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GRID RELIABILITY IN THE ELECTRIC ERA

Josh Macey, Shelley Welton, & Hannah Wiseman

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 achieve deep decarbonization, the United States must enter a new “electric era,” transitioning many sectors to run on electricity while also transforming the electricity system itself to run largely on clean but intermittent renewable resources. These new resources demand new approaches to electric grid reliability—approaches that the NERC model of reliability governance may inadequately deliver.

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 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, widespread agreement about the organization’s goals, and an industry structure in which regulated parties’ interests align with the public’s—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.

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 Worse still, outdated NERC standards often help entrench fossil fuel interests by justifying electricity market rules poorly suited to accommodate renewable resources.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 Politicians,

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meanwhile, lobbed accusations about who was responsible. As the entity in charge of grid reliability in the United States and much of Canada and Mexico, NERC made a brief appearance in news accounts and policy discussions. But as memory of the blackout faded, so too did public scrutiny of this peculiar institution.

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.” 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 (letter of resignation from the Texas Public Utility Commission after the 2021 blackout arguing for shared culpability among “[t]he 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”).


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 ENVT. 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, 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).
existence dates back far longer, to 1968, when electric utilities voluntarily formed the corporation to jointly establish grid reliability standards. 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.

Climate change complicates grid reliability in two ways. First, responding to the problem requires a transformation of the electricity grid to run on zero-carbon (“clean” energy), even as the grid expands in order to allow the country to “ electrify everything”—from vehicles to cooking and heating—thereby launching a new “electric era” of energy. This transformation to a grid powered predominantly by renewable energy is well underway in the United States and will accelerate as a result of the Inflation Reduction Act of 2022. However, because of its intermittency, renewable energy requires new approaches to reliability, including flexible solutions such as battery storage, “reactive” power that can turn on quickly, and commitments from consumers to reduce consumption. As we explain, we believe NERC has been insufficiently proactive in responding to the shifting nature of modern grid reliability.

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8 See infra notes 9-Error! Bookmark not defined. 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’’); 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 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 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).
12 NERC has instead focused on 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. In urging a broader lens, we do not intend to minimize the importance of these concerns, which are important components of enhancing grid
The second reason NERC’s job is becoming increasingly difficult stems from the effects of climate change on the U.S. grid. Climate change is worsening wildfires, exacerbating droughts that threaten the viability of hydroelectric dams as sources of electricity, and contributing to more erratic and frequent cold snaps and heat waves throughout the country—with significant attendant grid management challenges. These reliability challenges are compounded by the aging nature of U.S. grid infrastructure and growing cyber threats and other security risks. The United States experiences “more power outages than any other developed country” and has seen a ten-fold increase in major outages between the mid-1980s and 2012. 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 described these risks as “unprecedented” and warned that “two-thirds of North America [was] at risk of energy shortfalls” for the following summer.

Given these evolving challenges, it is time to fully theorize and scrutinize the decision to rely primarily on a privatized self-regulatory model to ensure grid reliability. But NERC has given less attention than we believe is merited to reactive and flexible resources and practices, including localized microgrids powered by renewable energy and battery and greater interregional connection of the transmission grid. 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).

reliability. Scholars of administration have coalesced around a set of criteria that allows self-regulation to function well, including technical expertise, incentives to self-policing fairly, and alignment between the goals of industry and the goals of government regulators.\textsuperscript{17} We argue that 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.\textsuperscript{18} For decades, there was regulatory consensus that baseload resources—electricity generation that runs constantly and has relatively low fuel costs—should provide a steady stream of power during ordinary conditions.\textsuperscript{19} There was also consensus that “peaker” plants, which were generators with higher operating costs but lower fixed costs, should be called online during periods of peak electricity demand.\textsuperscript{20}

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 an incentive to monitor their interconnected neighbors, since a neighboring utility’s reliability failures could create cascading blackouts and damage equipment throughout an entire region.\textsuperscript{21} And regulators knew who to blame when things went wrong: the utilities charged with providing power to their service territories and NERC, the industry-led entity charged with developing reliability standards. There were thus clear lines of accountability that led directly to utilities and 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.\textsuperscript{22} 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

\textsuperscript{17} See infra Part I(B).
\textsuperscript{20} See supra note 19.
\textsuperscript{21} See infra Part II.B (discussing regulatory reactions to blackouts during the utility era).
\textsuperscript{22} See infra Part I.B (discussing NERC’s arguments for self-regulatory authority).
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. In addition, because much of NERC’s expertise comes from regulated utilities—NERC outsources most data collection and modeling to market participants—expertise is being provided by firms that own and operate traditional reliability solutions.

Incentives to self-policing 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 and introducing new market structures and market participants. In more recent years, the rapid ascendance of new competitors that are critical in a lower-carbon electrified era—including renewable energy, energy storage, and demand management companies—has only compounded this challenge. Utilities—still a dominant voice within NERC—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. And when reliability disasters do occur, industry members (and sometimes government agencies) can engage in intra-industry finger-pointing, rather than accept failures as a matter of collective responsibility. Moreover, the enlarged array of players involved in ensuring grid reliability obscures the fact that a small number of energy market participants have outsized control within several of the core institutions governing electricity. 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 large, entrenched actors to implement their agendas across institutions in opaque and unaccountable ways.

The final factor that typically 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, rather than consistent output and peak availability, are paramount. But

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23 See infra Part IV.A.
24 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.
25 See infra Part II.B.
26 See, e.g., infra notes 364368 and accompanying text.
27 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).
28 See infra Part III.D.
as we show, 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.29

This all creates 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.30 Although the Federal Energy Regulatory Commission (FERC) oversees NERC, it is limited by an unusually stringent deference regime that requires the agency to defer to NERC and other regional reliability entities.31 FERC has taken steps recently to force NERC to adopt standards to better integrate renewable energy reliably and prepare for climate extremes,32 but 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 spilled over the banks of what NERC can realistically and legally accomplish via its self-regulatory, standard-setting model.33 This dispersed responsibility reinforces the need for substantial revision of the current self-regulatory model for grid reliability.

To address these challenges, this Article advocates for a more public and comprehensive approach to grid reliability governance. Although we see a critical ongoing place for NERC,34 we argue that the organization should play a more cabined and embedded technical and expertise-based role within a largely public regime. Without fundamental changes to grid governance, the United States risks more frequent and severe grid reliability crises in the coming years. We propose 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.35

29 See infra Part III.D.
30 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 10 (showing anticipated federal progress on greenhouse gas emission reductions as a result of investments under the Inflation Reduction Act).
31 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).
32 See infra Part III.E.
33 See infra notes 154-160 and accompanying text.
34 See infra note Error! Bookmark not defined. and accompanying text for discussion of the difficulties that FERC faces in attempting to hire engineers.
35 See Part IV and Appendix B.
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. An emerging throughline in this dilatory rhetoric is to emphasize the threats that a rapid clean energy transition poses to grid reliability. NERC itself sometimes engages in this rhetoric: In 2023, NERC’s President and CEO James Robb testified that the current pace of the energy transition (toward more renewable energy) was not being managed “in an orderly way” and framed the problem as one of eroding baseload resources, warning that “[c]onventional generation is retiring at an unprecedented rate.” Similarly, 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.” In our view, it is precisely the other way around: our institution for developing and implementing technical grid requirements for reliability is out of synch with the necessary pace of system transformation.

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.

36 David Wallace Wells, What’s Worse, Climate Denial or Climate Hypocrisy?, N.Y. TIMES OP-ED (June 22, 2022).
37 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.”).
38 Testimony of James B. Robb Before the Committee on Energy and Natural Resources, United States Senate, June 1, 2023, https://www.energy.senate.gov/services/files/D47C2B83-A0A7-4E0B-ABF2-9574D9990C11.
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. 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.” 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. 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. At the other end, there is what scholars term “meta-regulation,” a nested arrangement in which the state has some legal oversight authority over self-regulatory arrangements. There are a variety of forms of meta-regulation, such as “enforced self-regulation,” in which a government actor enforces “privately-made rules” in addition to its own rules; “mandated-self-regulation,” in which the government requires industry to self-regulate; and “co-regulation,” in which “public agencies and private market actors cooperate in the creation, implementation, and enforcement of rules.”

41 Coglianese & Mendelson, supra note 40, at 150.
42 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 Omarova, supra note 40, at 676-766; Coglianese & Mendelson, supra note 40, at 147-48. See also BALDWIN, CAVE, & LODGE, supra note 43, at 146 (describing co-regulation).
The obvious question then becomes, when is such a public-private arrangement desirable? And more granularly, how can policymakers know where on the continuum of self-regulation an industry should fall?\footnote{The first question posed above is much better theorized than the second. See Coglianese & Mendelson, supra note 40, at 162 (noting that “much more research is needed” to understand “the circumstances under which meta-regulation can successfully deliver public value”).}

There are three core features that scholars widely identify as making self-regulation workable in a particular industry or setting. The first feature is \textbf{specialized industry expertise}. Self-regulation is particularly important where an industry is complex, dynamic, and not well understood by outside regulators.\footnote{Coglianese & Mendelson, supra note 40, at 153; BALDWIN, CAVE, & LODGE, supra note 43, at 139; Benjamin P. Edwards, \textit{The Dark Side of Self-Regulation}, 85 \textit{UNIV. CINCINNATI L. REV.} 573 (2017); Hammond, supra note 5, at 1717; Birdthistle & Henderson, supra note 42, at 55.} In this circumstance, regulators may lack the knowledge or bandwidth to craft effective rules and standards, making industry participation a prerequisite to sound results.\footnote{Omarova, supra note 40, 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”).} 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.\footnote{Coglianese & Mendelson, supra note 40, at 152; BALDWIN, CAVE, & LODGE, supra note 43, at 139; Omarova, supra note 40, at 674; Ogus at 97-98; Peter Grajzl & Peter Murrell, Allocating Lawmaking Powers: \textit{Self-regulation vs. Government Regulation}, 35 \textit{J. COMP. ECON.} 520, 521 (2007).} And finally, harnessing industry expertise can allow for speedier adoption of rules and faster adaptation to changing circumstances.\footnote{BALDWIN, CAVE, & LODGE, supra note 43, at 140; Coglianese & Mendelson, supra note 40, 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, \textit{Outsourcing Government Regulation}, 53 \textit{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.”).} Financial markets are sometimes described as a quintessential 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.\footnote{See Edwards, supra note 47, at 601; Omarova, supra note 40, at 669-70.} The Internet—also a technically complex and dynamic beast—is also a common example.\footnote{See, e.g., Llewellyn Joseph Gibbons, \textit{No Regulation, Government Regulation, or Self-Regulation: Social Enforcement or Social Contracting for Governance in Cyberspace}, 6 \textit{CORNELL J. L. & PUBLIC POL’Y} 475, 509 (1997); Philip J. Weiser, \textit{Internet Governance, Standard Setting, and Self-Regulation}, 28 \textit{N. KY. L. REV.} 822, 825-26 (2001).}

For self-regulation to work, industry members must also have \textbf{incentives to fairly self-police}—that is, industry members must believe they get something worthwhile out of a system of self-regulation.\footnote{Birdthistle & Henderson, supra note 42; Hammond, supra note 5, at 1718.} This criterion tends to be met...
when an industry is “small, relatively homogeneous, and interconnected.”

These types of industries sometimes possess an “industry commons” problem, in which the public’s or regulators’ perceptions of a risk posed by the industry affects all actors within that industry—even those that pose lower risk. 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. 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.” 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. In contrast, as Coglianese and Mendelson observe, “firms in a large, heterogeneous industry can probably defect more easily on any self-regulatory collective action.” Moreover, if firms differ too much in size,

54 Coglianese & Mendelson, supra note 40, 154; Ogus, at 101-02 (explaining that self-regulation works best “where the affected group is relatively homogeneous and externalities are largely absent”); cf. Andrew A. King & Michael Lenox, Industry Self-Regulation Without Sanctions: The Chemical Industry’s Responsible Car Program, 43 Academy of Mgmt. J. 698, 702 (2000) (discussing Mancur Olson’s theory that firms will cooperate in organizations such as SROs—overcoming collective action challenges—when there is a small group of firms, since a collective good or harm will fall quite heavily on any one firm in the group).


56 See JOSEPH V. REES, HOSTAGES OF EACH OTHER 2 (1994); see also Coglianese & Mendelson, supra note 40, at 160-61; Michael J. Lenox & Jennifer Nash, Industry Self-Regulation and Adverse Selection: A Comparison Across Four Trade Association Programs, 12 Bus. Strategy & The Env’t 343, 343 (2003) (“Fatal accidents, damaging spills and the emission of toxic pollutants have consequences not only for the offending firms but all firms within an industry.”).

57 Rees, supra note 56, at 160-61. In addition to the shared threat of public outcry and greater regulation of a relatively homogenous industry, the physical interconnectedness of an industry, either through reliance on a shared resource (such as fish) or interconnected infrastructure, such as shared transmission lines, can also produce effective self-regulation. King & Lenox, supra note 54, at 713 (noting that the “nature of the common good, or commons, being protected” by self regulation influences the effectiveness of self-regulation).

58 Birdthistle & Henderson, supra note 42, 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”).

59 Coglianese & Mendelson, supra note 40, at 160-61; see also BALDWIN, CAVE, & LODGE, supra note 43, at 154 (discussing the challenges of deliberation in self-regulation among groups that have divergent interests). More heterogenous groups are also less likely to be able to effectively police their members to ensure that their members are complying with industry standards and not simply free-riding on the public benefits of perceived beneficial outcomes of self regulation, such as safety. See Lenox & Nash, supra note 56, at 346-47 (noting the importance of close monitoring of member behavior and other internal compliance mechanisms for self regulation to be effective).
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.”

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. For example, scholars have argued that 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. 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.” 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.

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

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60 Edwards, supra note 47, at 605. See also Birdthistle & Henderson, supra note 42, 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 56, at 49 (attributing nuclear self-regulation’s success to its ability to create “close integration between regulator and regulated” and foster a communitarian spirit).

61 See Baldwin, Cave, & Lodge, supra note 43, 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 50, at 405 (noting the necessity of natural alignment or the ability of the oversight agency to “create incentives to align its interests and the interests of the private actor.”).

62 See Rees, supra note 56, at 72-73 (describing the “industrial morality” cultivated via nuclear self-regulation); see also Shapiro, supra note 50, 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”). To be sure, analysis of the nuclear and securities industries suggests that they, too, often fail in practice to live up to the ideals of self-regulation. Our analysis does not turn upon these industries being demonstrably good candidates for self-regulation—we merely offer them as frequently used examples.

63 Baldwin, Cave, & Lodge, supra note 43, at 142; see also Edwards, supra note 47, 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.””).

64 Hammond, supra note 5, at 1715; The Governance of Self-Regulatory Organizations, 69 Fed. Reg. 32326, 32328 (June 9, 2004) (requesting public comment on a governance structure for SROs in the securities industry, including questions of how much power the SRO should have over regulatory and compliance actions, who should be on the SRO board, and how the board should be nominated and elected).
known problems.”65 In these situations, meta-regulation gains importance and appeal.66 Embedding self-regulation within regulatory oversight can help pull the outcomes of self-regulation “closer to the overall public interest.”67 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 regulation, or when an industry finds itself no longer able to fully control its members.68

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.69 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.70 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.71 And as particularly relevant to this Article, F.C. Simon observes that when the regulated industry implicates strong and sometimes conflicting public interests—as is the case with electricity, which involves powerful environmental values, social objectives such as affordability, and economic ideals such as competition—the effectiveness of meta-regulation must be closely scrutinized.72

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65 Edwards, supra note 47, at 608. See also Birdthistle & Henderson, supra note 42, 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”).

66 Coglianese & Mendelson, supra note 40, at 161 (“Meta-regulation seems to address some of the drawbacks of a purely self-regulatory approach.”). But see Birdthistle & Henderson, supra note 42, at 5 (decrying the “governmentalization” of self-regulatory organizations in the financial space).

67 Coglianese & Mendelson, supra note 40, at 163.

68 See Coglianese & Mendelson, supra note 40, at 163-64 (describing chemical industry’s and nuclear industry’s self-regulatory efforts); Baldwin, Cave, & Lodge, supra note 43, at 141 (“[W]here [incentives] are not fully effective, it is common for organizations to seek explicit recognition from the state and control to make membership compulsory.”).

69 Coglianese & Mendelson, supra note 40, 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 43, 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”).

70 Baldwin, Cave, & Lodge, supra note 43, at 159-60; see also Omarova, supra note 40, at 670 (treating as an advantage SRO’s “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 61, at iv (noting challenges created by “dual or wasteful regulatory oversight conducted by multiple regulatory offices”).

71 See Hammond, supra note 5, at 1709.

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. Over the past fifty years, NERC has purposefully and explicitly 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 incentives are in the right place, the experts are engaged. Mutual interest exceeds personal gain.

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.

73 Cf. Baldwin, Cave, & Lodge, supra note 43, at 164 (noting the need to assess the appropriateness of self-regulation in context).
74 Quoted in NERC History, at 94-95.
Figure 1. Key Elements of U.S. Grid

Historically, electric utilities operated as “vertically integrated” regulated monopolies, charged with supplying necessary generation, transmission, and distribution infrastructure within their territories. 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 to provide backup power to each other. 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. The Pennsylvania-New Jersey Interconnection became the first official “power pool”—where regional utilities formalized a generation-sharing arrangement—in 1927.

Numerous additional pools, interconnections, and ties formed and expanded in the following decades among U.S. utilities and some Canadian counterparts as well. 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, Congress in 1935 passed the Federal Power Act (FPA). That Act maintained state jurisdiction over the distribution

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75 Spence, supra note 18, at 769.
76 NERC History, Appendix, at 147 (describing “the first recorded implementation of economic dispatch”).
78 NERC History at 148.
79 Id. At 148-50.
80 273 U.S. 83, 84 (1927).
system and electricity generation but gave the Federal Power Commission (FPC, now FERC) authority over interstate “wholesale sales” of electricity and interstate transmission.\(^{81}\)

Despite these jurisdictional shifts, ad hoc industry self-management of electric grid reliability remained the norm for several decades.\(^{82}\) There is a reasonable argument that such self-management was justified under prevailing conditions. Individual utilities had a monopoly over their service territories.\(^{83}\) 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 invest in infrastructure needed to support grid reliability, because they earned a profit off such capital expenditures.\(^{84}\)

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.”\(^{85}\) 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.\(^{86}\) 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.”\(^{87}\)

Based on this logic—and to forestall federal regulation—the electricity industry instead proposed its own reliability council. Following negotiations, the

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\(^{82}\) 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.


\(^{84}\) 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).

\(^{85}\) Nevius, *supra* note 7, at 3.


FPC ultimately agreed, and in June 1968, twelve regional and area utility organizations signed an agreement creating NERC.\textsuperscript{88} 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.\textsuperscript{89} NERC also created a “Technical Advisory Committee” to develop voluntary reliability criteria for the industry.\textsuperscript{90}

Over the next decade, NERC conducted numerous reviews and reports on various pressing matters of reliability. Its board chairs appeared periodically before Congress.\textsuperscript{91} Things hummed along at this pace until the late 1970s, when Congress passed the Public Utilities Regulatory Policy Act (PURPA).\textsuperscript{92} Among other things, PURPA sought to inject more competition into the industry by requiring utilities to purchase the output of certain small renewable or efficient energy generators.\textsuperscript{93}

NERC then undertook a study scrutinizing its own role and functions in light of the changing system, but ultimately recommended few changes.\textsuperscript{94} 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.”\textsuperscript{95} To translate this into SRO theory-speak, the industry worried that its internal alignment and incentives to self-policing might be weakening. Alternatively or additionally, this demonstrated the same (self-preserving) worry currently being expressed by a NERC dominated by large utility interests: that the addition of new, competitive market entrants represented a threat to reliability as defined by NERC—and therefore should be slowed down, not encouraged.\textsuperscript{96}

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 required utilities to offer “open access” to their transmission lines to all comers

\textsuperscript{88} Nevius, \textit{supra} note 7, at 5-6.
\textsuperscript{89} \textit{Id.} at 9.
\textsuperscript{90} \textit{Id.} at 10-11.
\textsuperscript{91} \textit{Id.} at 11-18.
\textsuperscript{93} \textit{Id.}
\textsuperscript{94} Nevius, \textit{supra} note 7, 21-22.
\textsuperscript{95} \textit{Id.} at 24.
\textsuperscript{96} See \textit{supra} text accompanying notes 38 & 44 [44 cross ref not hyperlinked] (showing NERC’s current concerns about renewable energy market entrants).
at fair rates.\textsuperscript{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.\textsuperscript{98} Ultimately, utilities in two-thirds of the U.S. (as measured by population) joined an RTO.\textsuperscript{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.\textsuperscript{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.”\textsuperscript{101} As it noted, NERC’s traditional “peer-reviewed standards coupled with voluntary cooperation” worked well when “costs associated with maintaining reliability could be recovered through rates.”\textsuperscript{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.”\textsuperscript{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.\textsuperscript{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.\textsuperscript{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

\textsuperscript{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).

\textsuperscript{98} FERC Order No. 2000 (1999).


\textsuperscript{101} Id. at vii.

\textsuperscript{102} Id. at xi.

\textsuperscript{103} Id. at xi, 1.

\textsuperscript{104} Id. at xiii.

\textsuperscript{105} FERC Primer at 31; Advisory Board Task Force; at 13, Nevius, supra note 7, at 35.
fashion, without favoring one or another set of market participants.\textsuperscript{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.\textsuperscript{107} FERC itself was simultaneously exploring such changes, including through a 1998 inquiry and technical conference on reliability.\textsuperscript{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.\textsuperscript{109} Instead, NERC’s president proposed a “NERC Amendment” that would keep reliability oversight with NERC and the NERC-recognized regional councils.\textsuperscript{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.”\textsuperscript{111}

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.”\textsuperscript{112} It further noted that NERC needed enhanced enforcement authority to effectively take on this role.\textsuperscript{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.”\textsuperscript{114} Yet NERC was emphatic that a self-regulating organization remained superior to a government body in terms of flexibility, technical competence, and innovation.\textsuperscript{115}

\textsuperscript{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. \textit{Id.} at 26.

\textsuperscript{107} Advisory Board Task Force, at xv, 10.

\textsuperscript{108} Cited in Advisory Board Task Force, at 38.

\textsuperscript{109} Nevius, \textit{supra} note 7, at 29.

\textsuperscript{110} Nevius, \textit{supra} note7, at 30.

\textsuperscript{111} \textit{Id.} at 31.

\textsuperscript{112} Advisory Board Task Force, at 25.

\textsuperscript{113} Advisory Board Task Force, at 25; NERC History at 34 (describing NERC’s position that “peer pressure” would no longer be sufficient).

\textsuperscript{114} Nevius, \textit{supra} note 7, at 36 (quoting speech by NERC Board vice chair Erle Nye).

\textsuperscript{115} \textit{Id.} at 44 (describing the conclusions of a NERC Blue Ribbon Panel report).
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 100 people died in New York City alone.118 The causes of death were numerous and wide-ranging, as they typically are in a major blackout, and included 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, and 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

116 Id. at 47.
117 FERC Primer at 31-32.
119 Id. at 191-2.
valuable products. Consulting groups and the Department of Energy estimated the impacts of the two-day blackout at $4.2 to $10 billion.\textsuperscript{120}

The events leading to this catastrophe started in two portions of the grid in Ohio that were at the time called “control areas,” whose operators were responsible for continuously managing the flow of power through the grid.\textsuperscript{121} Operators of these adjacent control areas, FirstEnergy and American Electric Power (AEP), both exacerbated the problem. FirstEnergy failed to properly trim trees around their transmission lines, and both FirstEnergy and AEP failed to manage the flow of power through their transmission lines and to properly balance generation and load.\textsuperscript{122} 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.\textsuperscript{123} 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.\textsuperscript{124}

A variety of technologies and human interventions can prevent cascading outages, including better technologies to sense changes in voltages and current caused by a single fault and isolating that fault to avoid cascading effects.\textsuperscript{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 and management of “reactive power”—generators that can be quickly ramped up to maintain needed voltage in wires—

\begin{itemize}
\item \textsuperscript{122} Id. at 12, 17-21.
\item \textsuperscript{124} U.S.-Canada Power System Outage Task Force, supra note xx, at 7-8.
\end{itemize}
in both FirstEnergy’s and AEP’s areas caused an initially small outage to cascade through the Northeast.\footnote{126}

In addition to these technical problems, the 2003 Blackout 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. 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.\footnote{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 represent[ed]” and had “no authority to develop strong reliability standards and to enforce compliance with those standards.”\footnote{128} Collectively, these findings pointed to a need for rethinking the tools and systems in place for managing reliability.\footnote{129}

The 2003 blackout reveals how 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.\footnote{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.\footnote{131}

The Task Force that investigated the causes of the 2003 found that this 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,” and utilities’ inability to “adequately communicate [their] emergency operating conditions to neighboring systems.”\footnote{132} All of these conclusions highlight the extent to which one principle of effective self-
regulation—a relatively homogenous industry with incentives to fairly police—had eroded in reliability regulation 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, 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. 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 seek recognition as the electric reliability organization (ERO)”—and then proceeded to reference NERC as the ERO for the remainder of its report.

Congress obliged, adopting these changes in the Energy Policy Act of 2005 (EPAct 2005). 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. EPAct 2005 further specified certain characteristics for this ERO, including an independent governing board and fair stakeholder representation and public participation in its governance. FERC implemented these requirements in two orders focused on the rules for ERO certification and reliability standards.

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.”

The path to a NERC ‘dictatorship’ was short: After revising its bylaws to accord with EPAct’s ERO requirements, NERC filed its application with

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133 Nevius, supra note 7, at 72.
134 U.S.-CANADA POWER SYSTEM OUTAGE TASK FORCE, supra note 121, at 140.
135 U.S.-CANADA POWER SYSTEM OUTAGE TASK FORCE, supra note 121, at 142 and throughout.
137 FERC Primer at 37; Fed. Power Act § 215.
FERC to be named the ERO in April 2006. Just a few months later, in July 2006, FERC certified NERC as the nation’s ERO. It also approved most of NERC’s previously voluntary reliability standards as mandatory and enforceable reliability standards under the new statutory framework. With these changes, NERC moved along the self-regulatory spectrum towards greater meta-regulation but retained its centrality in establishing the rules of grid reliability.

II. NERC’S MODERN POSITION, STRUCTURE, AND FUNCTIONS

With NERC’s entrenchment and evolution as a self-regulatory organization established, this Part turns to exploring the modern landscape of grid reliability governance and NERC’s central role within it. This sets the stage for our argument in Parts III and IV that grid reliability governance no longer suits the criteria for industry self-regulation. 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. 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 of an industry as complex and capital-intensive as electricity also, however, requires systematic longer-term planning and sustained oversight to ensure that the infrastructure necessary for a reliable grid—including generation, transmission, distribution—is constructed and maintained over time.

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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.  
A variety of private and public actors at different levels of government are responsible for these various elements of grid reliability. Under the legal framework of FPA section 215, NERC has regulatory authority to “enforce[e] compliance with mandatory reliability standards”\(^{146}\) for all entities “associated with the bulk power system.”\(^{147}\) 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 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.\(^{149}\)

Other regulatory actors also have significant roles in grid reliability. FERC is at least nominally given ultimate authority, as section 215 of the FPA 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

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\(^{148}\) 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).
instructed to “rebuttably presume” that standards proposed by regional entities under its supervision are “just and reasonable.”

Legally, this creates a type of *triple* deference regime, the effects of which we explore later.

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.

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.” 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.” States also maintain control over siting—though not planning or distributing the costs of—new transmission infrastructure.

That means that very little 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.

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. 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

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152 16 U.S.C. § 824o(d).
153 See *infra* Part II.
156 Stein, *Regulating Reliability, supra* note xx, at 1193-94.
158 Federal Power Marketing Administrations may site transmission lines, and FERC may do so in corridors designated as critical by the Department of Energy. Klass et al., * supra* note 5, at 1040-41.
160 See *infra* text accompanying notes 165-168 (on RTOs’ role in balancing supply and demand).
The most important function of grid reliability—and one that requires extensive planning—is “load-resource” balance. This involves exactly matching: 1) the demand for and use of electricity (load), with 2) the amount of electricity “injected” into the grid (dispatched) from generators, which are also called resources.\(^{161}\) 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**\(^{162}\)

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.”\(^{163}\) 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.\(^{164}\)

\(^{161}\) Natl. Renewable Energy Lab., *supra* note 144, at 1.


\(^{163}\) Reliability Functional Model, *supra* note xx, at 8.

\(^{164}\) Id.
In most parts of the country, RTOs or “independent system operators” (ISOs) fill the role of balancing authorities. Like NERC, they are non-profit 501(c)(6) organizations, run by boards of directors, that control the operation of a web of connected transmission lines and 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. 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.

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.

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). 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.

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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.


169 Id. at 6.


171 Calculating and Using Reporting ACE in a Tie Line Bias Control Program, supra note 170.
2. Planning, Developing, and Operating a Reliable Grid

Beyond centrally regulating effective balancing of the actual electricity flowing through the grid, NERC standards also influence—but do not fully dictate—grid planning, development, and operations. On the planning front, NERC standards influence how various grid actors 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.172 FERC, in turn, requires all transmission 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.173 And many states require their utilities to engage in “integrated resource planning” that looks ahead to projected future demand and evaluates options to meet it cost-effectively and reliably.174

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,175 even in the case of interstate transmission lines.176 NERC and FERC explicitly lack authority to force states to build anything against their will.177

173 FERC Order No. 1000 (2011).
175 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).
176 Klass & Wilson, supra note 157.
177 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.”).
Yet NERC standards still wield quiet force within decisionmaking around “resource adequacy,” the state- and RTO-driven process of ensuring that planned additions of generating capacity match future demand needs. NERC standards dictate calculation and reporting methods that directly influence states’ and RTOs’ numerical floors for generation capacity. 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 experienced forced outages—and how often. NERC sets the calculation procedures for identifying these forced outages and runs the database—relied upon by RTOs—that tracks forced outages. At the state level, utilities often cite NERC reliability standards in asking states to approve the construction of new fossil fuel-fired power plants. As these examples illustrate, NERC-established standards have cascading effects beyond NERC’s substantive jurisdictional boundaries. We explore the implications of this influence further in Part III.

Finally, 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 respond to rapid changes in generation and load.

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179 See, e.g., id. (noting that “historical reserve margins have often exceeded the NERC-recommended levels).
183 See, e.g., Petition of Southern Indiana Gas and Electric Company d/b/a/ Centerpoint Energy Indiana South (“CEI South”), Cause No. 45564 at 11 (2022), https://www.in.gov/iurc/files/ord_45564_062822-.pdf (showing a utility representative arguing before a state commission that NERC’s Long-term Reliability Assessment “supports CEI Souths’ request to install fast-starting, quick-ramping generation via the [natural gas] CTCs [combustion turbines] in order to support the growing portfolio or renewable resources and maintain reliable service”).
184 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 anti-virus software, for software that is part of the bulk power system); COM-002-4 Operating
administers numerous reliability standards that address the safe operation of the grid. NERC is not alone in this task, however: states, too, centrally influence grid operations because they regulate distribution reliability and electric utilities’ expenditures. FERC also has a role in transmission line operation through its regulation of the rates that line operators may charge for use of the lines, including coverage of expenditures for reliability.

Another important facet of grid operation is ensuring fuel supply to power plants that run on fuel, such as natural gas-fired and hydroelectric power plants. Here again, states and federal entities beyond NERC play a central role, although NERC often highlights risks associated with fuel supply, sometimes in hopes of spurring action beyond its jurisdictional sphere. 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. States regulate natural gas wells and determine whether these wells must be winterized to withstand extreme cold. The federal Pipeline and Hazardous Materials Safety Administration (PHMSA) and states regulate the safety and operations of gas pipelines.

Personnel Communications Protocols (requiring standard communication procedures and training in communication for all operating personnel associated with the bulk power system).

See supra note 184.


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

See, e.g., FERC-NERC-Regional Entity Staff Report, supra note xx, at 222-23 (recommending the implementation of advanced monitoring and control technologies at natural gas wells and recommending state, federal, and local arrangements for coordinating information about gas and electricity).

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 drinking 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.”).

Areas such as hydroelectricity and many aspects of gas pipelines and wells are thus beyond the authority of FERC, NERC, and Regional Entities, who have all pressured 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.\textsuperscript{192} FERC also has some direct authority in this area, regulating siting, construction, rates, and operations of interstate gas pipelines—sometimes expressly for reliability.\textsuperscript{193} And here, NERC again at least has leverage. For example, when FERC attempted in 2022 to update its interstate natural gas pipeline certification and siting standards to address environmental justice issues and climate, a dissent to the updated policy statement by FERC Commissioner Danly stated:

The North American Electric Reliability Corporation (NERC) recently highlighted just how important natural gas is to our electric system when it explained in its most recent Long Term Reliability Assessment that ‘[n]atural gas is the reliability ‘fuel that keeps the lights on,’ and natural gas policy must reflect this reality.’ Today’s issuance is unlikely to allay NERC’s reliability concerns.\textsuperscript{194}

Industry vociferously and successfully pushed back against formalization of the updated certification standards; they are now merely advisory.\textsuperscript{195}

In sum, this subpart has attempted to situate NERC within the broader landscape of grid reliability—highlighting NERC’s core areas of oversight and influence, but also the ways in which its ability to fully ensure grid reliability is complicated and limited by the diverse array of actors and institutions involved in modern grid governance. As should be apparent from this brief but complex overview, electric reliability governance today bears little resemblance to the idealized SRO described in Part I or NERC’s early justifications as to why the grid fit this ideal. This is a point that we will return to in Part IV, where we consider whether the theory elucidated there still makes sense in this evolving regulatory landscape.


\textsuperscript{193} 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). In crafting this order, FERC again relied on NERC, inferring power plant outage rates caused by inadequate fuel from NERC’s coding and tracking of data because RTOs do not collect this information. See id. at 47.

\textsuperscript{194} 87 Fed. Reg. 11548 (2022).

\textsuperscript{195} Miranda Wilson, FERC retreats on gas policies as chair pursues clarity, EE News, March 24, 2022, https://www.eenews.net/articles/ferc-retreats-on-gas-policies-as-chair-pursues-clarity/.

Electronic copy available at: https://ssrn.com/abstract=4547667
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, 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. 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.”

NERC regional entities cover all portions of the continental United States and Canada (Figure 3).

Figure 3. Regional Entities

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

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196 See supra Part I.
197 16 U.S.C. § 824o (e)(4) (authorizing this delegation).

Electronic copy available at: https://ssrn.com/abstract=4547667
plays these roles for the Canadian provinces and portions of Mexico under terms negotiated with respective regulatory counterparts in those countries.200

Both NERC and its regional entities are 501(c)(6) not-for-profit corporations.201 NERC is governed by a twelve-member Board of Trustees,202 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.203 NERC’s Member Representatives Committee—comprised of two representatives from ten designated industry sectors—elects the trustees.204

Proposed reliability standards originate from NERC’s Standards Committee, which includes a cross-section of elected industry representatives.205 Most of the current Standards Committee members represent large utilities; others represent state utility regulatory commission, regional transmission

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200 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. Between 2006 and 2018, NERC and the relevant Regional Entities that extend into Canada signed memoranda of understanding with all Canadian provincial utility regulators. Mexico’s energy regulator also 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. See 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; MOUS, NERC, https://www.nerc.com/FilingsOrders/ca/Canadian%20mous%20DL/Canada%20MOUs%202020.pdf; Canada, NERC, https://www.nerc.com/AboutNERC/keyplayers/Pages/Canada.aspx.


203 Id.


organizations, and regional entities. Any member of NERC, including a Regional Entity Member, may request the development, modification, or withdrawal of a reliability standard. 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. 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. Committee actions for approving standards are taken by majority vote of the present members.

After the Standards Committee develops a proposed standard, NERC’s Registered Ballot Body votes and comments on it. The ballot body consists of over 400 registered ballot voters broken into segments, 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 distribute 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). 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.

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209 Id. at 11.
210 Id.
Given the composition of NERC’s registered ballot body (Figure 4), weighted voting by segment 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 segment—most often the largest segment, generation. Vertically integrated utilities also have a vote in this segment because they own generating units. But because entities are allowed to have representatives within every sector for which they qualify, 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 membership groups in which these same utilities frequently hold outsized sway.214 Added all up, the major utilities have voting power in as many as five of the ten NERC segments—making their voices critical to any potential reforms and giving them functional veto power. Because these same segments also determine the composition of the Standards Committee, the entire standard-development process is weighted toward those with greatest voice and representation within and across sectors.

If a standard makes it through the ballot body gauntlet, it goes on to the NERC Board of Trustees.215 NERC’s Member Representatives Committee advises the Board of Trustees on whether the standard should be adopted, and the Board of Trustees, if it chooses to adopt the standard, forwards it to FERC for approval under the extensive standards for deference noted in Part I.216 FERC

214 See infra discussion of SERC; see also Welton, supra note 166.
216 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.
can also approve region-specific reliability standards proposed by Regional Entities so long as they are “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.”

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, which develops private standards for the operation of wholesale and retail power and wholesale and retail natural gas and which sometimes collaborates with NERC. NERC itself also subscribes to another meta-SRO, the American National Standards Institute (ANSI), which “provides a framework for fair standards development.” 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. These rules—in addition to FERC requirements—drive the composition and rules governing NERC standard-setting and board elections.

These details of NERC’s internal design can feel tedious. Yet, as we have endeavored to show, they matter when it comes to the kinds of reforms proposed, discussed, voted on, and adopted or rejected by the organization. We now attempt to tie these institutionalist points to substantive outcomes, concluding that together, they forebode trouble for the world of reliability self-governance.

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 reliability governance. This part turns to assess NERC’s performance as the nation’s ERO. In many respects, NERC has been reasonably successful in maintaining grid reliability, both

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221 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).
historically and under modern conditions. 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 amount 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 Part collates and analyzes evidence of NERC’s outdated response to grid reliability, arguing that NERC has been very good at some aspects of reliability regulation but quite deficient in others. A recurring theme in this Part is NERC’s ability to identify new challenges to reliability through reports and statements by its leaders but its failure to act—or act quickly enough—on the challenges that it has explicitly identified, and even emphasized. A second theme is NERC’s myopic focus on technical standards, which do not adequately address the sea change that is needed to electrify an entire electric grid, power it through zero-carbon intermittent resources, protect this grid from increasingly extreme weather and cyber threats, and maintain the reliability of the system. This problem is not new. As the report addressing the causes of the 2003 blackout presciently observed, “NERC standards are frequently administrative and technical rather than results-oriented.”

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

As explored in Part I, the 2003 blackout and other reliability failures that preceded it ultimately spurred Congress to add a meta-regulator (FERC) to police the actions of the SRO NERC, although this policing came with a heavy dose of deference to NERC. As FERC began its role of approving and making mandatory NERC’s reliability standards and reviewing NERC’s enforcement of these standards, some of the deficiencies of this reliability governance model became clear. 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.”

Many early complaints about NERC focused on the slow speed of its standard-setting. NERC’s stakeholder-driven standard-setting process—its

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“great strength” in many eyes—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.

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.” 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. Industry representatives were outraged at FERC’s meddling and reacted particularly strongly to FERC’s order on frequency response, which the head of the American Public Power Association described as having “a real unfortunate ready, fire, aim dynamic.”

The frequency response order was a direct response to perceived deficiencies in NERC’s reliability governance in light of a grid that was changing to address the climate crisis. In it, FERC 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.

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.” 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.” But FERC did not

224 Schneider, J. D. (2013). NERC on a wire. Public Utilities Fortnightly, 151(2), 32-38
227 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).
228 2010 Tech Conf Transcript at 178-79.
229 Mandatory Reliability Standards for the Bulk Power Sys., 130 FERC ¶ 61,218, 61,991 (2010)
230 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).
231 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.
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.

In the wake of FERC’s stronger assertion of NERC oversight in the “March Massacre,” NERC continued to insist 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.\(^\text{232}\) 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 18\(^{th}\) . . . We all want to improve reliability.”\(^\text{233}\) 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.”\(^\text{234}\) Only FERC 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.”\(^\text{235}\)

In the ensuing years, as renewable energy penetration continued to grow and climate change concerns to mount, new questions emerged about NERC’s 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?”\(^\text{236}\) 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.”\(^\text{237}\) That meant that perhaps NERC was missing key facets of the modern reliability challenge in its standard-setting process—a point already emphasized in the 2003 task force report criticizing the focus on technical regulation rather than results.\(^\text{238}\)

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.\(^\text{239}\)

\(^{232}\) 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.”).

\(^{233}\) 232 Transcript at XX.

\(^{234}\) P. 107 Transcript.

\(^{235}\) Transcript at 170.

\(^{236}\) Transcript at XX.

\(^{237}\) B.W. Radford, Reliability vs. resiliency, 152 Public Utilities Fortnightly __4-4.6 (quoting LaFleur at tech conference).

\(^{238}\) Radford, supra note 230.

\(^{239}\) See supra text accompanying note 222.
B. Modern Grid Reliability Failures: Two Portraits of the Challenges

The tensions between NERC and its meta-regulator, and the deficiencies of NERC’s grid reliability governance in the midst of a climate crisis, have only become more apparent since the first decade of NERC’s role as a regulated SRO. 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. In Texas alone, at least 246 people died from the storm. Most of these deaths were attributable to loss of power. 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. Forty-nine percent of Texans lost water as pump stations lost power, with the average water outage lasting fifty-two hours.

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. 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. 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”

242 Id.
243 Hegar, supra note 4.
244 Id. at 4.
245 Id. at 5.
246 Id.
(demand). The ERCOT CEO reported that at its worst point, the grid was only minutes away from complete failure.\(^{247}\)

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.\(^{248}\) Water lines carrying water for steam or cooling to power plants froze, and ice accumulated on wind turbines.\(^{249}\) 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.\(^{250}\) 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 a similarly-sized role.\(^{251}\) 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.\(^{252}\)

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.\(^{253}\) These record-high temperatures caused particular grid


\(^{249}\) Id. at 9.

\(^{250}\) Id. at 8.

\(^{251}\) Id.


stress as the sun set, when demand remained high due to air-conditioning usage but solar output declined. 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. 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 reliability challenges that this Article explores. Over and over again, in summer and winter reliability assessments, in annual employee retreats, and in official reports following major blackouts or near-misses, and in Congressional testimony from its President and CEO, 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. 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.”

NERC further acknowledged both the challenges and opportunities associated within

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257 See Robb, supra note 43 [xx cross reference not hyperlinked].
259 Id. at 6.
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. Further, NERC noted that extreme heat in Texas increases demand and threatens inadequate supply of generation—a gap largely filled by additions of solar energy and some wind in recent years. 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. In June 2023, NERC’s President and CEO stated in Congressional testimony that “we must identify new resources to replace retiring generation that provides both sufficient energy and essential reliability services (such as flexibility, voltage support, frequency response, and dispatchability)” and that “we must shift focus from planning for solely ‘capacity on peak’ to ‘energy 24x7’ due to the changing fuel mix.”

These assessments suggest that NERC is, on one level, wholly 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—the new approach to grid reliability requires more instantaneous flexibility and planning for times when generation will increase or decrease. A grid operator facing a 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 reduce 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 form the core of the “dynamic resource adequacy” paradigm recognized by NERC staff as critical to reliability in the electric era yet not encompassed within NERC standards.

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, such as

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260 Id. at 5.
261 Id. at 4.
263 Testimony of James B. Robb, supra note 42 [xx cross reference not hyperlinked] at 1.
weatherization of generation and the strengthening of transmission lines, is now deemed essential in light of extreme weather and other modern grid realities.\(^{266}\)

Beyond the need for some critical hardening, there is growing recognition of the importance of resilient resources—those that can continue operating during storms and provide power when extreme weather or wildfires cause larger grid outages.\(^{267}\) 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.\(^{268}\) 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.\(^{269}\)

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—even as it has been slow to adopt standards that might help instill confidence in DER as a grid reliability solution.\(^{270}\) 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

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\(^{267}\) Hirsch et al., supra note @.


\(^{270}\) 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.
and records real-time information on bulk power system security incidents (physical and cyber threats) and NERC Standards personnel. 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. 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.

Despite some meaningful progress, 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 inadequate response 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. 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 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, many of which are drafted by regional entities and not by NERC itself.
1. NERC’s Preference for Baseload Resources

In numerous reports, NERC has expressed concern about the reliability challenges arising from the retirement of baseload generators that can provide electricity when called on. These are generators that run nearly all of the time to cover the base level of electricity demand typically present. 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. When severe weather disrupts pipeline service or creates supply shortfalls, generators that store fuel onsite can provide crucial reliability services, 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 they can operate if their primary fuel type becomes unavailable. In recent years, these capabilities have provided crucial reliability services.


277 Caveat that this has not always worked.


279 Id.
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. 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.” 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.

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 routinely advises entities outside its jurisdiction about how to manage emerging threats to grid reliability.

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

280 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.”)

281 Id.

282 But see Robb, supra note 38 (noting the importance of flexible resources in congressional testimony).


can recover the costs of winterization, and that state oil and gas commissions should require weatherization of wells. 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.

In the short run, with an electric grid dominated by gas, maintaining a secure gas supply is indeed critical. But 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. 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. 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. Nevertheless, NERC’s reports typically treat baseload, fuel-secure resources as the preferred reliability solution and often directly advocate for market interventions that give special treatment to these resources.

286 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.
287 See Stein, Distributed Reliability, supra note xx.
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). 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 obvious answer—despite evidence that natural gas itself may lack the flexibility NERC reflexively imbues it with (a point we take up further below).

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

290 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 REVIEWS 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).

291 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.”).
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. Typically, NERC sets a goal of fifteen percent reserve margins. NERC thus 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.

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


293 See id. (“If not provided, NERC assigned 15 percent Reserve Margin for predominately thermal systems and 10 percent for predominately hydro systems.”). We should note, however, that while NERC sets a target reserve margin, frequently the “Reference Margin Level is established by a state, provincial authority, ISO/RTO, or other regulatory body.” NERC, Rules of Procedure § 804 (2022), https://www.nerc.com/AboutNERC/RulesOfProcedure/NERC%20ROP%20effective%202020825_no%20appendicies.pdf. However, “[i]f a Reference Margin Level is not provided by an assessment area, NERC applies 15% for predominately thermal systems and 10% for predominately hydro systems.” Id. NERC outsources the work of evaluating the risk associated with a region’s reserve margin to assessment areas. NERC emphasizes that “[m]ethods and assumptions differ by assessment area and may not be comparable.” Id. at 35

294 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. For an analysis of why capacity markets are not meeting reliability needs, see Jacob Mays & Joshua Macey, Accreditation, Performance, and Credit Risk in Electricity Capacity Markets, (2023), https://optimization-online.org/?p=23247.

295 Cf. ERCOT, supra note 248, 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 caused by the direct impacts of cold on power plants, such as frozen valves or water lines at the power plants).
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. 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. While a comprehensive analysis of resource adequacy markets is beyond the scope of this paper, recent scholarship has shown that the concept of capacity is poorly defined, fails to consider correlated outages, and imprecisely measures resources’ availability during scarcity hours. 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

296 See, e.g., Stein, Regulating Reliability, supra note Error! Bookmark not defined.; Klass et al., supra note 5.
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 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.” 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. 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, 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, events surrounding wildfires have shown 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. 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.

300 See supra note @ and accompanying text.
301 At least, if not connected to battery devices.
303 Id.
Further investigation revealed that 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.\(^{304}\) 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 both harmful to renewables’ financial performance and made the grid less reliable.

3. NERC’s Influence Over Resource Adequacy Interventions

The recommendations contained in NERC reliability reports have a robust afterlife. Often, 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 Trump Administration’s 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 \textit{161 times}—observing again and again that “NERC is concerned with the trend of [baseload] retirements as it relates to reliability and resilience.”\(^{305}\) In particular, DOE cited NERC documents that discussed gas deliverability challenges,\(^{306}\) that emphasized the need for baseload generators,\(^{307}\) and that expressed concern about the “impact of premature retirements” of conventional units such as coal plants [that] provide frequency response services.\(^{308}\)

DOE’s proposed fuel security rule was a striking, 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, when regions face reliability challenges, they often cite NERC reports to support market interventions that ensure that gas-fired resources would be exempted from many of the competitive pressures other resources face.\(^{309}\)

\(^{304}\) 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).


\(^{306}\) Id. at 12.

\(^{307}\) Id. at 14.

\(^{308}\) Id. at 64.

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 provide cost recovery to resources that provide essential reliability services to prevent them from otherwise retiring due to non-competitiveness. 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. The decision to grant cost recovery was justified in large part because the plant’s retirement would cause to reliability issues.

Other reliability-must-run agreements further highlight the extent to which sophisticated players can take advantage of 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.


312 NERC Certification Review Summary Report at 2 (2023) (explaining balancing authority responsibilities and relevant NERC requirements).
NERC does not consider whether utilities are creating the balancing authority as a mode of anticompetitive behavior. FERC and state PUCs have jurisdiction over market power issues.

In 2014, NERC certified a balancing authority for the Michigan Upper Peninsula. 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. 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”. After finding that it did, NERC certified the new balancing authority.

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. 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).

But perhaps the most significant example of how incumbent utilities use seemingly neutral NERC reliability standards to favor their own interests is in the transmission system. To decarbonize quickly and cost effectively, the United States must invest in a significant amount of transmission capacity. Doing so allows renewables to provide power to areas that use large amounts of electric energy. It also increases the reliability of the bulk power system, since large

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316 See id.
317 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).
transmission lines allow areas experiencing scarcity conditions to import power from areas with surplus capacity. In addition, because the United States’ plan to decarbonize involves electifying carbon-intensive industries that are currently connected to the bulk electric system, it is necessary to increase transmission capacity in order to accommodate the additional demand that will be created by electifying everything.

Building new transmission in the United States requires developers to navigate a complex regulatory system. A full analysis of the regulatory process for planning, siting, and allocating the costs of new transmission is beyond the scope of this paper. A core problem today is that, although investor-owned utilities spend tens of billions of dollars a year building transmission lines, most of this investment goes towards small local lines that do not support deep decarbonization. By building small lines, transmission operators reduce the need to build regional lines that would more cost effectively meet their transmission needs and better support the United States’ decarbonization goals. In addition, transmission operators that own generating units may prefer to build local lines because doing so protects their generators’ market power, reduces competition from neighboring regions, and creates a need for investment in new generating units that would not exist if additional transmission capacity allowed the region to import more power from neighboring regions.

Yet despite the fact that investing in local lines increases costs, reduces reliability, and makes it difficult for renewables to interconnect to the bulk power system, transmission operators have a strong incentive to build a local lines. Most states do not review permits of local lines. At the federal level, RTO review

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319 Ill. Com. Comm’n v. FERC, 721 F.3d 764, 774 (7th Cir. 2013) (explaining that additional transmission allows regions to lower reserve margins).
321 See Edison Electr. Inst., Industry Data, [https://www.eei.org/resources-and-media/industry-data](https://www.eei.org/resources-and-media/industry-data) (explaining that, in 2021, “investor-owned electric companies spent $25.0 billion on transmission investment “ and “$40.3 billion on distribution investment”).
322 See Building for the Future Through Electric Regional Transmission Planning and Cost Allocation and Generator Interconnection, 179 FERC ¶ 61,028, at 35-36 (Apr. 21, 2022) (“The vast majority of investment in transmission facilities since the issuance of Order No. 1000 has been in local transmission facilities. For example, transmission investment to resolve local needs accounted for almost 80% of total transmission investment in MISO from 2018 to 2020. Similarly, in PJM, about two-thirds of the total transmission investment in the region went to resolving local needs.”).
of these lines is often limited to requesting an explanation of why the local line is needed. \[324\] Thus, utilities experience much less regulatory scrutiny when they invest in local lines instead of regional ones. In addition, because utilities do not need to compete with merchant developers when constructing local lines—FERC requires that regional lines undergo competitive solicitations but has exempted local lines from this requirement—utilities have a financial incentive to build local lines in order to avoid the risk that a competitor will win the contract to build the line. Thus, taken as a whole, the current framework for building transmission lines creates strong financial incentives for utilities to invest in precisely the wrong types of lines. Given this regulatory system, it is little surprise that the majority of transmission investment today is spent on the wrong types of lines.

It is worth emphasizing, however, that NERC reliability standards play an important role in allowing transmission operators to build small, local lines. One of the primary reasons that utilities are able to build local lines instead of regional ones is that, if a line is needed to remain in compliance with NERC standards, the utility does not need to go through the regional planning process. \[326\] In PJM, for example, transmission operators can construct new lines outside of the regional planning process if the lines are needed to meet NERC reliability standards. \[327\] Transmission operators are also allowed to submit their own local planning criteria, which are again often influenced by NERC standards. \[328\]

PJM does not meaningfully review these projects. Instead, it conducts a “do-no-harm analysis to ensure such projects do not negatively affect the reliability of the system.” \[329\] PJM “does not share the results of [its] analysis.” \[330\] It merely states that “PJM cannot examine systems not under [its] planning purview,” but that it does ensure that projects “meet the definition of supplemental projects in the [region’s operating tariff]” prior to being allowed to

\[325\] See FERC Order No. 1000, 136 FERC ¶ 61,051 (Jul. 21, 2011)
\[328\] See id.
According to PJM, this is because it “does not have the authority or expertise to determine when a facility is at the end of its useful life or otherwise needs to be replaced.” Utilities in other RTOs also are exempted from regional planning when a project is needed to comply with NERC standards.

Of course, we cannot prove that utilities manipulate their own transmission planning criteria to reduce the need for regional lines, or that any particular local line does not meet a pressing reliability need. Yet the turn away from regional planning clearly serves incumbent utilities’ financial interests, and there is at least strong circumstantial evidence that utilities are building local lines to avoid competition and limit regulatory oversight, and that NERC standards play an important role in allowing them to continue the parochial approach to planning new lines. Again, 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 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 draft reports and perform research about their own regions’ vulnerability to extreme weather events and other reliability challenges. This arrangement creates confusing

331 Id.
334 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
and misleading lines of accountability that allow utilities to essentially bolster self-serving takes on regional reliability under the guise of NERC’s expertise. It also likely explains seeming inconsistencies within NERC reports, since different sections are based on data and models submitted by different regional entities, which are themselves controlled by different utilities, RTOs, and reliability entities.

The result is that the actual data collection and drafting of reliability reports is outsourced to entities that are governed largely, if not entirely, by the incumbent utilities that have to comply with reliability standards. NERC itself stresses that its seasonal reliability reports are “independent assessment[s] by NERC and the ERO Enterprise.”\textsuperscript{335} In the same sentence, however, NERC acknowledges that the “reliability assessment process is a coordinated reliability evaluation between the NERC Reliability Assessment Subcommittee, the Regional Entities, and NERC staff with demand and resource projections obtained from the assessment areas.”\textsuperscript{336}

The actual report authorship follows a bewildering process, which NERC describes in its Reliability Assessment Guidebook.\textsuperscript{337} Regional entities collect data submitted to NERC for reports. They develop modeling techniques that NERC uses to assess reliability, and regions routinely use different modeling techniques. Often, the regional entity that manages a particular region drafts the sections for that region. As a result, 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,”\textsuperscript{338} it is actually drawing from the regional entity’s assessment. SERC is the regional entity in the Southeast and consists entirely of large utilities in the region. Thus, when NERC says that the Southeast has sufficient capacity, the reality is that the regulated monopolists that serve the Southeast are claiming that they have sufficient capacity. Yet

because the statement is published under NERC’s name, the conclusion has an imprimatur of independence.

In fact, all the underlying data in NERC reports come from regional entities.339 The regional entities provide actual and forecasted demand, the number and type of generating units, capacity and capacity transfers, planned transmission projects, and so on. Some of this information, such as forecasted demand, involves discretionary decisions that can further utilities’ financial interests. However, because NERC does not explain how regional entities are supposed to forecast demand or anticipate outages, it falls to the regional entity to develop the model that makes these forecasts. In this sense, the document only “promote[s] consistency for high-level data,” rather than actually requiring consistency.340

That said, NERC does not simply accept data as it is provided. Rather, there is a “peer review process that leverages industry subject matter expertise from various sectors of the industry [meant] to ensure the validity of the data and information provided by the Regional Entities.”341 Two peer members are assigned to review each assessment area’s data. Reviewer comments are discussed with the Regional Entity’s representative and refinements and enhancements are made as needed. The finalized product is then subject to additional review by the entire Reliability Assessment Subcommittee (RAS).

This arrangement is codified in NERC’s Rules of Procedure. The Rules of procedure emphasize that “the major sources of data and information for this program are the Regional Entities.”342 That does not mean NERC plays no role in reviewing reliability assessments. A team of reliability and technical experts develops and formulates independent conclusions about the near-term and long-term reliability of the Bulk Power Systems.”343 Still, despite the fact that NERC reviews data submission, Regional Entities are responsible for providing most essential information:

Regional Entity reliability self-assessments shall address, among other areas, the following topics: demand and Net Energy for Load; assessment of projected resource adequacy; any transmission constraints

that may impact bulk transmission adequacy and plans to alleviate those constraints; any unusual operating conditions that could impact reliability for the assessment period; fuel supply adequacy; the deliverability of generation (both internal and external) to Load; and any other reliability issues in the Region and their potential impacts on the reliability of the Bulk Power Systems.\textsuperscript{344}

Thus, even though NERC reliability reports are published under NERC’s name, it seems as though the regional entities are responsible for providing nearly all of the underlying information, of conducting the modeling and forecasting that supports NERC’s conclusions, and even of drafting parts of the text that makes its way into NERC reliability assessments.

In addition to the information provided to NERC, regional entities also submit supporting narratives that later feed into NERC’s reliability assessment.\textsuperscript{345} NERC even admits that risk analysis is performed by the assessment areas themselves, and that “[m]ethods and assumptions differ by assessment area and may not be comparable.”\textsuperscript{346} Interestingly, the 2023 Summer Reliability Assessment summarizes the types of assessments each region performs. It seems that regions have developed distinct approaches to assessing

\textsuperscript{344} Id.
\textsuperscript{345} Id.
reliability. 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].” These reports often follow the pattern described above, where NERC emphasizes the need for baseload resources and resources that can store fuel onsite. These reliability assessments, which are provided by local entities, often provide the strongest statements about reliability issues in the region.449


448 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.”).

449 See id. at 23, 19, 22, 24. (“Entities in SERC-Central have not identified any potential reliability issues for the upcoming summer season”; “Based on [its] Probabilistic Assessment, NYISO may rely on limited use of its operating procedures that are designed to mitigate resource and energy shortages”; “PJM expects no resource problems over the entire 2023 summer peak season”; “[SERC-East] Entities have not identified any emerging reliability issues”).
Occasionally, NERC statements expressing concern regarding renewables also appear to be taken verbatim from regional entities. For example, NERC reports that “ERCOT is also experiencing large increases in renewable production curtailments due to transmission constraints, and these curtailments are increasingly occurring at solar PV sites,” something that ERCOT itself reported.\textsuperscript{350} This is perhaps not surprising, given that one of the documents in which ERCOT reported the issue was a study “conducted for the North American Electric Reliability Corporation (NERC) as part of its 2022 Long Term Reliability Assessment.”\textsuperscript{351}

Yet NERC never cites where its conclusions come from. There are no explicit citations in the entire NERC Summer Reliability Report. The closest NERC comes to attributing authorship to other entities is sentences such as “Based on a WECC Probabilistic Assessment, the WECC-SW assessment area had negligible LOLH” or “SPP projects a low likelihood of any emerging reliability issues.”\textsuperscript{352} There are no links to where the RTOs performed their calculations or independent NERC assessments of their conclusions.

Reliance on these regional reports is particularly problematic given regional governance constructs. In brief, incumbent utilities often fully control the regional planning entities or at least have substantial influence.\textsuperscript{353} NERC thus outsources reliability analyses to entities that stand to profit or lose from decisions made surrounding reliability in the region, which seems to be in tension with the requirement that NERC conduct an “independent” reliability assessment.

Recall that SROs are most effective when there are clear lines of accountability, and when the SRO is independent. From an accountability standpoint, NERC’s reliability assessment procedure is dubious. When NERC

\begin{itemize}
\item \textsuperscript{351} ERCOT, Zonal Reliability Report, supra note \textsuperscript{Error! Bookmark not defined.}, at 22n11.
\item \textsuperscript{352} See NERC, 2023 Summer Assessment, supra note 336 at 33, 27.
\item \textsuperscript{353} For example, SERC, the Southeast Reliability Entity, is composed of nine large utilities that operate in the region. SERC, Reliability Plan for the Southeastern Subregion Reliability Coordinator 2 (May 3, 2022), https://www.nerc.com/comm/RSTC/RTOS/Reliability%20Plan%20-%20SeRC%20Southeastern%20Subregion_5-5-2022.pdf.
\end{itemize}
says that the Southeast has “not identified any potential reliability issues for the upcoming summer season,”

"it is repeating a conclusion that was made by SERC—NERC’s regional entity for the southeast. SERC, in turn, is 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 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—NERC’s meta-regulator after 2005? In this final subsection assessing NERC’s modern performance, we explain why—for legal and jurisdictional reasons—FERC has not been able to fully close the gaps created by NERC. This sets the stage for our discussion of solutions in Part IV, many of which would give a stronger role to FERC as a true “umbrella” organization for reliability.

In many 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).355 We explore below several examples of forward-looking actions by FERC that expressly addressed reliability challenges posed by the climate crisis and responses to it, and which aimed to force NERC action in this vein. These positive examples reinforce our conclusion that FERC is capable of expertly assessing reliability and intervening to improve it. But despite these positive examples, the SRO structure of reliability governance—particularly the deference that FERC must afford to NERC decisions, and FERC’s often risk-averse interpretation of its own jurisdictional limits—constrains the agency’s effectiveness.

First, for the positive view of FERC’s actions with respect to reliability in the electric era: In 2021, FERC commenced a proceeding entitled “Climate

354 Id. at 23, 19, 22, 24. Based on [its] Probabilistic Assessment, NYISO may rely on limited use of its operating procedures that are designed to mitigate resource and energy shortages”; “PJM expects no resource problems over the entire 2023 summer peak season”; “[SERC-East] Entities have not identified any emerging reliability issues”). Id. at 23, 19, 22, 24.

Change and Extreme Weather,” designed to address the threats to grid reliability that extend far beyond the Southern cold snap of 2021. 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. 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.”

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. 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. Indeed, FERC justified its jurisdiction in this area by noting that transmission line congestion directly affects wholesale electricity rates.

FERC also proactively requires access to some NERC information to determine whether new reliability standards are needed. For example, in 2016, FERC ordered NERC to grant FERC staff access to NERC databases that provide information on generation and transmission outages. These included, among others, the Generating Availability Data System that RTOs and other entities rely upon in determining the among of new generating capacity needed, as noted in Part II.A.2.

Similarly, FERC has had to force NERC into an adequate response to the reliability issues posed by inverter-based resources (IBRs, which are mostly

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360 Id.


362 FERC Order No. 824, 155 FERC P 61275 (2016).

363 Id. at *2 (2016 WL 3439798).
renewables).\textsuperscript{364} 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.\textsuperscript{365} FERC found, however, that NERC’s “actions to date have not successfully addressed the most common reliability issues posed by IBRs.”\textsuperscript{366} 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.”\textsuperscript{367} 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.”\textsuperscript{368} Yet because of the SRO arrangement between FERC and NERC, FERC could not remedy this problem itself—instead, it had to take a circuitous path through NERC and hope that the organization develops high-quality standards.

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.\textsuperscript{369} It was only after the 2021 reliability crisis in the South, coupled with 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.\textsuperscript{370}

\textsuperscript{364} See supra note \textsuperscript{4} and accompanying text introducing inverter-based resources.

\textsuperscript{365} Registration of Inverter-Based Resources, 181 FERC ¶ 61,124 at PP. 28-29 (Nov. 17, 2022).

\textsuperscript{366} 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).

\textsuperscript{367} See Notice of Proposed Rulemaking, Reliability Standards to Address Inverter-Based Resources, 181 FERC ¶ 61,125 (Nov. 17, 2022).

\textsuperscript{368} Id.

\textsuperscript{369} 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 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).

Despite important FERC efforts to update reliability standards for an electric era plagued by growing threats to the grid from climate change, FERC’s ability to force NERC into action on these issues has proven slow and piecemeal under FERC’s existing legal and policy tools. This is due in part to the limits that Congress places on FERC’s jurisdiction and also, we argue, FERC’s failure to fully exercise its existing jurisdictional authority. Under the present legal structure, FERC 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.\textsuperscript{371} FERC has also been repeatedly timid in flexing its existing jurisdictional powers to solve modern reliability issues that it could address through, for example, transmission siting and greater regional control over electricity flows and markets. This is in part due to political economy—the fear of recalcitrance by states that vehemently resist any efforts to require regional management of the grid or federal transmission line siting, for example.\textsuperscript{372} In its totality, the present FERC-NERC arrangement simply appears ill-suited for the dynamism and complexity of the modern grid.

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.

\textsuperscript{371} See infra Part IV.B.2.a.
\textsuperscript{372} See, e.g., Klass et al., supra note 5, at 1040 (noting that after a federal court’s rejection of a FERC attempt to use limited federal transmission line siting authority, experts argued that FERC could have tried to use again in light of the limited holding); Hannah J. Wiseman, Regional Cooperative Federalism and the U.S. Electric Grid, 90 G.W. L. Rev. 147, 166 n. 80 (describing the two orders in which FERC encourage but did not mandate the formation of RTOs, which open up wholesale energy markets and allow more competitive generators, including renewable generators, to enter those markets); Iulia Gheorghiu, Despite authority to require RTOs, Glick says FERC will encourage bottom-up approach to creating power markets, Utility Dive, Dec. 3, 2021, https://www.utilitydive.com/news/despite-authority-to-require-rtos-glick-says-ferc-will-encourage-bottom-up/610874/; Regional Transmission Organizations, 65 Fed. Reg. 810, 937 (Jan. 6, 2000) (codified at 18 C.F.R. pt. 35) (expressing concern about “usurp[ing] state authorities over siting, planning, and reliability of the transmission system.”).
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.

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. 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. 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. Although NERC members appear highly technically adept in managing a reliable power system based primarily on baseload resources, the organization 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.

Thus, industry expertise at least provides a less thoroughgoing reason for industry self-regulation in the electric era. That said, in our proposed solutions,

373 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%20Minutes%202013/Policy-Input-Package-August-2022-PUBLIC-POSTING.pdf.
374 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-agency-s-staff-openings/.
375 See supra notes @@ and accompanying text.
we recognize that enduring channels of critical knowledge counsel for preserving NERC in some form.\(^{376}\)

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 through an interconnected system, as shown by the Northeast blackout of 2003\(^{377}\)—making electric utilities “hostages of each other.”\(^{378}\)

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.\(^{379}\)

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 difficult to assign responsibility for discrete 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

\(^{376}\) See infra Part IV.B.
\(^{377}\) See supra notes 118-122 and accompanying text.
\(^{378}\) See supra note 57.
\(^{379}\) See supra Part I.B.
traced in Part III.C, even as NERC staffers themselves often admirably identify and voice the need for change. 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.

3. Alignment of Interests/Accountability Mechanisms

Many of the same dynamics that erode electricity industry incentives to self-policing 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. 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 new 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. 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. 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

380 See also Stein, Regulating Reliability, supra note Error! Bookmark not defined., at 1194 (describing this array of actors and currently inadequate jurisdiction).

381 See supra Part III.

382 See supra Part III.C.3.
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.

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.383 Adding several more 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.\textsuperscript{384}

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.\textsuperscript{385} 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.\textsuperscript{386} Independent review bodies bring a bird’s eye perspective to agency action and can push agencies in new directions.\textsuperscript{387} 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.\textsuperscript{388}

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.\textsuperscript{389} 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

\textsuperscript{384} See supra note Error! Bookmark not defined. and accompanying text.
\textsuperscript{385} See supra note 214 and accompanying text.
\textsuperscript{386} See Appendix B for details.
\textsuperscript{387} 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, such as the Federal Railroad Administration, that address these causes. About Us, Natl. Transp. Safety Bd., https://www.ntsb.gov/Pages/home.aspx.
\textsuperscript{388} 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 Off., 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.
\textsuperscript{389} See Electricity Modernization Act of 2005, § 215(c).
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 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.\footnote{390 See supra Part III.}

Despite these potential benefits, some might argue that adding independent oversight will, although despite shifting reliability regulation toward an important modern focus, also increase bureaucratic red tape and further slow needed reliability reforms. This is a risk—but one we believe is justified by the need for transformative shifts in reliability governance to match public goals for the system.

That said, it is also the case that 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.\footnote{391 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, \textit{Regulating Reliability}, supra note \textit{Error! Bookmark not defined.}.} 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 public 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.

Electronic copy available at: https://ssrn.com/abstract=4547667
a. 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.”[^392] Although this triple deference standard allows FERC to reject NERC standards that are blatantly misguided,[^393] 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.[^394] This would, of course, require congressional reform, as the Energy Policy Act of 2005 mandates these deference standards. But again, with a galvanizing moment such as another nationally-relevant reliability incident, Congress could be spurred to act.

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.[^395]

One approach would be for FERC’s Office of Electric Reliability (OER), which currently serves an oversight and collaborative role with NERC and


[^395]: See Stein, Regulating Reliability, supra note Error! Bookmark not defined., at 1238-1261 for an account of factors supporting FERC jurisdiction over “system-wide reliability.”
states, 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 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 characteristics and regional variations in climate impacts and their relationship to reliability. Of course, there are risks to this model as well: notice-and-comment rulemaking has spawned a huge range of related litigation that could entangle more publicly set standards (especially in an era of decreasing agency deference), and NERC might be less willing to lend its expertise under this model as well. But ultimately, we think the benefits of consolidated and publicized processes outweigh hypothetical drawbacks, especially since standard-setting is too slow and already deeply proceduralized under the current model.

One other 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.

b. 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. FERC would both draft and finalize reliability standards in all of these areas—with the advice of NERC—allowing

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398 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”).
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. 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, transmission siting, and regional resource adequacy. 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, for fully functional reliability governance for the electric era, we believe that the most effective solution is a national, centralized, top-down entity with comprehensive responsibility for reliability of the entire U.S. electric grid. 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. 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.

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 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

399 See Stein, Regulating Reliability, supra note Error! Bookmark not defined., at 1236 (noting FERC’s efforts in some of these areas but arguing for broader FERC controls).
400 See Welton, Rethinking Grid Governance, supra note @.
401 See supra Part Stein, Regulating Reliability, supra note Error! Bookmark not defined., at 1195 (highlighting importance of transmission planning to reliability).
403 Id. at 24.
404 Id. at 11.
405 See supra notes @@ and accompanying text.
“hardening” of electric distribution wires. 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.

Relegating NERC to the status of an advisory entity to FERC would raise a variety of objections, but most would be the same arguments that NERC has raised before when threatened with more public reliability regulation. These would include, for example, arguments that NERC is an effective SRO due to the interdependence of its actors, the risk of collective failure, and the tight-knit nature of its actors. But as we have documented, all of these conditions have substantially changed. And the most compelling reason for the continued reliance on an SRO for U.S. grid reliability governance—industry expertise—would be preserved by maintaining NERC as an important advisory entity to FERC.

Another challenge of making FERC the Fed of reliability would be resource-based. FERC is already tasked with a wide range of energy-related functions, such as oversight of interstate oil pipeline tariffs, granting of certificates and eminent domain authority for interstate natural gas pipelines, and a variety of functions relating to wholesale electricity and transmission rates. But FERC already has basic staffing to review NERC’s actions and work with NERC to examine the causes of reliability incidents. These positions could be

406 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 Error! Bookmark not defined., at 1233-34.
408 See supra Part I.B.
409 These staff appear to primarily work in the FERC Office of Electrical Reliability and Office of Enforcement. See, e.g., NERC and FERC Staff Recognized for Work on Joint Cold Weather Inquiry, North Am. Electr. Reliability Corp., Nove. 18, 2021,
enhanced with budget modifications. Congress has indicated a willingness to pour billions of dollars into a modernized, reliable grid through the Infrastructure Investment and Jobs Act and Inflation Reduction Act. If this modern, “greener” grid is not reliable, federal efforts to transform the grid are likely to fall flat due to enhanced public opposition. Investment in a governance system that would better ensure reliability would thus likely have large returns.

We have barely scratched the surface of interesting debates to be had about the relative merits of these major potential changes in federal-state jurisdictional lines in energy law—even as we have gone on too long. 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.

c. 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, and NERC— comprised of industry members intimately familiar with the wires, substations, transmission and generation—remains a vital source of technical expertise. But NERC’s technical strengths are diffi-
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.

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 undermine self-regulation.

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 reliability governance must change. More fundamentally, FERC needs broader jurisdiction within this space, as others have persuasively argued.412

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

412 See generally Stein, Regulating Reliability, supra note Error! Bookmark not defined..
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.\textsuperscript{413} 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.\textsuperscript{414} 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.”\textsuperscript{415}

\textsuperscript{413} 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.

\textsuperscript{414} 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 \textsuperscript{Error! Bookmark not defined.}, at 1196.