more fulsome regulatory structure that can achieve a new reliability paradigm.

[355] *See also* Stein, Regulating Reliability, *supra* note 13, at 1194 (describing this array of actors and currently inadequate jurisdiction).
[356] See *supra* Part III.
[357] *See supra* Part III.C.3.

B. Governance Solutions

For decades, NERC has done an admirable job of keeping the lights on most of the time, avoiding all but a few significant bulk power system failures. But as we have illustrated, the conditions that once justified reliability self-regulation simply no longer exist. New and mounting pressures make NERC's job not just more difficult but potentially untenable. A more holistic, forward-looking governance model for reliability is necessary to embrace both the potential and the challenges of the electric era.

This Part offers a continuum of solutions that would improve U.S. reliability governance. These solutions range from smaller, internal procedural reforms within NERC, to larger institutional changes in NERC and FERC's roles in reliability governance. Appendix B presents these solutions in table format and in greater detail; below we sketch our broader theory and approach to improving NERC and reliability governance.

1. Internal Reforms

The first set of reforms that might improve reliability governance are internal to NERC. As our research highlights, NERC standard-setting often displays a proclivity for traditional reliability solutions, while failing to pursue reforms that might enhance the ability of newer resources to reliably serve the grid. Similarly, although NERC has repeatedly recognized the reliability threats posed by climate change, it has been slow to respond with new or updated standards, or to adequately penalize failures to comply with the standards. Further, NERC has failed to fully embrace the potential of low-carbon resources—particularly small-scale ones—to address both climate change mitigation and adaptation, such as renewable microgrids that both reduce carbon emissions and can sometimes ride out weather extremes and other emergencies.

Several internal governance reforms might help align NERC's agenda-setting and standard-setting with public priorities for the electric era. One possibility is board reform. NERC's current board is elected by the industry and often comes from its ranks.[358] Adding several public representatives to the board—perhaps one-third of total membership—might help steer NERC's priorities towards those of regulators. Similarly, modifications to the composition of the standard-setting committee might help shift its incumbency bias by creating sectoral representation that better mirrors the state of the industry today.[359]

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[358] North Am. Electr. Reliability Corp., Amended and Restated Bylaws 6 (2021), https://www.nerc.com/gov/Annual%20Reports/Amended%20and%20Restated%20Bylaws%20 4-5-21.pdf.

[359] See supra note 213 and accompanying text.

Equally important are reforms to NERC's ballot body itself. As the composition of the electricity sector has dramatically shifted, voting rules have not kept pace. It should not be the case that utilities have at least three—and arguably five—times the voting power of independent generators or demand-side companies.[360] Under FERC oversight, NERC should shift the boundaries between industry segments and sectoral membership rules to better align with the modern industry and its shifting goals and paradigms.

We also believe that an independent committee, comprised of a mix of federal and state officials, should be constituted to review NERC's approach to reliability and its effectiveness in achieving publicly established reliability objectives.[361] Independent review bodies bring a bird's eye perspective to agency action and can push agencies in new directions.[362] Such a committee could both evaluate NERC's progress and make suggestions for overcoming many of the jurisdictional gaps that plague reliability governance. Alternatively, the Government Accountability Office (GAO)—an existing agency already tasked with reviewing agency actions and making recommendations to agencies—could play this role.[363]

These suggestions for internal NERC reform are all relatively feasible. To force board and committee changes, FERC can use its certification authority over NERC, threatening to decertify it if it does not meet updated governance criteria that respond to changing grid conditions.[364] Similarly, either FERC or Congress could undertake the relatively non-controversial step of constituting a new oversight committee.

These shifts might also facilitate real change within and beyond NERC. A more proactive standard-setting committee, coupled with a ballot body likely to approve of forward-looking changes, might significantly change both the content and pace of standard-setting around the clean energy transition. A more publicly accountable NERC board could help both pressure and support such developments—and could shift the rhetoric coming out of NERC about the clean energy transition from a place of delay to optimism and can-do spirit. At the

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[360] *See supra* note 224 and accompanying text.
[361] See Appendix B for details.
[362] For example, the National Transportation Safety Board—an independent federal agency—reviews the causes of transportation incidents, such as aviation or rail accidents and recommends changes to agencies that address these causes. About Us, Natl. Transp. Safety Bd., https://www.ntsb.gov/Pages/home.aspx.
[363] Indeed, the GAO has already stepped into an analogous role at times, such as in 2021, when it made recommendations to FERC for how to improve the coordination of reliability. U.S. Govt. Accountability Offc., Electricity Grid Resilience: Climate Change is Expected to Have Far-Reaching Effects and DOE and FERC Should Take Actions 44 (2021), https://www.gao.gov/assets/gao-21-346.pdf.
[364] See Electricity Modernization Act of 2005, § 215(c).

same time, a move away from outdated standards would limit the ability of other grid actors to use NERC requirements as their own tactical delay tool.[365]

Despite these potential benefits, internal governance reforms cannot fully solve the challenges we have identified. As we have discussed, NERC also faces an inability to respond, legally and jurisdictionally, to some of the most pressing reliability problems today. Accordingly, we also believe that more robust reforms to reliability governance—external to NERC—are imperative.

2. External Reforms

To adequately drag grid reliability governance into the twenty-first century—toward a grid with numerous, diverse, flexible, and responsive resources and generation sources that can withstand or quickly bounce back from weather extremes—more extensive external reforms are likely necessary.[366] To be sure, such reforms will be difficult under current political economic realities, given large utilities' outsized clout across multiple spheres of reliability governance (within NERC, regional entities, and RTOs; and at state pulic utilities commissions). But more events like the Southern freeze of 2021, or worse, could galvanize public opinion, opening a window of opportunity for extensive governance changes.

Here we explore a range of such changes—some more fundamental than others—that should be considered if such a window materializes. Our proposals for external reform center on creating more public, comprehensive control over reliability governance. Today's highly-networked grid needs a regulatory regime in which the public, federal agency notionally charged with ensuring grid reliability—FERC—can legally and practically accomplish the mission, via a stronger oversight role of the numerous actors that currently have separate and sometimes overlapping authority over reliability.

Modifying Deference and Restructuring FERC and NERC

The first larger institutional change that might improve reliability governance is a shift in the legal deference regime. As we explored in Part II, the current reliability process involves triple deference from FERC to NERC to regional entities: FERC must give "due weight" to NERC's technical expertise when reviewing NERC reliability, and NERC must presume that regional entity reliability standards are "just and reasonable." Although this triple deference

[365] *See supra* Part III.
[366] Scholars such as Amy Stein have also proposed comprehensive reliability reforms that accord with the ones presented here—though without a focus on NERC. *See* Stein, *Regulating Reliability*, *supra* note 13.

standard allows FERC to reject NERC standards that are blatantly misguided,[367] it does not give the agency much ability to *shape* NERC standards in its preferred directions. A deference regime that gave FERC the ability to employ its regulatory knowledge and priorities in reviewing proposed standards, and to request specific amendments in the public interest, could both speed NERC standard-setting and help make it more responsive to administrative imperatives.[368]

A bolder set of reforms would more fundamentally change the structure of reliability governance—a move that we think may be necessary in light of the growing complexity of grid reliability in the electric era. As we have highlighted throughout this Article, reliability governance is multifaceted and extends well beyond reliability standards. Reliability now also hinges on proper linkages between the electric and gas systems, interconnection rules for renewables and microgrids, the shape and size of the interstate transmission network, and a well-planned balance among resources with different performance characteristics. Accordingly, the case for vesting more power in a public, centralized entity for overseeing the multi-faceted nature of reliability gains persuasiveness in the electric era.[369]

One approach would be for FERC's Office of Electric Reliability (OER), which currently serves an oversight and collaborative role with NERC and states,[370] to have the primary authority to propose reliability standards to FERC. In this restructuring, NERC might become a nested entity within this office, free to suggest, support, or oppose standards but not to drive the standard-setting agenda. This type of more traditional notice-and-comment approach to standard-setting would facilitate broader participation in standard-setting, in recognition of the broader expertise necessary to manage reliability in the electric era. And it would eliminate NERC members' ability to gatekeep the types of standards developed and proposed. At the same time, maintaining the structures and membership of NERC and regional entities and giving them prominent access to FERC officials would preserve their expertise regarding system-wide needs and

[367] It is not uncommon for FERC to send NERC's proposed reliability standards back for revision. In one of its early bulk orders on NERC's proposed reliability standards, FERC designated 24 of 83 proposed mandatory and enforceable reliability standards as "pending," citing concerns about preventing blackouts. FERC Order No. 693, Mandatory Reliability Standards for the Bulk Power System 1 (2007), https://www.ferc.gov/sites/default/files/2020-04/E-13.pdf.

[368] *Cf.* U.S. Govt. Accountability Offc., Electricity Grid Resilience: Climate Change is Expected to Have Far-Reaching Effects and DOE and FERC Should Take Actions 44 (2021), https://www.gao.gov/assets/gao-21-346.pdf (recommending that FERC "could require NERC to update reliability standards to specifically address climate change").

[369] *See* Stein, Regulating Reliability, *supra* note 13, at 1238-1261 for a persuasive account of factors supporting FERC jurisdiction over "system-wide reliability."

[370] Fed. Energy Reg. Commn., Office of Electric Reliability, https://www.ferc.gov/office-electric-reliability-oer.

characteristics and regional variations in climate impacts and their relationship to reliability.

One challenge of shifting standard-setting responsibility to FERC would be the international nature of NERC. The provinces that have agreed to NERC jurisdiction explicitly avoid any U.S. *federal government* authority over the Canadian system. This challenge could likely be addressed through revised memoranda of understanding between Canadian provincial governments and FERC, in which Canadian provinces more expressly indicated an intent merely to harmonize regulatory standard-setting but explicitly disclaim any accession to U.S. jurisdiction.

FERC as the "Reliability Fed"

It may be time to go bigger yet and vest FERC with the full authority it needs to properly manage reliability through the electric era—making it essentially the "Fed" of electric grid reliability. Under this model, Congress would award FERC control over all critical functions of reliability governance, including reliability standard setting and enforcement, transmission planning and siting, regional resource adequacy, and integration of energy storage and other flexible resources, among other functions.[371] FERC would both draft and finalize reliability standards in all of these areas—with the advice of NERC—allowing the agency far more comprehensive planning and control over the many facets of grid management that influence reliability.

FERC already takes action in many of these areas, including electricity market oversight, interconnection policies, and mandates for regional and interregional transmission planning.[372] But in other areas, it lacks control—including, as we have documented, the initial crafting of reliability standards as well as electricity market design and participation rules,[373] transmission siting, and regional resource adequacy.[374] A comprehensive set of reliability functions placed firmly within FERC's jurisdiction would help to synthesize what is currently a highly scattered approach to reliability.

In short, just as the Federal Reserve is responsible for maintaining the stability of the entire U.S. financial system, the United States needs a national, centralized, top-down entity with comprehensive responsibility for reliability of

[371] Cf. Congr. Res. Svc., *supra* note xx, at 16 ("Congress could assess whether the existing regulatory framework is sufficient to maintain reliability given the changing mix of energy sources used for electricity generation").
[372] *See* Stein, Regulating Reliability, *supra* note 13, at 1236 (noting FERC's efforts in some of these areas but arguing for broader FERC controls).
[373] *See* Welton, Rethinking Grid Governance, *supra* note @.
[374] *See supra* Part Stein, *Regulating Reliability*, *supra* note 13, at 1195 (highlighting importance of transmission planning to reliability).

the entire U.S. electric grid.[375] The Fed is unique in the breadth of its responsibilities: it steers national monetary policy by establishing interest rates and purchasing securities, among other measures.[376] It also ensures the health of individual financial institutions by regulating them and, through regional reserve banks, serving as a "bank for banks"—lending them money and processing transactions among banks such as checks, for example.[377]

FERC is the closest institution the United States has to the Fed in the energy context. But in contrast with the Fed, FERC faces key limitations on its authority, created both through the Federal Power Act's splintering of jurisdiction between the federal government and the states[378] and the many varieties of self-regulation embedded within electricity law (including, NERC, RTOs, and regional entities). To bolster FERC's authority would likely require reforms to both sets of limitations. To address the federalism divide, Congress could extend FERC's reach over retail electricity specifically in the context of reliability. Such a move would allow FERC clear jurisdiction to mandate that retail utilities consider the use of microgrids, battery storage, or enhanced demand response in addition to traditional reliability measures such as the "hardening" of electric distribution wires.[379] Alternatively, FERC might create a federal-regional-state authority in which RTO members, state public utility commissioners, and members of FERC had voting authority. This commission could jointly govern those aspects of reliability that inextricably spill across jurisdictional lines. There are examples of this approach in governing shared environmental resources such as rivers; educational policy; some shared physical infrastructure, such as bridges and airports; and financial risk—although none that has functioned without challenges.[380]

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[375] Fed. Reserve System, The Fed Explained: What the Central Bank Does 1 (2021), https://www.federalreserve.gov/aboutthefed/files/the-fed-explained.pdf.
[376] *Id*. at 24.
[377] *Id*. at 11.
[378] *See supra* notes @@ and accompanying text.
[379] Amy Stein provides other examples of areas ripe for more federal control over retail reliability, such as requirements to protect power substations on the distribution grid from attack. Stein, *Regulating Reliability*, *supra* note 13, at 1233-34.
[380] Dave Owen & Hannah Wiseman, Co-Equal Federalism and Federal-State Agencies, 55 Ga. L. Rev. 287 (2021) (describing this form of governance, assessing its benefits and drawbacks, and providing examples); U.S. Department of the Treasury, Financial Stability Oversight Council, https://home.treasury.gov/policy-issues/financial-markets-financial-institutions-and-fiscal-service/fsoc. The difficulty of bringing together parallel actors within one organization and achieving effective, coordinated action is highlighted by organizations such as the Federal Stability Oversight Council (FSOC) in the financial regulatory area. Congress created FSOC to achieve the same types of goals that we highlight in the electric reliability context—facilitating "regulatory coordination" and "information sharing and collection" of information about risks. U.S. Dept. of the Treasury, About FSOC, https://home.treasury.gov/policy-issues/financial-markets-financial-institutions-and-fiscal-service/fsoc/about-fsoc. But there is so much disagreement among the members that FSOC has had trouble achieving its congressional mandates of identifying and addressing risks to financial stability.

There are interesting debates to be had about the relative merits of these major potential changes in federal-state jurisdictional lines in energy law—but they run afield of our focus on NERC reform. Our point here is to emphasize that shifting the degree of self-regulation between NERC and FERC itself cannot solve many of the challenges plaguing grid reliability, because the legal challenges extend well beyond questions over self-regulation. A major overhaul of the system—should it become politically possible and physically necessary—should attend to all these dimensions of the modern reliability challenge.

NERC as the Reliability Expert

Whither NERC in this new world of reliability regulation? We do not see NERC as unnecessary or impotent in these new regimes; rather, its technical expertise will remain crucial. At present, we worry that NERC's technical strengths often mask the need for updated, revised, and expanded reliability approaches, as other agencies tend to simply assume that complex, highly technical standards are adequate. But these technical strengths are difficult to replace. FERC has difficulty hiring electrical engineers,[381] and NERC—comprised of industry members intimately familiar with the wires, substations, software, repair practices, and droves of other technical infrastructure and actions necessary to maintain reliability—has a long-curated trove of technical knowledge.

But as we have traced, reliability in the electric era requires far more than technical standards. It requires a re-configuration of the entire electric system toward one that more substantially integrates and balances distributed resources, consumer demand reductions, and far-flung centralized renewable generation plants. How precisely to harness NERC's expertise in a more centralized system—without having it unduly influence regulators—is a difficult question. We see a continuing role for the agency in identifying areas of grid weakness and vulnerability, in preparing retroactive reviews of reliability incidents, in gathering data on individual generation outages through the Generating Availability Data System, and in implementing simulations to practice responses to reliability threats. In short, we recommend that NERC continue carrying out most of its current responsibilities—but more in an advisory than a formal governance role. This will force FERC to take more ownership of reliability standards and the many other facets of reliability governance that demand an accountable, comprehensive, integrated approach. NERC, in turn, will continue to provide the valuable information and technical support necessary for effective grid reliability governance.

[381] *See supra* note 349.

CONCLUSION

The United States has the least reliable electricity system of any developed country. Things do not look set to improve: wildfires, droughts, floods, and increasingly extreme storms exacerbated by climate change are pummeling regions throughout the country. We have traced several reasons to believe that NERC's self-regulatory model—heretofore a fairly trustworthy way of ensuring grid reliability—will falter under these conditions. Although NERC might have once effectively policed a tight-knit group of similar industry actors, the electric industry has changed dramatically over the years in ways that cause self-regulation to falter.

Drawing from both SRO and energy law scholarship, we argue for a revitalized approach to U.S. grid reliability, moving along the continuum of self-regulation toward enhanced federal government control. And we contend that at minimum, NERC's internal governance structures and the deference to utilities baked into the reliability governance must change. More fundamentally, FERC needs broader jurisdiction within this space, as others have persuasively argued.[382]

Our goal has been to drag an under-studied yet vastly important private governance organization into the limelight, highlighting NERC's central role in maintaining grid reliability. We hope our examination proves fruitful for SRO theory and energy law alike. NERC is an unusual and understudied example of SRO federalism, raising particularly challenging questions about the dynamics of private delegation under shifting public priorities and physical conditions.[383] At the same time, as we have traced, NERC is but one piece of the larger, siloed, jurisdictionally complex tapestry of energy governance that may need reforming for the electric era.[384] It is of paramount importance to develop a regulatory apparatus capable of managing reliability through this coming era. In the words of California Energy Commissioner Siva Gunda, "[i]f we stumble on keeping the lights on, the whole climate agenda is at risk."[385]

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382 *See generally* Stein, Regulating Reliability, *supra* note 13.

383 Emily Hammond's work has sparked an important conversation in this area and provided an important framework for analysis of delegation to SROs. *See* Hammond, *supra* note 5.

384 We focus directly on these silos in our previous article *Grid Reliability Through Clean Energy*. Klass et al., *supra* note 5. Amy Stein has also done important work framing and analyzing these silos. Stein, *Regulating Reliability*, *supra* note 13, at 1196.

385 Anne C. Mulkern, *California Faces Summer Blackouts from Climate Extremes*, SCI. AM., May 23, 2022, https://www.scientificamerican.com/article/california-faces-summer-blackouts-from-climate-extremes/.