IDEOLOGY VS. INTEREST GROUP POLITICS IN U.S. ENERGY POLICY*

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The political economy of energy policy in the United States is dominated by a combination of ideological partisanship and interest group lobbying. Both are reflected in the widespread belief that, under the Obama administration, the Environmental Protection Agency ("EPA") was engaged in a misguided "war on coal," despite the coal industry's status as the leading industrial source of air pollution and compelling evidence that the benefits of EPA's regulations vastly exceed their costs. This conflict is persistent and unresolved, notwithstanding repeated involvement of the Supreme Court over the last few years. The politics of this conflict are compounded by tensions between electricity managers and environmental regulators. Much of this tension is driven by competing perspectives: EPA's focus has been on the national costs and benefits of its rules, whereas grid managers operate regionally. This Article resolves the apparent conflicts by downscaling the regulatory analyses of three high-profile (and highly litigated) EPA rules addressing emissions of conventional pollutants, air toxics, and greenhouse gases associated with climate change from coal-fired power plants. This Article utilizes complementary EPA databases and draws on several model estimates to examine the regional impacts—both costs and benefits—of regulations targeting coal-fired power plants.

Overall, this Article finds that the distribution of both the compliance costs and environmental benefits of the rules are roughly commensurate with each region's reliance on coal-fired

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power plants, particularly older facilities. That is, the benefits of reducing emissions under these rules are predominantly local. As a consequence, regulatory benefits exceed costs not only at the national level but at the regional level as well, and typically by large margins. Further, with a few important caveats, we find that while the EPA rules will hasten power plant closures, most will occur in electricity markets that have sufficient excess capacity to mitigate potential threats to electricity supplies and reliability. Nevertheless, opposition to the rules persists, which we explain as the product of a combination of both interest group and ideological/partisan opposition. Interestingly, ideological/ partisan opposition appears to hold greater sway based on varying levels of political opposition regionally and may—incrementally—be shifting in EPA's favor.

INTRODUCTION

Energy policy in the United States is shaped by ideological conflicts between the political parties and powerful interests with large assets at stake. While the increasing polarization of American politics is well recognized,[1] conflicts over regulation of the energy sector are especially sharp, inciting repeated interventions by the Supreme Court in recent years.[2] EPA's regulation of electric utilities has become a focal point of this partisan divide and an ideological litmus test for congressional campaigns.[3] It is also emblematic of the broader trends in congressional politics, characterized by a shift from norms of cooperation among centrists of both parties in the 1970s and 1980s to the dominance of bitter partisanship today.[4] In the 1970s, for example, a Republican president created EPA,[5] and a Democratic president oversaw the deregulation of natural gas prices;[6] in the 1980s

1. For a good overview of the various theories of congressional polarization, see generally JOHN H. ALDRICH, WHY PARTIES? THE ORIGIN AND TRANSFORMATION OF POLITICAL PARTIES IN AMERICA (1995) (summarizing the polarization literature); KEITH T. POOLE & HOWARD ROSENTHAL, CONGRESS: A POLITICAL-ECONOMIC HISTORY OF ROLL CALL VOTING (1997) (measuring ideological polarization over time and tracing it to differences across issue groups); SEAN M. THERIAULT, PARTY POLARIZATION IN CONGRESS (2008) (crediting Congress's adoption of supermajoritarian procedures); Morris P. Fiorina & Samuel J. Abrams, *Political Polarization in the American Public*, 11 ANN. REV. POL. SCI. 563 (2008) (crediting polarization to party activists, not passive partisans).

2. For a summary of this litigation, see *infra* Section I.B.

3. Bloomberg reports that more than 14,000 anti-EPA ads and more than 34,000 pro-coal ads aired in 2014 Senate campaigns, compared to about 5,000 pro-EPA ads and another 15,000 pro-green energy ads. *See 980,570 Ads*, BLOOMBERG POL., http://www.bloomberg.com/politics/graphics/2014-senate-ads-and-issues/ [https://perma.cc/94AE-9J5J] (last updated Oct. 13, 2014).

4. The most widely cited data on the ideological polarization in Congress are those assembled originally in Keith Poole and Howard Rosenthal's DW-NOMINATE dataset, which places members of Congress on an ideological spectrum based upon members' voting behavior. *See* NOLAN MCCARTY, KEITH T. POOLE & HOWARD ROSENTHAL, POLARIZED AMERICA: THE DANCE OF IDEOLOGY AND UNEQUAL RICHES 5 (2006); *see also The Polarization of the Congressional Parties*, VOTEVIEW.COM, http://voteview.com/political_polarization_2014.htm [https://perma.cc/YL47-GET5] (last updated Mar. 21, 2015).

5. *See The Guardian: Origins of the EPA*, U.S. ENVTL. PROT. AGENCY, https://archive.epa.gov/epa/aboutepa/guardian-origins-epa.html [https://perma.cc/9TBQ-TPLP] (last updated Sept. 6, 2016). Richard Nixon established EPA from parts of other agencies by executive action in 1970. Reorganization Plan No. 3 of 1970, 3 C.F.R. 199 (1970), *reprinted in* 5 U.S.C. app. at 208 (2012).

6. *See* Natural Gas Policy Act of 1978, Pub. L. No. 95-621, 92 Stat. 3351 (codified as amended in scattered sections of 15 U.S.C.). Jimmy Carter signed into law the Natural Gas Policy Act of 1978, which deregulated wellhead prices in the hopes of stimulating more exploration for natural gas. *See id.* For a description of the early effects of the Natural Gas Policy Act, see Richard J. Pierce, *Reconsidering the Roles of Regulation and Competition in the Natural Gas Industry*, 97 HARV. L. REV. 345, 348–52 (1983).

and early 1990s, a bipartisan Congress addressed the problem of acid rain and the global threat of ozone losses in the stratosphere,[7] and a Republican president ran for election as the "environmental president."[8] Today, however, the parties are each more ideologically homogenous than at any time in the postwar era,[9] yet are further divided on issues that concern the regulation of the energy industry, most notably climate change.[10]

Growing partisanship is central to the political stalemate that exists over national policies at the intersection of energy and the environment, and regulation of coal-fired power plants is its epicenter. Congressional gridlock has caused the locus of policymaking to revert to the executive branch and the courts.[11] This movement has incited a backlash in Congress, where the Obama administration EPA's efforts to regulate emissions from coal-fired power plants are commonly portrayed as a "war on coal" and a regulatory "train wreck."[12] In substance, the debate reflects the contrasting visions of energy policy that growing partisanship has cultivated between the political parties: one vision, more associated with Democrats and the ideological left, is premised on transitioning away from fossil fuels and toward cleaner modes of generating electricity; another vision, more associated with Republicans and the ideological right, is that alternative sources of energy are antithetical

7. *See* Clean Air Act Amendments of 1990, Pub. L. No. 101-549, tit. IV, VI, 104 Stat. 2399, 2584–2634, 2648–72 (codified as amended at 42 U.S.C. §§ 7651–51o, 7671–71a (2012)).

8. *See* Opinion, *Bush vs. Clinton: What Is an Environmental President?*, L.A. TIMES (Sept. 27, 1992), http://articles.latimes.com/print/1992-09-27/opinion/op-488_1_environmental-policy [https://perma.cc/R8XA-SK9K] (noting that this was George H.W. Bush in 1988).

9. *See The Polarization of Congressional Parties*, *supra* note 4.

10. *See* Ned Resnikoff, *Senate Committee Again Debates Existence of Climate Change*, MSNBC (Jan. 30, 2014, 2:06 PM), http://www.msnbc.com/all-6#49725 [https://perma.cc/9LEL-J389] (discussing "climate deniers," including Senator Jim Inhofe's repeated claims that climate change science is a hoax). For scientific assessments showing consensus on the issue of climate change, see, for example, NAT'L CLIMATE ASSESSMENT & DEV. ADVISORY COMM., U.S. GLOB. CHANGE RES. PROGRAM, CLIMATE CHANGE IMPACTS IN THE UNITED STATES 1 (2014), http://s3.amazonaws.com/nca2014/low/NCA3_Climate_Change_Impacts_in_the_United%20States_LowRes.pdf?download=1 [https://perma.cc/B9CF-QFHQ]; Intergovernmental Panel on Climate Change [IPCC], *Climate Change 2013: The Physical Science Basis—Summary for Policymakers*, at 15, 23 (2013), https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WGIAR5_SPM_brochure_en.pdf [https://perma.cc/7AMS-M975].

11. For a detailed examination of this phenomenon, see generally Jody Freeman & David B. Spence, *Old Statutes, New Problems*, 163 U. PA. L. REV. 1 (2014).

12. *See, e.g.*, JAMES E. MCCARTHY & CLAUDIA COPELAND, CONG. RESEARCH SERV., R41914, EPA'S REGULATION OF COAL-FIRED POWER: IS A "TRAIN WRECK" COMING? 7 (2011), http://www.lawandenvironment.com/uploads/file/CRS-EPA.pdf [https://perma.cc/KUA8-37QR].

to energy security and economic prosperity.[13] These opposing visions are infused with deeper partisan conflicts over the role of government in the economy.[14]

The ideological barriers to constructive policymaking are compounded by high-stakes interest group politics in the electric utility sector. Private opposition to EPA's rules is driven in part by the disparities between the concentration of regulatory costs in a single industry and diffuse benefits that are shared by the wider public. The rules at the center of this debate require fossil-fueled power plants to reduce emissions of pollutants associated with a long list of adverse health and environmental impacts. The addition of new controls will lower the incidence of asthma, birth defects, and thousands of premature deaths annually;[15] it will also reduce power plant emissions of greenhouse gases ("GHGs") that contribute to climate change. The political economy[16] of EPA's rules is made more challenging by the high stakes. Power plants are the largest industrial sources of major air pollutants (including GHGs) in the United States,[17] and EPA's rules represent a genuine threat to the economics of the coal industry. The Obama administration EPA rules, along with rising competition from natural gas-fired power, put coal industry and electric utility jobs at risk and are projected to prompt the closure of many coal plants. These factors partly explain why coal-producing states fell solidly for Donald Trump in the 2016 presidential election.[18] Moreover, the potential negative impacts are

13. *See generally* ALEX EPSTEIN, THE MORAL CASE FOR FOSSIL FUELS (2014) (arguing that there are no significant environmental or other downsides to continued extensive reliance on fossil fuels). This stands in sharp contrast to the scientific understandings that motivate the EPA rules, the impacts of which are analyzed in this Article.

14. Poole and Rosenthal describe this ideological divide as one centered on the role of government intervention in the economy. *See* Royce Carroll et al., *DW-Nominate Scores with Bootstrapped Standard Errors*, VOTEVIEW.COM, http://voteview.com/dwnomin.htm [https://perma.cc/9GNU-SHZC] (last updated Sept. 17, 2015).

15. For a more thorough description of these effects, see *infra* Section I.A.

16. The term "political economy" has several meanings in scholarly literature, but is used here to refer to the interaction between political action and economic action, in both directions—that is, the effects of new laws and regulations on economic actors and their decisions, as well as those actors' attempts to influence lawmaking through political action.

17. David E. Adelman, *Environmental Federalism when Numbers Matter More Than Size*, 32 UCLA J. ENVTL. L. & POL'Y 238, 287–88 (2014) (noting that in 2005, electric utilities accounted for 80% of the SO_2 emissions from industrial sources, over 60% of the NO_x emissions, and over 50% of the $PM_{2.5}$ emissions).

18. *See* Michael Bastasch, *Here's Why Trump Won Big in Coal Country*, DAILY CALLER (Nov. 10, 2016, 10:06 AM), http://dailycaller.com/2016/11/10/heres-why-trump-won-big-in-coal-country/ [https://perma.cc/EVV8-5VPE]; Leigh Paterson & Reid Frazier, *Coal Country Picked Trump. Now, They Want Him to Keep His Promises*, NPR (Jan. 1,

not limited to the coal sector; several recent studies suggest that retirements of coal plants could undermine the reliability of the electric grid as well.[19]

Of course, the election of Donald Trump raises the possibility that the EPA rules will be repealed or weakened.[20] EPA has defended its rules on the ground that their benefits exceed the respective costs by a wide margin.[21] However, the agency's arguments are based on national averages and therefore ignore disparities in the geographic distribution of the costs and benefits for each rule.[22] This analysis is problematic because the costs will not be evenly spread. In particular, coal-fired power plants at risk of closure are concentrated in the Midwest and Southeast, and coal-producing regions are located in just a few eastern and western states.[23] The perceived salience of such geographic disparities is enhanced by the temporal lags that exist between the costs and benefits of EPA's rules. The economic costs (including job losses) are near term and fall on identifiable individuals, whereas the benefits will accrue in the future to people whom we can count but cannot identify—those who will *avoid* an illness or premature death.[24] EPA is therefore advancing the very kind of "concentrated costs/diffuse benefits" policies that political scientists have long recognized as posing the greatest political challenges.[25] As a consequence, opposition to EPA's rules[26] has two

2017, 3:06 PM ET), http://www.npr.org/2017/01/01/507693919/coal-country-picked-trump-now-they-want-him-to-keep-his-promises [https://perma.cc/ZS7M-RFT5].

19. For a more thorough description of these economic impacts, see *infra* Part III.

20. *See* Steven Mufson & Brady Dennis, *Trump Victory Reverses U.S. Energy and Environmental Priorities*, WASH. POST (Nov. 9, 2016), https://www.washingtonpost.com/news/energy-environment/wp/2016/11/09/trump-victory-reverses-u-s-energy-and-environmental-priorities/?utm_term=.224ea5c09de4 [https://perma.cc/4S2N-3F7D].

21. For a discussion of EPA's cost-benefit estimates, see *infra* Section III.C.

22. *See infra* notes 262–67 and accompanying text.

23. *See infra* Section III.A.

24. *See infra* notes 301–03 and accompanying text.

25. The intuition here is that when costs (or benefits) are concentrated among a very few, those few are motivated to apply pressure to their elected representatives in order to influence policy, and that that motivation disappears when costs (or benefits) are diffused. Thus, political action that imposes costs on a few for the benefit of the many is particularly difficult to enact in a representative democracy. Political scientist James Q. Wilson is often credited with explaining the political difficulty of enacting these kinds of regulatory policies. *See* James Q. Wilson, *The Politics of Regulation*, *in* THE POLITICAL ECONOMY: READINGS IN THE POLITICS AND ECONOMICS OF AMERICAN PUBLIC POLICY 82, 85–89 (Thomas Ferguson & Joel Rogers eds., 1984); *see also* THEODORE J. LOWI, THE END OF LIBERALISM: THE SECOND REPUBLIC OF THE UNITED STATES 50–61 (2d ed. 1979).

26. *See* Jean Chemnick, *Jay Rockefeller—The Evolution of a Coal State Senator*, N.Y. TIMES (Jan. 18, 2011), http://www.nytimes.com/gwire/2011/01/18/18greenwire-jay-rockefeller-the-evolution-of-a-coal-state-s-4772.html?pagewanted=all [https://perma.cc/NT3Z-X25L (staff-uploaded archive)]; Nick Wing, *Joe Manchin Shoots Cap-And-Trade Bill with Rifle in New*

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distinct sources—ideologically opposed Republicans *and* interest group-driven coal-state Democrats.[27]

Our purpose here is to examine the relationship between the projected costs and benefits of the EPA rules, on the one hand, and the politics surrounding their adoption, on the other. This analysis uses publicly available data from several EPA datasets[28] to explore the geographic distribution of the costs and benefits of the EPA rules. Part I examines the factual and historical basis of EPA's complex suite of regulations. After briefly describing the virtues of coal-fired power in American electricity markets and the externalities associated with its air emissions, we review the Clean Air Act ("CAA") rules that comprise the bulk of EPA's alleged "war" on coal-fired electricity generation.

Part II discusses a recent series of reports analyzing the potential effects of EPA's rules on management of the electric grid and the reactions of electricity regulators and other stakeholders to these rules. The discussion focuses on the perspectives of regulators whose mission is guided by the broader public interest, as opposed to nongovernmental actors with an economic or organizational interest that predisposes them to either favor or disfavor the EPA rules. Most of this commentary raises significant technical questions and is strongly or cautiously negative. However, not all the commentary is negative: substantial variation exists in the degree of concern expressed by federal, regional, and state officials. What is unmistakable in the comments is a widespread concern about the potential threats EPA's rules pose to maintaining reliable electricity supplies and the importance of regulatory flexibility for maintaining grid stability.

In Part III, in order to explore the effects of EPA regulation on the reliability of the electric grid, we utilize several complementary EPA datasets to examine the types and geographic distribution of coal plants at risk of closure under the new EPA rules. This analysis

Ad, HUFFINGTON POST (Oct. 11, 2010, 3:53 PM), http://www.huffingtonpost.com/2010/10/11/joe-manchin-ad-dead-aim_n_758457.html [https://perma.cc/AKN8-CNP6].

27. *See, e.g.*, Caroline May, *Manchin on EPA Rule: Obama Administration "Deniers"*, BREITBART (June 3, 2014), http://www.breitbart.com/Big-Government/2014/06/03/Manchin-on-EPA-Rule-Obama-Administration-Deniers/ [https://perma.cc/7H6A-D9LP] (describing Senator Manchin's opposition to the EPA rule).

28. The data analyses presented below utilize data drawn from EPA's Integrated Planning Model ("IPM") datasets for the MATS rule and CSAPR, IPM 4.10, and the more recent dataset for the CPP, IPM 5.13. The data are analyzed from IPMs 4.10 and 5.13 Base Cases, as well as the datasets EPA generates for each rule, assuming each rule is implemented. For the details of the analysis, see *infra* Part III.

shows that (1) while the impacts of the EPA rules are not uniform across wholesale power markets, they are typically proportional to each region's reliance on coal-fired power; (2) in the few instances where a region's share of the costs of a rule is greater than its share of coal-fired generation capacity nationally, it is because the region's fleet is older and smaller, and produces more pollution; (3) regions that bear the highest costs receive the greatest benefits because the health benefits of the EPA rules are predominantly local; and (4) the net benefits of EPA's rules are positive—and typically by large margins—not just nationally, but in every regional power market.[29] With regard to grid stability, the data reveal that the regions projected to have the greatest numbers of coal plant closures have significant excess generation capacity to mitigate these losses.[30] In short, we find little evidence to oppose EPA's rules on either economic or distributional grounds.

Finally, Part IV explores the political economy of EPA's rules in greater detail to answer the following question: why are the highly favorable net benefits of EPA's rules at the national *and* regional levels failing both to foster a more constructive public debate and to mitigate the influence of ideological and interest group politics? To answer this question, this Article explores the variation in state and regional positions on the EPA rules. It notes that some state and regional opposition to the rules is consistent with interest group politics, and the notion that concentrated economic costs (or the risk of such costs in the form of reliability risks) loom larger in the policy process than diffuse environmental benefits.[31] However, some of the regions and states hit hardest by the risk of plant closures have raised far stronger objections than others, and much of the variation in state and regional position taking on the rules seems more consistent with state and regional ideological differences than with interest group pressure.[32]

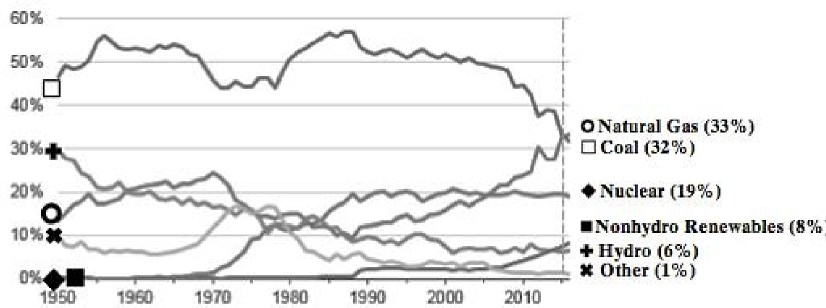
I. THE EVOLUTION OF REGULATIONS GOVERNING COAL-FIRED ENERGY GENERATION

Coal has traditionally claimed the lion's share of the American electric generation supply because of its low cost, large domestic

29. *See infra* Part III.
30. *See infra* Section III.B.
31. *See infra* notes 295–99 and accompanying text.
32. *See infra* Part IV.

reserves, and reliability.[33] These characteristics make it exceptionally attractive to grid managers as a source of electricity—none of the other generation technologies has had such a powerful combination of stabilizing attributes.[34] However, coal has lost market share to natural gas and renewables in recent years, as Figure 1 indicates.

Figure 1: Shares of Electricity Generation: 1950–2016[35]



Historically, coal-fired and nuclear power plants have had high capacity factors,[36] while other technologies have been used to serve daily or seasonal peaks in demand.[37] For this reason, coal-fired and

33. *See infra* Figure 1. The United States has the largest coal reserves in the world, amounting to more than one-fourth of economically proven reserves globally. *International Energy Statistics: Total Recoverable Coal*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=1&pid=7&aid=6 [https://perma.cc/2DPE-HT6J]. The technologies underlying coal generation are very well established and robust, and coal has the substantial virtues of being easy to transport and stockpile at generation plants, which further enhances its reliability as a fuel for electricity generation. *See* Emily Hammond & David B. Spence, *The Regulatory Contract in the Marketplace*, 69 VAND. L. REV. 141, 165 (2016).

34. *See* Hammond & Spence, *supra* note 33, at 163–66. By contrast, natural gas-fired power plants depend upon supply of fuel in real time over the natural gas pipeline network, and renewable sources are beholden to the whims of nature (that is, they depend upon the sun shining, the wind blowing, or the water flowing). Supplies of uranium for nuclear power are nearly as secure as coal supplies, but nuclear power is more expensive than coal-fired power. For an in-depth discussion of the relative reliability of the different electric generation technologies, see *id.*

35. *Natural Gas Expected to Surpass Coal in Mix of Fuel Used for U.S. Power Generation in 2016*, U.S. ENERGY INFO. ADMIN. (Mar. 16, 2016), http://www.eia.gov/todayinenergy/detail.cfm?id=25392 [https://perma.cc/6BF4-28JC].

36. A plant's "capacity factor" is the percentage of time it is dispatching power to the grid. For example, if a plant is dispatching power to the grid during 7,888 of the 8,765 hours in a year, its capacity factor is 0.90.

37. For the U.S. Energy Information Administration's ("EIA") estimates of capacity factors of different generation technologies, see U.S. ENERGY INFO. ADMIN., LEVELIZED COST AND LEVELIZED AVOIDED COST OF NEW GENERATION RESOURCES IN THE

nuclear power are characterized as "base load technologies."[38] Energy generation sources are distinguished on these bases because power is dispatched to the grid on an as-needed basis to serve load; accordingly, plants with the lowest marginal costs are dispatched first, subject to the need to avoid grid congestion and to maintain reliability.[39] Thus, as EPA rules aimed at the pollution harm associated with coal combustion increase the costs of operating coal-fired power plants, they in turn influence the frequency with which those plants are dispatched.

A. Widespread Health and Environmental Impacts

A growing number of studies are revealing that the technical and economic virtues of coal-fired power are overshadowed by their singularly large pollution externalities. Coal combustion produces a variety of air pollutants, including: (1) carbon dioxide ("CO_2"), the most common GHG; (2) sulfur dioxide ("SO_2"), a precursor of acid rain and particulate matter; (3) nitrogen oxides ("NO_x"), precursors of both acid rain and ground-level ozone (smog); (4) other forms of fine particulate matter ("PM" or "$PM_{2.5}$"), a major contributor to premature human mortality; and (5) mercury, a neurological toxin.[40] Coal-fired power plants are the largest sources of SO_2 and mercury in the United States.[41] As Table 1 indicates, coal plants emit nearly twice

ANNUAL ENERGY OUTLOOK 2016 6 (2016), http://www.eia.gov/forecasts/aeo/pdf/electricity_generation.pdf [https://perma.cc/W25T-5NP8].

38. For a more detailed discussion of base load technologies, see Hammond & Spence, *supra* note 33, at 157–66 (defining base load as "the portion of demand that is relatively constant and in need of service most of the time"). A base load plant may have a capacity factor of 75%, meaning that it is operating and dispatching power to the grid 75% of the time during the year. A peaking plant may have a capacity factor as low as 5%.

39. *See* FED. ENERGY REG. COMM'N, SECURITY CONSTRAINED ECONOMIC DISPATCH: DEFINITION, PRACTICES, ISSUES AND RECOMMENDATIONS 5 (2006), http://www.ferc.gov/industries/electric/indus-act/joint-boards/final-cong-rpt.pdf [https://perma.cc/G2QS-MZWW]. This rule of operation is referred to as "security constrained economic dispatch" ("SCED"). *Id.*

40. *See Coal & the Environment*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/energyexplained/?page=coal_environment [https://perma.cc/5CLN-HZSX]; *What is Acid Rain?*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/acidrain/what-acid-rain [https://perma.cc/QPA2-YXWV] (last updated Mar. 31, 2016).

41. *See* D. KOSSON ET AL., U.S. ENVTL. PROT. AGENCY, CHARACTERIZATION OF COAL COMBUSTION RESIDUES FROM ELECTRIC UTILITIES—LEACHING AND CHARACTERIZATION DATA 5 (2009), https://nepis.epa.gov/Exe/ZyPDF.cgi/P1007JBD.PDF?Dockey=P1007JBD.PDF [https://perma.cc/5D5X-RNMT]; U.S. ENERGY INFO. ADMIN., NATURAL GAS 1998: ISSUES AND TRENDS 51 (1999), http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/natural_gas_1998_issues_trends/pdf/it98.pdf [https://perma.cc/J35D-CL4D].

the CO_2 and many times the NO_x, PM, and SO_2 as power plants that use other fossil fuels to generate electricity.[42]

Table 1: Air Emissions from Combustion of Different Fossil Fuels[43]

	Source (lbs/Billion Btu)		
Pollutant	**Natural Gas**	**Oil**	**Coal**
Carbon Dioxide	117,000	164,000	208,000
Nitrogen Oxides	92	448	457
Sulfur Dioxides	0.6	1,122	2,591
Particulates	7	84	2,744

Coal combustion produces more harm to human health and the environment than any other industrial source. A 2009 National Academy of Sciences study estimated the annual non-climate-related external damages from coal-fired power plants to be $62 billion, representing about thirty percent of the average retail price of electricity.[44] A more comprehensive 2011 study, reported in *American Economic Review*, quantified the damages from conventional air pollutants for 820 industries.[45] The study found that the net benefits[46] of only seven of the industries (including coal-fired power) were negative,[47] and that coal-fired power plants produced by far the

42. U.S. ENERGY INFO. ADMIN., *supra* note 41, at 58. Of course, nuclear power and renewable generation produce none of these emissions, though all forms of power generation produce emissions when the full life cycle of the technology is considered.

43. *Id.*

44. Press Release, Nat'l Academies, Report Examines Hidden Health and Environmental Costs of Energy Production and Consumption in U.S. (Oct. 19, 2009), http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12794 [https://perma.cc/62DG-STDT] (equating these non-climate damages to be about 3.2 cents per kilowatt-hour ("kWh")); *see also Average Retail Electricity Prices in the U.S. from 1990 to 2015*, STATISTA, https://www.statista.com/statistics/183700/us-average-retail-electricity-price-since-1990/ [https://perma.cc/L2YE-7UH2] (reporting the average retail price of electricity in 2015 to be 10.42 cents per kWh).

45. *See* Nicholas Z. Muller, Robert Mendelsohn & William Nordhaus, *Environmental Accounting for Pollution in the United States Economy*, 101 AM. ECON. REV. 1649, 1664 (2011). In CAA parlance, "conventional" pollutants are distinguished from toxic pollutants like mercury, and from GHGs.

46. Specifically, the results were expressed in terms of net costs—the ratio of environmental damages to value added for each industry. *Id.*

47. *Id.* at 1665 tbl.2. The ratio of environmental damage to value added was higher for oil-fired generation (5.13) than coal-fired generation (2.20), and even higher for solid waste combustion and incineration (6.72). *Id.* The ratio for natural gas-fired generation

largest amount of environmental damages, estimated at $53 billion per year.[48] Similarly, a second 2011 study conducted by public health experts calculated that the annual life cycle health and environmental costs of coal to the American public were as high as half a *trillion* dollars[49] and "conservatively" estimated that internalizing these costs would "double[] to triple[]" the price of electricity generated from coal.[50] These harms are orders of magnitude greater than those produced by other electric generation sources.[51] In terms of the overall U.S. economy, "[c]oal plants are responsible for more than one-fourth of [gross environmental damage ("GED")]," and the coal sector causes harms that are "larger than the combined GED due to the three next most polluting industries."[52]

Emissions from American coal plants also represent a significant contribution to the harms from coal-fired electricity generation globally. According to the World Bank, just three countries—the United States, China, and India—accounted for almost 70% of the electricity generated globally from coal in 2010, while the countries outside the top ten collectively accounted for just 13% of the global total.[53] Per capita, the United States is more reliant on coal than any of the other leading countries; even China's per capita coal generation is only about 40% of that in the United States.[54] Moreover, China,

was just 0.34, however, denoting a positive cost ratio for that industry. *Id.* at 1670 tbl.5. Moreover, the study did not assess the cost of carbon dioxide emissions as part of the analysis. *Id.* at 1664.

48. *Id.* at 1665. The next largest amount of damage was associated with the livestock production industry at $14.8 billion. *Id.* By contrast, environmental damages from natural gas-fired production were estimated to be less than $1 billion per year. *Id.* at 1669.

49. Paul R. Epstein et al., *Full Cost Accounting for the Life Cycle of Coal*, 1219 ANN. N.Y. ACAD. SCI. 73, 73 (2011).

50. *Id.*

51. Epstein and his coauthors put the number of annual deaths from all electric generation at 13,200. *Id.* at 91. Researchers at NASA and Columbia University estimate that nuclear power has averted 1.84 million air pollution-related deaths worldwide that would have resulted from fossil fuel combustion but for reliance on nuclear energy. *See* Pushker A. Kharecha & James E. Hansen, *Prevented Mortality and Greenhouse Gas Emissions from Historical and Projected Nuclear Powe*r, 47 ENVTL. SCI. & TECH. 4889, 4891 (2013).

52. Muller et al., *supra* note 45, at 1667.

53. This analysis is based on data originally downloaded from the World Bank DataBank, *see Indicators*, WORLD BANK, http://data.worldbank.org/indicator [https://perma.cc/4XCE-BXL5], and is on file with the *North Carolina Law Review*; *see also Primary Coal Consumption 2010*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/beta/international/rankings/#?prodact=7-2&cy=2010&pid=7&aid=2&tl_id=2-A&tl_type=a [https://perma.cc/CR5C-GJCD].

54. India is an outlier here with just 0.53 megawatt-hours ("MWh") per person generated from coal, in contrast to the 6.45 MWh per person in the United States, making per capita generation from coal twelve times greater than in India. *Id.* Further, in terms of

India, and the United States are projected to dominate the global market for coal and coal-fired power generation for the foreseeable future,[55] with U.S. per capita generation continuing to exceed the levels in China and India by a substantial margin.[56] It is against this backdrop that we consider recent efforts to address emissions from coal combustion in the United States, the wealthiest of the big three coal-fired power producers.[57]

The widespread harms associated with coal-fired power reflect major gaps in the CAA regulatory regime. The basic structure of that regime was created in 1970 and distinguishes between conventional pollutants (the most commonly emitted pollutants from industrial and mobile sources) and more hazardous or toxic pollutants, which are subject to more stringent and comprehensive regulation.[58] The CAA has been amended on several occasions since 1970, most recently in 1990, without altering this basic distinction between conventional and toxic pollutants.[59] Nonetheless, that statute and EPA regulations exempt a significant number of coal-fired power plants—often through lax grandfathering provisions—and emissions levels still vary greatly between plants.[60] The forty-five-year history of the CAA is replete with battles in Congress, the executive branch, and the courts over attempts to bring *all* coal plants up to modern pollution control standards. The struggle to control emissions from the oldest and dirtiest coal plants dates back to the 1980s and includes both innovative initiatives, such as the acid rain pollution-trading

per capita reliance on coal-based electricity, only Australia generated more from coal per capita than the United States, but it generates less than one-tenth the quantity of electricity annually. *Id.*

55. MATTHIAS FINKENRATH, JULIAN SMITH & DENNIS VOLK, INT'L ENERGY AGENCY, CCS RETROFIT: ANALYSIS OF THE GLOBALLY INSTALLED COAL-FIRED POWER PLANT FLEET 35–36 (2012), https://www.iea.org/publications/freepublications/publication/CCS_Retrofit.pdf [https://perma.cc/2KCN-L8XJ] (noting that these three countries will account for eighty-six percent of the new coal-fired power plants constructed globally through 2035).

56. *See supra* note 53.

57. WORLD BANK, THE CHANGING WEALTH OF NATIONS: MEASURING SUSTAINABLE DEVELOPMENT IN THE NEW MILLENNIUM 162–63, 165, 168 (2011), http://documents.worldbank.org/curated/en/630181468339656734/pdf/588470PUB0Weal101public10BOX353816B.pdf [https://perma.cc/MTH3-R6RL].

58. *See* U.S. ENVTL. PROT. AGENCY, THE CLEAN AIR ACT IN A NUTSHELL: HOW IT WORKS 3, 10, 12–13 (2013), https://www.epa.gov/sites/production/files/2015-05/documents/caa_nutshell.pdf [https://perma.cc/D659-4GXY].

59. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (codified as amended at 42 U.S.C. §§ 7401 to 7671a (2012)); s*ee also* Adelman, *supra* note 17, at 264–65 (noting that the 1990 amendments "did little to alter the central framework of the CAA").

60. *See infra* Part III.

program,[61] and long-running battles over so-called "new source review."[62] Indeed, two of the EPA rules examined here—the rules on interstate transport of conventional air pollutants[63] and emissions of toxic pollutants from coal-fired plants[64]—are just the latest rounds of regulatory battles that date back to the 1990s.[65] Among the CAA rules that comprise EPA's alleged war on coal, only the rules governing GHG emissions are of relatively recent vintage. We turn to those rules in the next section.

B. *The Protracted History of EPA's Air Pollution Rules*

Critics of EPA's regulatory agenda point to a long list of recent agency initiatives aimed at fossil-fueled power plants, including new rules addressing water pollution discharges,[66] the handling of coal ash as a solid waste,[67] and the use of cooling water.[68] However, critics view

61. *See* Clean Air Act Amendments of 1990, Pub. L. No. 101-549, tit. IV, 104 Stat. 2399, 2584–634, 2648–72 (codified as amended at 42 U.S.C. §§ 7651–51o (2012)).

62. This was a decades-long conflict over agency and environmental group attempts to extend CAA requirements to older power plants. For a description of this issue, see generally Envtl. Def. v. Duke Energy Corp., 549 U.S. 561 (2007).

63. *See infra* Section I.B.1.

64. *See infra* Section I.B.2.

65. For an explanation of these rules and their ancestry, see *infra* Section I.B.

66. On June 7, 2013, EPA proposed a rule under the Clean Water Act that would set the first federal limits on toxic metals in wastewater that can be discharged from steam electric power plants. Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category, 78 Fed. Reg. 34,432, 34,435 (proposed June 7, 2013) (to be codified at 40 C.F.R. pt. 423). EPA estimated that fewer than half of all coal-fired plants would incur costs to comply with the proposed rule because most already have technology in place that would be compliant. *Id.* at 34,469.

67. In 2010, EPA proposed to regulate the disposal of fly ash and bottom ash—known in an EPA proposed rule as "coal combustion residuals," or "CCRs"—in surface impoundments or landfills under the Resource Conservation and Recovery Act of 1976 ("RCRA"). Hazardous and Solid Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals from Electric Utilities, 75 Fed. Reg. 35,128, 35,128 (proposed June 21, 2010) (to be codified at 40 C.F.R. pts. 257, 261, 264, 265, 268, 271, 302). Other methods of coal ash disposal remain exempt from RCRA regulation under the Bevill determination. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 80 Fed. Reg. 21,302, 21,309 (Apr. 17, 2015) (to be codified at 40 C.F.R. pts. 257, 261) (deferring final action on disposal in landfills and surface impoundments and retaining an exemption for beneficial use).

68. In 2011, EPA proposed new requirements aimed at reducing fish entrainment at cooling water intake structures associated with existing power plants and industrial facilities and modifying the rule for new facilities. National Pollutant Discharge Elimination System—Cooling Water Intake Structures at Existing Facilities and Phase I Facilities, 76 Fed. Reg. 22,174, 22,174 (proposed Apr. 20, 2011) (to be codified at 40 C.F.R. pts. 122, 125). EPA estimates that all steam electric generating facilities will be affected by this rule, and estimates total annualized compliance costs at a 3% discount rate for facilities covered by this rule to be $384 million, of which approximately $318 million will

the agency's Clean Air Act rules as the heart of the war on coal,[69] particularly the Cross-State Air Pollution Rule ("CSAPR"), the Mercury and Air Toxics Standards ("MATS") rule, and the Clean Power Plan ("CPP"), targeting GHG emissions from existing power plants.[70] This Section briefly describes the key provisions of the EPA rules and the legal battles they have generated. Two seemingly contradictory patterns emerge from the descriptions: (1) the highly protracted and intensely litigated nature of the rulemaking processes and (2) the strength of the environmental, human health, and economic grounds for promulgating them.

1. The Cross-State Air Pollution Rule

The foundation of the CAA's regulation of conventional pollutants (including SO_2, PM, and ozone) is the establishment of National Ambient Air Quality Standards ("NAAQS") for each such pollutant.[71] The statute directs EPA to set the NAAQS at a level that

fall on steam electric generators. *Id.* at 22,218–19 (exhibit VII-3). EPA and industry disagree over the likely economic effects of these costs on electric generating units. NAM D. PHAM & DANIEL J. IKENSON, NPD CONSULTING, A CRITICAL REVIEW OF THE BENEFITS AND COSTS OF EPA REGULATIONS ON THE U.S. ECONOMY 5 (2012), http://www.nam.org/Issues/Energy-and-Environment/EPA-Overregulation/A-Critical-Review-of-the-Benefits-and-Costs-of-EPA-Regulations-on-the-U_S_-Economy/ [https://perma.cc/B9S5-QH8T]. EPA projects that compliance costs will average only a few hundredths of a cent per kWh of electricity generated. National Pollutant Discharge Elimination System—Cooling Water Intake Structures at Existing Facilities and Phase I Facilities, 76 Fed. Reg. at 22,228–29 (exhibit VII-11).

69. *See, e.g.*, Larry Bell, Opinion, *Clean Air Act: EPA's Charade to Justify War on Coal Plants*, FORBES (Jan. 14, 2014, 8:00 AM), http://www.forbes.com/sites/larrybell/2014/01/14/clean-air-act-epas-charade-to-justify-war-on-coal-plants/print/ [https://perma.cc/EC3Q-TBRT (staff-uploaded archive)].

70. EPA has also proposed revisions to its NAAQS for PM, ozone, and NO_x, which in turn impact coal-fired power plants indirectly. The Obama EPA has initiated, completed, or is considering three important NAAQS revisions that may have important effects on fossil-fired power plants. In 2010, EPA revised the NAAQS for SO_2. Primary National Ambient Air Quality Standard for Sulfur Dioxide, 75 Fed. Reg. 35,520, 35,520 (June 22, 2010) (to be codified at 40 C.F.R. pts. 50, 53, 58). EPA revised the NAAQS for ozone in 2015. National Ambient Air Quality Standards for Ozone, 80 Fed. Reg. 65,292, 65,292 (Oct. 26, 2015) (to be codified at 40 C.F.R. pts. 50–53, 58). EPA is considering revising the current annual NAAQS for PM, but has not yet proposed a revision. Its internal review documents indicate it is considering making the standards more stringent. *See* U.S. ENVTL. PROT. AGENCY, POLICY ASSESSMENT FOR THE REVIEW OF THE PARTICULATE MATTER NATIONAL AMBIENT AIR QUALITY STANDARDS ES-1 to -3 (2011), http://www.epa.gov/ttn/naaqs/standards/pm/data/20110419pmpafinal.pdf [https://perma.cc/UEE4-VVXY]. However, because the effects of NAAQS revisions on coal-fired power plants are dwarfed by the effects of these other rules that regulate the sector more directly, this analysis does not address NAAQS revisions.

71. Clean Air Act § 109, 42 U.S.C. § 7409 (2012).

will "protect the public health" with "an adequate margin of safety."[72] States with air quality control regions that do not comply with the NAAQS (so-called nonattainment areas) are required to develop plans for coming into compliance with the NAAQS and to ensure that other regions in attainment with the standards remain in compliance.[73] Fossil-fueled power plants built or modified after passage of the CAA must obtain permits covering their emissions of conventional pollutants,[74] and whether the plant is located in an attainment or nonattainment area determines the stringency of the plant's permitted emissions limits.[75]

EPA has struggled for two decades to issue regulations governing the interstate transport of ozone precursors from the Midwest and the South that cause NAAQS violations in downwind states in the East.[76] After years of pressure from northeastern states[77] and Congress, the Clinton administration EPA established a more stringent ozone standard in 1997[78] and promulgated a rule in 1998

72. *Id.* § 109(b)(1).

73. *Id.* § 110.

74. *Id.* § 111(a)(2) (applying the CAA standards to new and modified sources).

75. *See id.* §§ 165, 173. New sources located in nonattainment areas face more stringent requirements, including the requirement that their permit reflect the "lowest achievable emission rate" for the pollutant in question, and the requirement to obtain "offsets" (reductions in emissions from existing sources) to make room for their emissions. *See id.* § 173.

76. Violations of the ozone NAAQS are largely attributable to local vehicle emissions, but the problem is exacerbated by the interstate transport of ozone and its precursors, particularly NO_x, emitted by fossil-fueled power plants. *See Controlling Air Pollution from Motor Vehicles*, N.Y. DEP'T OF ENVTL. CONSERVATION, http://www.dec.ny.gov/chemical/8394.html [https://perma.cc/GL67-G8H2] ("In many urban areas, motor vehicles are the single largest contributor to ground-level ozone which is a common component of smog."); *Ozone—The Pollution Paradox*, N.Y. DEP'T OF ENVTL. CONSERVATION, http://www.dec.ny.gov/chemical/8561.html [https://perma.cc/Z3PR-AN9G] ("[O]zone formation occurs most commonly over cities with large numbers of industries, power plants and vehicles . . . .").

77. The Clean Air Act's so-called "good neighbor provision" addresses the interstate transport of air emissions by requiring states to include provisions in their State Implementation Plans ("SIPs") to regulate emissions "which will . . . contribute significantly to nonattainment [with a NAAQS in a downwind state]." § 110(a)(2)(D). After Congress added the good neighbor provision to the statute in 1990, EPA and several states formed the Ozone Transport Assessment Group ("OTAG"). *See* Finding of Significant Contribution and Rulemaking for Certain States in the OTAG Region for Purposes of Reducing Regional Transport of Ozone, 63 Fed. Reg. 57,356, 57,360–61 (Oct. 27, 1998) (to be codified at 40 C.F.R. pts. 51, 72, 75, 96).

78. *See* National Ambient Air Quality Standards for Ozone, 62 Fed. Reg. 38,856, 38,858 (July 18, 1997) (to be codified at 40 C.F.R. pt. 50). The existing standard, which was expressed in terms of a one-hour average limit, was replaced by an eight-hour standard at a level of 0.08 parts per million (ppm); the new standard was generally considered to be more stringent. *Id.*

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designed to control ozone emissions regionally by (1) restricting emissions of ozone precursors from twenty-two states in the eastern half of the country, (2) specifically mandating that power plants account for a significant portion of the reductions, and (3) establishing a voluntary cap-and-trade program to minimize the costs of the reductions.[79] The Bush administration EPA replaced the Clinton EPA rule in 2005 with its own, less stringent Clean Air Interstate Rule ("CAIR").[80] Progress was interrupted, however, in July 2008 when the U.S. Court of Appeals for the District of Columbia Circuit overturned CAIR for, among other things, failing to ensure that upwind contributions to NAAQS violations would be reduced.[81] After initially vacating the rule, the court granted EPA's petition to leave it in place pending amendments conforming to the court's decision.[82]

The Obama administration EPA was left with the CAIR program in limbo. It responded to the D.C. Circuit decision with a new rule of its own, the CSAPR, that was promulgated in August 2011.[83] The saga continued in the courts with a successful industry challenge in the D.C. Circuit, which struck CSAPR down in August 2012,[84] followed by a June 2014 Supreme Court verdict in *EPA v. EME Homer City Generation, L.P.*[85] that overturned the D.C. Circuit decision and upheld the rule.[86] The CSAPR requires twenty-seven states to reduce power plant emissions of SO_2 and NO_x that contribute to ozone or fine particle pollution in downwind states.[87] The SO_2 emissions reductions mandated by the rule are dramatic:

79. *See* Finding of Significant Contribution and Rulemaking for Certain States in the OTAG Region for Purposes of Reducing Regional Transport of Ozone, 63 Fed. Reg. at 57,356, 57,407–14, 57,456. This rule is known as the "NO_x SIP Call" because it required states to submit revised SIPs describing plans to implement these additional restrictions. *See id.* at 57,356, 57,361.

80. Clean Air Interstate Rule, 70 Fed. Reg. 25,162, 25,162 (May 12, 2005) (to be codified at 40 C.F.R. pts. 51, 72, 73, 74, 77, 78, 96) (imposing SO_2 and NO_x emission limits ("budgets") on twenty-eight eastern states and the District of Columbia).

81. North Carolina v. EPA, 531 F.3d 896, 901, 907 (D.C. Cir. 2008), *on reh'g in part*, 550 F.3d 1176 (D.C. Cir. 2008).

82. North Carolina v. EPA, 550 F.3d 1176, 1177–78 (D.C. Cir. 2008).

83. Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208 (Aug. 8, 2011) (to be codified at 40 C.F.R. pts. 51, 52, 72, 78, 97).

84. EME Homer City Generation, L.P. v. EPA, 696 F.3d 7, 38 (D.C. Cir. 2012), *rev'd*, 134 S. Ct. 1584 (2014).

85. 134 S. Ct. 1584 (2014).

86. *Id.* at 1593.

87. Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. at 48,208.

emissions would decline to seventy-three percent below 2005 levels in the covered states by 2014.[88] EPA estimates that the rule will impose compliance costs on the power sector of about $2.4 billion annually when fully implemented[89] and render about 4.8 gigawatts ("GW")[90] of coal-fired generation uneconomic.[91] EPA estimates that the monetized benefit will be $110 to $250 billion per year.[92]

2. The Mercury and Air Toxics Standards

The fight over whether (and how stringently) to regulate mercury emissions from power plants has an even longer lineage, spanning three decades. Despite evidence in the late 1980s that the accumulation of mercury in the food chain was associated with increased incidences of birth defects and neurological damage in humans, EPA continued to defer regulating mercury emissions from coal-fired power plants.[93] Spurred by a congressional directive in the 1990 amendments to the CAA, the Clinton administration EPA prepared studies of mercury emissions[94] and concluded that

88. *Id.* at 48,349. Additionally, CSAPR is projected to reduce emissions of CO_2 from electrical generating units by about 25 million metric tons annually. *Id.* at 48,311.

89. U.S. ENVTL. PROT. AGENCY, REGULATORY IMPACT ANALYSIS (RIA) FOR THE FINAL TRANSPORT RULE 255 (2011) [hereinafter CSAPR RIA], https://www3.epa.gov/ttnecas1/docs/ria/transport_ria_final-csapr_2011-06.pdf [https://perma.cc/5VPU-EFJF] (estimating $800 million in annualized compliance costs); Gabriel Nelson, *EPA Orders Power Plants to Clean Up Interstate Emissions*, N.Y. TIMES (July 7, 2011), http://www.nytimes.com/gwire/2011/07/07/07greenwire-epa-orders-power-plants-to-clean-up-interstate-87138.html [https://perma.cc/26AE-KZET (staff-uploaded archive)] (explaining that the $2.4 billion CSPAR cost includes $1.6 billion in existing costs under CAIR). EPA estimates the benefits of the rule, primarily in the form of tens of thousands of premature deaths avoided, to be significantly greater than this number. *See* Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. at 48,350.

90. In the context of electric generation, a power plant's potential to generate (its capacity) is measured in watts (or megawatts ("MW")). The amount of electricity it produces is measured in watt-hours. For example, a 100 MW plant operating at full capacity for one hour generates 100 MWh of electricity. One GW is equal to 1,000 MW, which is equal to 1,000,000 kilowatts ("KW"), which is equal to 1,000,000,000 watts.

91. Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. at 48,346.

92. CSAPR RIA, *supra* note 89, at 1. For updates to the rule and its implementation, see *Cross-State Air Pollution Rule*, U.S. ENTVL. PROT. AGENCY, https://www.epa.gov/csapr/ [https://perma.cc/Y3L9-6927] (last updated Nov. 7, 2016).

93. Michael B. Gerrard, *Supreme Court Ruling on Mercury Shows Little Deference to EPA*, N.Y. L.J. (Sept. 10, 2015), http://web.law.columbia.edu/sites/default/files/microsites/climate-change/supreme_court_ruling_on_mercury_shows_little_deference_to_epa_0.pdf [https://perma.cc/YZ3E-TSPY].

94. For examples of the mercury studies, see generally U.S. ENVTL. PROT. AGENCY, MERCURY STUDY REPORT TO CONGRESS (1997), https://www3.epa.gov/ttn/atw/112nmerc/volume1.pdf [https://perma.cc/KQZ2-VCAQ]; U.S. ENVTL. PROT. AGENCY, STUDY OF

regulating them as an air toxic was "appropriate and necessary."[95] This finding would have led the Clinton administration EPA to propose stringent technology-based mercury standards for new and existing power plants.[96] This strategy went too far for the Bush administration, however, which reversed the Clinton EPA's finding on the mode of regulation—treating mercury as a conventional pollutant rather than an air toxic.[97] The alternate legal framework adopted a less stringent "cap-and-trade" system for mercury emissions that was limited to new power plants.[98]

The courts figure prominently here as well. By 2008, the D.C. Circuit had struck down the Bush EPA mercury rule,[99] setting the stage for the Obama administration EPA to promulgate its MATS rule in February 2012.[100] The new rule, unsurprisingly, prompted a broad array of industry and environmental petitioners to challenge it in court. The D.C. Circuit rejected those challenges in 2014,[101] but the Supreme Court struck down the MATS rule in the spring 2015 case *Michigan v. EPA*.[102] The Court rejected EPA's conclusion that it need not consider costs in determining *whether* regulating mercury emissions from coal-fired power plants was "appropriate."[103] EPA had performed a cost-benefit analysis for the MATS rule, but not in conjunction with its initial decision to regulate.[104] The EPA cost-benefit analysis estimated that annual compliance costs for the

HAZARDOUS AIR POLLUTANT EMISSIONS FROM ELECTRIC STEAM GENERATING UNITS—FINAL REPORT TO CONGRESS (1998), https://nepis.epa.gov/Exe/ZyPDF.cgi/2000NXFY.PDF?Dockey=2000NXFY.PDF [https://perma.cc/B7EE-PF89].

95. Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units, 65 Fed. Reg. 79,825, 79,825–27 (Dec. 20, 2000).

96. *See id.* at 79,830. Section 112 of the Clean Air Act specifies that permits for toxic pollutants must reflect "maximum achievable control technology" ("MACT"). Clean Air Act § 112(d)(3), 42 U.S.C. § 7412(d)(3) (2012).

97. *See* Revision of December 2000 Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units and the Removal of Coal- and Oil-Fired Electric Utility Steam Generating Units from the Section 112(c) List, 70 Fed. Reg. 15,994, 15,994 (Mar. 29, 2005) (to be codified at 40 C.F.R. pt. 63).

98. *Id.* at 16,005.

99. New Jersey v. EPA, 517 F.3d 574, 578 (D.C. Cir. 2008).

100. National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. 9304, 9304 (Feb. 16, 2012) (to be codified at 40 C.F.R. pts. 60, 63).

101. White Stallion Energy Ctr., LLC v. EPA, 748 F.3d 1222, 1229 (2014), *rev'd sub nom.* Michigan v. EPA, 135 S. Ct. 2699 (2015).

102. 135 S. Ct. 2699, 2712 (2015).

103. *Id.* at 2711–12.

104. *Id.* at 2705–06.

electric power industry would be about $9.6 billion and that the rule would have negligible net impacts on jobs.[105] The agency estimated that the net benefits of the new rule would be $27 to $80 billion and that most of them would be derived from avoided human illnesses and premature deaths.[106] On April 25, 2016, EPA effectively reinstated the rule by reiterating its conclusion—this time after considering costs—that regulating mercury as a toxic pollutant is appropriate.[107] Industry and several states have further countered that the estimated costs of the MATS rule do not adequately assess its potential to undermine electric power reliability when coal-fired power plants are taken offline faster than they can be replaced. As discussed further below, EPA rejects this contention and maintains that industry compliance with the MATS rule would not adversely affect the reliability of electricity generation or transmission systems.[108]

3. The Clean Power Plan: Controlling Greenhouse Gases from Existing Power Plants

The Supreme Court's 2007 decision in *Massachusetts v. EPA*[109] established the legal basis for EPA to regulate GHG emissions from

105. National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. at 9425–26. Industry assessments, however, project much greater job losses and slightly higher costs. *See* ANNE E. SMITH ET AL., NERA ECONOMIC CONSULTING, AN ECONOMIC IMPACT ANALYSIS OF EPA'S MERCURY AND AIR TOXICS STANDARDS RULE 2, 5 (2012), http://www.nera.com/content/dam/nera/publications/archive2/PUB_MATS_Rule_0312.pdf [https://perma.cc/SF3B-9Q3R].

106. U.S. ENVTL. PROT. AGENCY, REGULATORY IMPACT ANALYSIS FOR THE FINAL MERCURY AND AIR TOXICS STANDARDS ES-1 (2011) [hereinafter MATS RIA], http://www.epa.gov/ttnecas1/regdata/RIAs/matsriafinal.pdf [https://perma.cc/2AK9-5CCX]. Crucially, these benefits include the effects of the MATS rule on reductions of non-mercury as well as mercury emissions, and in dicta, the Court questioned EPA's practice of including these "co-benefits" in its cost-benefit analysis. *See Michigan v. EPA*, 135 S. Ct. at 2706, 2711.

107. Supplemental Finding That It Is Appropriate and Necessary to Regulate Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units, 81 Fed. Reg. 24,420, 24,420 (Apr. 25, 2016) (to be codified at 40 C.F.R. pt. 63). The rule had remained in effect pending EPA's reissue of its "appropriate and necessary" decision, so technically the rule did not need to be reinstated. *See Michigan v. EPA*, 135 S. Ct. at 2712.

108. National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. at 9407.

109. 549 U.S. 497 (2007).

any source covered by the CAA.[110] In September 2013, EPA initiated the process of regulating GHG emissions from power plants under the New Source Performance Standards ("NSPS") program, which covers only new or modified fossil-fueled power plants,[111] and finalized the NSPS in August 2015.[112] Once EPA sets a standard for *new* sources of GHGs, CAA section 111(d) requires states to set "standards of performance" for certain *existing* sources under their jurisdiction, and these standards must conform with EPA guidelines.[113] In June 2014, EPA proposed the CPP,[114] which was finalized in October 2015.[115] The rule encompasses a set of state-level goals and guidelines for regulation of CO_2 emissions from existing power plants which, pursuant to CAA section 111(d), must reflect "the best system of emission reduction which . . . has been adequately demonstrated" ("BSER"), considering (among other things) compliance costs.[116]

The CPP guidelines address CO_2 emissions from fossil-fueled power plants, offering states the option of applying EPA-specified GHG emissions limitations directly to existing coal- and gas-fired generators or achieving similar reductions indirectly by substituting lower-emitting generators for coal-fired plants.[117] Specifically, states choosing these indirect approaches must meet EPA's emissions reduction goal for the state, which in turn is based upon a combination of three "building blocks": (1) enhancing the efficiency of coal-fired generation; (2) increasing the dispatch of natural gas-fired generators in place of coal-fired generators; and (3) expanding

110. *Id*. at 528–29. After *Massachusetts v. EPA*, the agency initiated a number of other GHG regulatory initiatives, one of which (its so-called "tailoring rule") was subsequently struck down by the Supreme Court. That decision, *Utility Air Regulatory Group v. EPA*, contains an instructive description of EPA's post-*Massachusetts v. EPA* GHG initiatives. Util. Air Regulatory Grp. v. EPA, 134 S. Ct. 2427, 2436–38 (2014).

111. Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 Fed. Reg. 22,392, 22,392 (proposed Apr. 13, 2012) (to be codified at 40 C.F.R. pt. 60).

112. Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,510, 64,510 (Oct. 23, 2015) (to be codified at 40 C.F.R. pt. 60).

113. Clean Air Act § 111(d), 42 U.S.C. § 7411(d) (2012).

114. Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 34,830, 34,830 (proposed June 18, 2014) [hereinafter Proposed Clean Power Plan] (to be codified at 40 C.F.R. pt. 60).

115. Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,662, 64,662 (Oct. 23, 2015) [hereinafter Clean Power Plan] (to be codified at 40 C.F.R. pt. 60).

116. *See* § 111(a)(1).

117. Clean Power Plan, *supra* note 115, at 64,662–66.

the use of zero-emission sources like renewables.[118] The guidelines also contemplate compliance by way of participation in multistate GHG permit trading programs.[119] Twenty-seven states have challenged the rule in court.[120] If the EPA regulations survive legal challenges, they will further erode the competitiveness of coal-fired power plants. EPA estimates that the annual costs of the CPP will rise to approximately $5.1 to $8.4 billion in 2030 but that they will remain far lower than the estimated benefits of $71 to $92 billion per year.[121]

II. EPA'S REGULATIONS VIEWED FROM THE PERSPECTIVE OF GRID REGULATORS

Opposition to EPA's rules has produced a blizzard of commentary on potential threats to stable supplies of electricity and grid management. As a preliminary matter, it is important to recognize that comments on proposed rules may be skewed toward the negative: affected parties may be more motivated to comment on rules that they perceive to pose a risk to their livelihood or goals.[122]

118. *Id.* at 64,667.

119. *Id.* at 64,664.

120. *E&E's Power Plan Hub*, E&E PUBLISHING, LLC, http://www.eenews.net/interactive/clean_power_plan#legal_challenge_status [https://perma.cc/MC5Y-KVBT]. The plaintiffs' motion to stay the effect of the rule pending their legal challenge was initially rejected by the D.C. Circuit in early 2016 but ultimately granted by the Supreme Court in an unprecedented decision on February 9, 2016. *See* Order in Pending Case, Chamber of Commerce v. EPA, No. 15A787 (U.S. Feb. 9, 2016); Adam Liptak & Coral Davenport, *Supreme Court Deals Blow to Obama's Effort to Regulate Coal Emissions*, N.Y. TIMES (Feb. 9, 2016), http://www.nytimes.com/2016/02/10/us/politics/supreme-court-blocks-obama-epa-coal-emissions-regulations.html?_r=0 [https://perma.cc/J28L-NWR8 (staff-uploaded archive)]. The D.C. Circuit is considering the case en banc and heard oral argument in September 2016. *See* Johnathan H. Adler, *Clean Power Plan to Get Unanticipated En Banc Review*, WASH. POST (May 16, 2016), https://www.washingtonpost.com/news/volokh-conspiracy/wp/2016/05/16/clean-power-plan-to-get-unanticipated-en-banc-review/?utm_term=.09de6dbcf4a6 [https://perma.cc/Q4VT-TZ9R]. For a more thorough discussion of state opposition to this rule, see *infra* Table 10.

121. U.S. ENVTL. PROT. AGENCY, REGULATORY IMPACT ANALYSIS FOR THE CLEAN POWER PLAN FINAL RULE ES-9, ES-20 to -21 (2015) [hereinafter CPP RIA, FINAL RULE], https://www.epa.gov/sites/production/files/2015-08/documents/cpp-final-rule-ria.pdf [https://perma.cc/G5MC-WZJ8] (applying a seven percent discount rate and including climate benefits plus health co-benefits). Similar to the other rules, the projected benefits of the CPP far exceed its projected costs, but similar to the MATS rule, the benefit estimates for the CPP are also dominated by non-GHG co-benefits. *Id.*

122. One of the earliest heuristics identified by behavioral economists Daniel Kahneman and Amos Tversky was our heightened sensitivity to the risk of loss. That is, we experience a smaller increase in utility from a gain of $*X* than the decrease in utility we experience from losing $*X*. This experimental result is very robust. *See* Daniel Kahneman & Amos Tversky, *Choices, Values, and Frames*, 39 AM. PSYCHOLOGIST 341, 342 (1982) (illustrating individuals' stronger preference for avoiding losses than for realizing equivalent gains).

Consequently, grid managers who do not perceive a threat to the grid from EPA rules may have been less likely to submit comments. That observation aside, the most prevalent concern expressed in the comments was that EPA's rules would prompt closure of too many coal-fired power plants too quickly.[123] This issue could arise if the rules require power plants to install pollution controls that render them uneconomic in wholesale power markets. If too many plants retire, or if they cannot be replaced with new capacity in a timely manner, the resulting shortfall in generating capacity could endanger system reliability. Proponents of EPA's rules believe these concerns are misplaced. They claim that coal plants are being driven out of the market by competition from natural gas-fired power plants and renewables[124] and that EPA's rules hasten that process only at the margins.[125] The opposing camp views EPA's rules as the primary driver of this decline.[126] Most of the critical commentary has focused on the MATS rule and the CPP,[127] which are also the most costly of these rules.[128] This disagreement has produced two waves of technical reports: one following the proposal of the MATS rule in 2011, and a second following the proposal of the CPP in 2014.

Collectively, the reports encompass views across the political spectrum and exhibit the perspectives of organizations with public and private interests. Among private business interests, the views of the Edison Electric Institute ("EEI"), an electric utility trade association, are representative. Although hedged in significant

123. For example, see *infra* note 150 and accompanying text.

124. For an up-to-date interactive database of state renewable portfolio standards and other state policies favoring renewables, see *Database of State Incentives for Renewables & Efficiency*, DSIRE, www.dsireusa.org [https://perma.cc/NK3T-2AM2].

125. *See, e.g.*, Alison Cassady, *Complex Market Forces Are Challenging Appalachian Coal Mining*, CTR. FOR AM. PROGRESS (Oct. 6, 2014), https://www.americanprogress.org/issues/green/report/2014/10/06/98371/complex-market-forces-are-challenging-appalachian-coal-mining/ [https://perma.cc/37U9-2N3E]; David Schlissel, Opinion, *Coal Will Not Recover*, PITT. POST-GAZETTE (Oct. 23, 2016, 12:00 AM), http://www.post-gazette.com/opinion/Op-Ed/2016/10/23/Coal-will-not-recover/stories/201610110033 [https://perma.cc/2VHD-4VVL].

126. The remainder of this Section discusses, and cites, several of these studies. Even before EPA's proposed GHG rules, analyses of the effects of the preceding rules were numerous enough to prompt Susan Tierney of World Resources Institute to describe keeping track of the studies as "a full time job" and to prepare a "field guide" to the studies. Susan Tierney, *Electric Reliability Under New EPA Power Plant Regulations: A Field Guide*, WORLD RES. INST. (Jan. 18, 2011), http://www.wri.org/blog/2011/01/electric-reliability-under-new-epa-power-plant-regulations-field-guide [https://perma.cc/3ZHA-QFJD].

127. *See, e.g.*, Nicolas Loris, *Obama's War on Coal Is Driving Up Energy Costs*, DAILY SIGNAL (Mar. 23, 2016), http://dailysignal.com/2016/03/23/obamas-war-on-coal-is-driving-up-energy-costs/ [https://perma.cc/E7D5-HSDB].

128. EPA's estimated compliance costs for each of these rules ran into the billions of dollars. *See supra* notes 105, 121 and accompanying text.

respects, EEI's 2011 report invited the inference that EPA's rules would jeopardize grid reliability based on projections that plant closures would greatly exceed EPA's estimates.[129] More recently, American Electric Power, a leading owner of coal plants nationally, has claimed that the CPP will jeopardize system reliability based on EPA's own projections of the number and rate of plant closures.[130] Other industry commentary has been more regionally targeted but no less critical. For example, Southwestern Electric Power Company ("SWEPCO") has argued that the CPP "assumes the retirement or reduced use of all coal- or lignite-fueled power plants serving SWEPCO's 24/7 base load" in SWEPCO's service area and consequently poses a critical threat to system reliability.[131]

At the other end of the spectrum, public interest organizations and other private entities have actively supported EPA's analyses or conducted their own favorable assessments. For example, a 2012 report issued by the Union of Concerned Scientists concluded that coal plant retirements were driven predominantly by market forces and that EPA rules would not jeopardize reliability given the excess generation capacity in the system.[132] Likewise, a 2010 analysis of the CSAPR and MATS rules prepared for Exelon Corporation, the

129. *See* STEVEN FINE, SHANYN FITZGERALD & JESSE INGRAM, EDISON ELECTRIC INSTITUTE, POTENTIAL IMPACTS OF ENVIRONMENTAL REGULATION ON THE U.S. GENERATION FLEET: FINAL REPORT 11 (2011), http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Integrated_Resource_Plan/2011IRP/EEIModelingReportFinal-28January2011.pdf [https://perma.cc/AJ5A-GZ6X]. For criticism of the methods used in the EEI report, see generally SUSAN F. TIERNEY & CHARLES CICCHETTI, THE ANALYSIS GROUP, THE RESULTS IN CONTEXT: A PEER REVIEW OF EEI'S "POTENTIAL IMPACTS OF ENVIRONMENTAL REGULATION ON THE U.S. GENERATION FLEET" (2011), https://web.archive.org/web/20150417222602/http://www.analysisgroup.com/uploadedFiles/News_and_Events/News/EEI_PeerReview_Tierney_Cicchetti%20_May2011.pdf [https://perma.cc/7XL4-GHP4].

130. *See AEP's View of EPA's Clean Power Plan Proposed Rule*, AEP ACTION NETWORK, https://www.aepadvocacy.com/issues.aspx?ArticleID=Article1 [https://perma.cc/UWK6-8U48].

131. *See* Lou Antonelli, *Proposed EPA Regs Would Close Welsh Plant*, DAILY TRIB. (Sept. 12, 2014, 6:54 PM), http://www.dailytribune.net/news/proposed-epa-regs-would-close-welsh-plant/article_2457d790-3ad8-11e4-960b-1714cb5d703b.html [https://perma.cc/S48R-9R84] (quoting Brian Bond, vice-president of external affairs for SWEPCO).

132. RACHEL CLEETUS ET AL., UNION OF CONCERNED SCIENTISTS, RIPE FOR RETIREMENT: THE CASE FOR CLOSING AMERICA'S COSTLIEST COAL PLANTS 3 (2012), http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_energy/Ripe-for-Retirement-Full-Report.pdf [https://perma.cc/9W54-B6VC]. The Bipartisan Policy Center reached similar conclusions in a 2011 report. JENNIFER MACEDONIA ET AL., ENVIRONMENTAL REGULATION AND ELECTRIC SYSTEM RELIABILITY 3 (2011), http://bipartisanpolicy.org/library/environmental-regulation-and-electric-system-reliability/ [https://perma.cc/7P9V-TH2T] (finding little risk to reliability because of market adaptations and the fact that retiring plants have low capacity factors).

largest merchant seller of electricity from nuclear power plants, concluded that coal plant retirements would lag planned capacity additions and that electricity grids were protected regionally by excess capacity that was more than sufficient to safeguard reliability.[133]

Analyses and commentary of those with economic or ideological biases[134] can be distinguished from comments submitted by organizations with direct responsibility for ensuring the reliability of the electric system. That latter set of comments is more varied and difficult to summarize, in part because the regulatory landscape itself is complex. The law divides responsibility for grid management among three types of entities: (1) electric reliability organizations, which are charged with ensuring system reliability and security pursuant to the Energy Policy Act of 2005;[135] (2) Independent System Operators ("ISOs")[136] and Regional Transmission Organizations ("RTOs"),[137] which are nonprofit associations of electric utilities that manage wholesale power and transmission markets;[138] and (3) state

133. IRA SHAVEL & BARCLAY GIBBS, CHARLES RIVER ASSOCIATES, A RELIABILITY ASSESSMENT OF EPA'S PROPOSED TRANSPORT RULE AND FORTHCOMING UTILITY MACT 3–4 (2010), http://blog.cleanenergy.org/files/2011/09/cra-reliability-assessment-of-epas-proposed-transport-rule.pdf [https://perma.cc/GHK9-7GL9]. The Bipartisan Policy Center reached similar conclusions. MACEDONIA ET AL., *supra* note 132, at 3.

134. A recent analysis of corporate speech by James Coleman has revealed that companies' warnings about the costs of environmental rules ought to be taken with a grain of salt. Coleman showed that when speaking to investors about a proposed EPA rule, companies paint a far more optimistic picture of their ability to absorb compliance costs than when speaking to regulators. *See* James W. Coleman, *How Cheap Is Corporate Talk? Comparing Companies' Comments on Regulations with Their Securities Disclosures*, 40 HARV. ENVTL. L. REV. 47, 70–71 (2016).

135. 16 U.S.C. § 824o (2012).

136. FERC's Order 888 encouraged utilities to join together to form ISOs to manage the grid and the geographically broader markets that accompanied the move to competition in wholesale electricity markets. *See* Order No. 888, Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 61 Fed. Reg. 21,540, 21,591–97 (May 10, 1996) (codified at 18 C.F.R. pts. 35, 385). Transmission owners retain ownership of their lines upon joining the ISO but relinquish control over pricing and scheduling of transmission services to the ISO. *Id.*

137. FERC's Order 2000 established the parameters for creating regional transmission organizations. *See* Order No. 2000, Regional Transmission Organizations, 65 Fed. Reg. 810, 810 (Jan. 6, 2000) (codified at 18 C.F.R. pt. 35). RTOs operate similarly to ISOs, and FERC originally hoped that RTOs would be much broader geographically. *Id.* at 861–64. However, this Article uses the terms RTO and ISO interchangeably.

138. In most places where there is no RTO to manage wholesale markets, investor-owned utilities ("IOUs") remain vertically integrated and traditionally regulated. In these places there tend to be fewer third-party wholesale transactions, and IOUs manage reliability collectively through informal power pools. *See generally* Paul L. Joskow, *Transmission Policy in the United States*, 13 UTIL. POL'Y 95 (AEI-Brookings Joint Center for Regulatory Studies) (2005) (describing how vertically integrated utilities manage

public utility commissions ("PUCs"), which oversee retail electricity service and manage the siting of generation and transmission facilities within their states, among other things.[139] In addition, the Federal Energy Regulatory Commission ("FERC") oversees wholesale power and interstate transmission markets by working with grid operators and other entities to promote reliability.[140] These organizations' analyses of the EPA rules are described in this Part, before turning to a broader evaluation of their effects in Part III.

A. Federal Regulators: FERC and NERC

FERC has primary responsibility for setting standards and ensuring grid reliability at the federal level, but it exercises this authority indirectly through other entities. Under the Energy Policy Act of 2005, FERC is required to designate one or more electric reliability organizations to enforce electric reliability standards.[141] In 2006, FERC designated the North American Electric Reliability Corporation ("NERC"),[142] a nonprofit organization created in 1968 following the massive blackout of the eastern seaboard earlier in that decade.[143] While the U.S. electric grid has been described as the world's largest machine,[144] it is in fact three grids: the Eastern Interconnection, the Western Interconnection, and the Electric

supply and demand of power in their control areas in the absence of RTOs). During the 1990s, a sizable minority of states also opted to restructure their retail electricity markets, mandating the unbundling of electricity sales from distribution services, opening up retail sales to competition, and authorizing market pricing. These markets tend to be found in the northeastern and midwestern United States, as well as in Texas and California.

139. The Federal Power Act recognizes state authority over retail rates and the siting of generation facilities. 16 U.S.C. § 824(a) (2012).

140. FERC has jurisdiction over the rates charged for wholesale power and transmission services, *id.* § 824(b), and to ensure that rates are just, reasonable, and nondiscriminatory, *id.* § 824d(a)–(b). FERC sometimes uses its power over "practices affecting" rates to encourage investment in generating and transmission capacity. *See generally* Conn. Dep't of Pub. Util. Control v. FERC, 569 F.3d 477 (D.C. Cir. 2009) (holding that the Federal Power Act authorizes FERC to regulate pricing of capacity markets as practices affecting wholesale rates).

141. § 824o.

142. Order Certifying North American Electric Reliability Corporation as the Electric Reliability Organization and Ordering Compliance Filing, 116 FERC ¶ 61,062, para. 3 (July 20, 2006).

143. *History of NERC*, N. AM. ELECTRIC RELIABILITY CORP. (Dec. 2012), http://www.nerc.com/AboutNERC/Documents/History_Dec12.pdf [https://perma.cc/8RTY-2XK3].

144. *See* PHILLIP F. SCHEWE, THE GRID: A JOURNEY THROUGH THE HEART OF OUR ELECTRIFIED WORLD 1 (2007) ("Taken in its entirety, the grid is a machine, the most complex machine ever made.").

Reliability Council of Texas ("ERCOT").[145] For electric reliability planning purposes, NERC has divided these grids into subregions.[146] Conditional on FERC approval,[147] NERC establishes a "reference" target level of energy generating capacity reserves referred to as a "reserve margin,"[148] but due to heterogeneity in power generation sources and other grid characteristics, each NERC subregion has discretion to refine its reserve margins consistent with local conditions.[149]

As the lead regulators nationally, NERC and FERC have been cautious in their critiques of the EPA rules. In 2011, NERC analyzed the effects on system reliability of several rules, including the CSAPR and MATS. The resulting report concluded "bulk power system reliability could be affected" in certain subregions if EPA did not allow sufficient time for construction of new capacity to replace retiring coal plants.[150] NERC qualified its conclusions, however, noting that it was too early to project accurately the "exact impacts" of the regulations and acknowledging that EPA could mitigate potential threats to reliability by allowing deadlines to be adjusted.[151] When state regulators, ISOs/RTOs, and other entities expressed concerns about the effects of the MATS rule (and to a lesser extent

145. *Energy in Brief: What is the Electric Power Grid and What Are Some Challenges it Faces?*, U.S. ENERGY INFO. ADMIN. (Dec. 22, 2015), http://www.eia.gov/energy_in_brief/article/power_grid.cfm [https://perma.cc/NX98-DD9M]; *History*, ERCOT, http://www.ercot.com/about/profile/history [https://perma.cc/F42H-JBYP].

146. These regions correspond (roughly, if not precisely) with ISO/RTO regions, *see infra* Section II.B, except in regions not covered by an ISO or RTO. For a map and descriptions of NERC regions, see *Regional Entities*, N. AM. ELECTRIC RELIABILITY CORP., http://www.nerc.com/AboutNERC/keyplayers/Pages/Regional-Entities.aspx [https://perma.cc/6RSU-CJ8P].

147. 16 U.S.C. § 824o(b)(1) (2012).

148. For a description of NERC reserve margins, see *M-1 Reserve Margin*, N. AM. ELECTRIC RELIABILITY CORP., http://www.nerc.com/pa/RAPA/ri/Pages/PlanningReserveMargin.aspx [https://perma.cc/ZQA6-ZRSH].

149. NERC's Reference Reserve Margin is equivalent to the Target Reserve Margin Level provided by each region or subregion's own specific margin based on "load, generation, and transmission characteristics as well as regulatory requirements." *See* N. AM. ELEC. RELIABILITY CORP., 2014 SUMMER RELIABILITY ASSESSMENT app. II at 34 (2014), http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/2014SRA.pdf [https://perma.cc/F3US-SHVX]. In 2014, if not provided, NERC assigned 15% Reserve Margin for predominately thermal systems and 10% for predominately hydro systems. *Id.*

150. N. AM. ELEC. RELIABILITY CORP., POTENTIAL IMPACTS OF FUTURE ENVIRONMENTAL REGULATIONS, EXTRACTED FROM THE 2011 LONG-TERM RELIABILITY ASSESSMENT 116–19 (2011), http://www.nerc.com/files/epa%20section.pdf [https://perma.cc/YLD3-8GJQ].

151. *Id.* at 116, 120.

CSAPR) on system reliability,[152] NERC responded by identifying measures for mitigating potential problems. NERC also took the opportunity, unusual at the time, to explain how it would advise EPA regarding waivers from MATS rule deadlines for coal plants it deemed necessary to maintaining grid reliability.[153]

More recently, NERC released an "initial reliability review" of the CPP that adopts a similarly qualified tone, noting at the outset that "detailed and thorough analysis will be required" to accurately assess the feasibility of the plan.[154] This observation did not prevent NERC from raising substantial concerns. Among other issues, NERC suggested that EPA's estimates of the power generation capacity lost to plant retirements "may be conservative," and that replacing it without jeopardizing reliability "may" be challenging.[155] NERC also took issue with the first and second building blocks identified in the CPP, raising particular concerns about the viability of significant efficiency gains in the power sector[156] and relying on increased operation of natural gas-fired units to offset the lost capacity from coal plant retirements.[157] While NERC's analysis stops short of declaring that the CPP will impair reliability, it urges EPA to include a provision for regulatory waivers much like it did for the MATS

152. *See, e.g.*, FED. ENERGY REG. COMM'N, MIDWEST INDEPENDENT TRANSMISSION SYSTEM OPERATOR, INC.'S RESPONSES TO REQUEST FOR EVIDENCE OF COMMISSIONER PHILLIP D. MOELLER ON EPA ISSUES FOR THE NOVEMBER 2011 RELIABILITY CONFERENCE 2 (2011), https://www.misoenergy.org/Library/Repository/Tariff/FERC%20Filings/Resp.%20Evidentiary%20Requests_AD12-1-000.pdf [https://perma.cc/9SR5-MZB8] (alleging a reliability problem caused by the MATS rule).

153. *See* Policy Statement on the Commission's Role Regarding the Environmental Protection Agency's Mercury and Air Toxics Standards, 139 FERC ¶ 61,131, paras. 1–23 (May 17, 2012).

154. N. AM. ELEC. RELIABILITY CORP., POTENTIAL RELIABILITY IMPACTS OF EPA'S PROPOSED CLEAN POWER PLAN: INITIAL RELIABILITY REVIEW 1 (2014), http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/Potential_Reliability_Impacts_of_EPA_Proposed_CPP_Final.pdf [https://perma.cc/E2R9-9JDD].

155. *Id.* at 2.

156. *Id.* at 8. The first building block on which EPA established state emission budgets, and on which EPA will judge state compliance plans, initially called for improving the heat rate at existing coal-fired units by 6%. Proposed Clean Power Plan, *supra* note 114, at 34,855–62. This was adjusted to 2.1% to 4.3% in the final rule. Clean Power Plan, *supra* note 115, at 64,744. "Heat rate" refers to the amount of energy required to produce a unit of electricity (e.g., btus per kWh). Lowering the heat rate represents improved efficiency.

157. The second building block contemplates "re-dispatch" of cleaner, combined cycle natural gas-fired plants in lieu of coal-fired plants. Proposed Clean Power Plan, *supra* note 114, at 34,862–66. NERC expresses doubt that coal-fired plants can improve their combustion efficiency to the degree that EPA does, and it contends that natural gas-fired plants are ill-suited to operating at the levels EPA contemplates in the rule. N. AM. ELEC. RELIABILITY CORP., *supra* note 154, at 9.

rule.[158] EPA apparently heeded that warning, including a so-called "reliability safety valve" waiver option for plants shown to be critical to maintaining system reliability.[159]

The responses of the FERC commissioners to the CPP roughly track their respective political affiliations. All five FERC commissioners addressed the effects of the CPP in 2014 testimony before Congress. Then-acting Chairman LeFleur, a Democrat,[160] was circumspect, urging a greater role for FERC and state energy regulators in the development and implementation of the plan, but she declined to comment about whether the rule would jeopardize grid reliability.[161] Commissioner Norris, another Democrat who left FERC in August of 2014,[162] was supportive of the EPA rule and expressed optimism that FERC could work with EPA to manage the "challenging" transition to a lower-carbon fuel mix.[163] Democrat Commissioner (now Chairman) Bay's[164] testimony was perfunctory but indicated a willingness to work with EPA and other regulators to implement the CPP.[165] By contrast, the two Republican commissioners expressed much more skepticism.[166] Commissioner

158. N. AM. ELEC. RELIABILITY CORP., *supra* note 154, at 22 (suggesting "a set of reliability assurance provisions that may include a reliability backstop").

159. *See* Clean Power Plan, *supra* note 115, at 64,671.

160. *See Commissioner Bay Assumes FERC Chairmanship*, HYDROWORLD.COM (Apr. 16, 2015), http://www.hydroworld.com/articles/2015/04/commissioner-bay-assumes-ferc-chairmanship.html [https://perma.cc/LBG7-HXBY] (describing LaFleur's political affiliation).

161. *See FERC Perspectives: Questions Concerning EPA's Proposed Clean Power Plan and Other Grid Reliability Challenges: Hearing Before the Subcomm. on Energy and Power of the H. Comm. on Energy and Commerce*, 113th Cong. 15–16 (2014) [hereinafter *FERC Perspectives*] (written statement of Cheryl A. LaFleur, Acting Chairman, Fed. Energy Regulatory Comm'n).

162. Ros Krasny, *U.S. FERC Commissioner John Norris to Leave Energy Regulator*, REUTERS (Aug. 7, 2014, 6:04 PM), http://www.reuters.com/article/us-usa-ferc-norris-idUSKBN0G72H020140807 [https://perma.cc/8MPB-T38R] (describing Norris's political affiliation).

163. *See FERC Perspectives*, *supra* note 161, at 33–34 (written statement of John Norris, Comm'r, Fed. Energy Regulatory Comm'n).

164. *Commissioner Bay Assumes FERC Chairmanship*, *supra* note 160 (describing Bay's political affiliation).

165. *See FERC Perspectives*, *supra* note 161, at 47–48 (written statement of Norman C. Bay, Comm'r, Fed. Energy Regulatory Comm'n). At the time of his testimony, Norman Bay had not yet been sworn in as FERC commissioner but had been confirmed by the Senate. *Id.* at 47.

166. The Federal Power Act requires that no more than three of the five commissioners be from the same political party. 16 U.S.C. § 792 (2012). Phillip Moeller was originally appointed to FERC by President George W. Bush and was subsequently reappointed by President Obama. Commissioner Tony Clark is a Republican appointed by President Obama. Both men have since left FERC. *See Commissioner Moeller to Leave FERC at End of October*, HYDROWORLD.COM (Oct. 6, 2015), http://www.hydroworld.com

Moeller asserted that "EPA is creating national electricity policy" that reorients grid management from its traditional focus on economic dispatching to one based on "environmental dispatch"[167] and expressed concerns about reliability that mirrored those highlighted in the NERC report.[168] Commissioner Clark's testimony amplified Moeller's views by accusing EPA of seeking to "reorder the jurisdictional relationship" between federal energy and environmental regulators.[169]

Thus, although neither FERC nor NERC has directly opposed the EPA rules, officials in both entities raise significant concerns about potential threats to grid reliability and express substantial reservations about the proposed regulations.

B. Regional Regulators: ISOs, RTOs, and NERC Regions

ISOs and RTOs are the independent entities charged by FERC with managing wholesale power markets and regional transmission services. ISOs/RTOs exist in seven planning regions that cover most of the United States. Figure 2 summarizes the geographic reach of the existing ISOs/RTOs as well as two large areas (the non-RTO West and the non-RTO Southeast), both dominated by traditionally regulated, vertically integrated utilities, that are not managed by ISOs/RTOs.

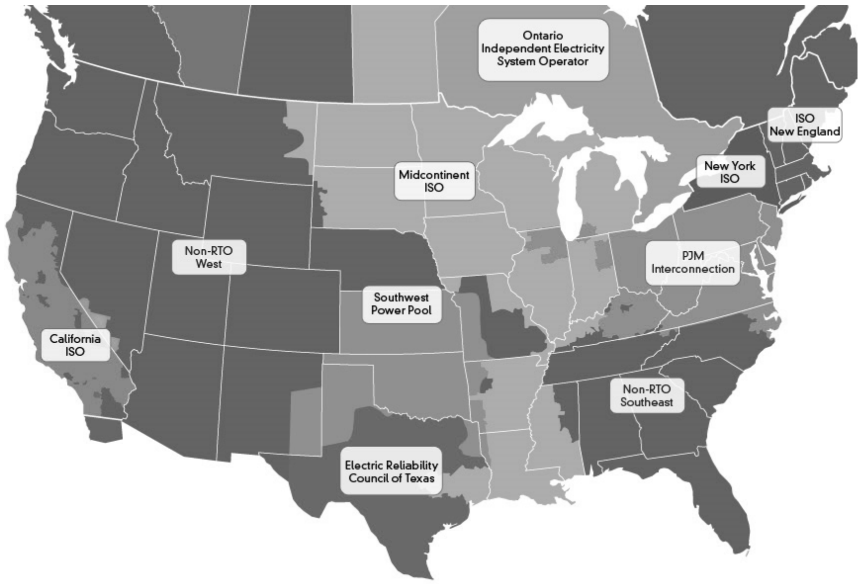
/articles/2015/10/commissioner-moeller-to-leave-ferc-at-end-of-october.html [https://perma.cc/QZU7-UAC8]; Michael Harris, *FERC Commissioner Tony Clark Stepping Down Mid-September*, HYDROWORLD.COM (Aug. 15, 2016), http://www.hydroworld.com/articles/2016/08/ferc-commissioner-tony-clark-stepping-down-mid-september.html [https://perma.cc/Q9KR-39ZU].

167. *See FERC Perspectives*, *supra* note 161, at 20–22 (written statement of Philip D. Moeller, Comm'r, Fed. Energy Regulatory Comm'n). Since his testimony before Congress, Commissioner Moeller has become more outspoken about his reliability concerns. In a letter to EPA Administrator Gina McCarthy, Moeller expressed concern about (1) the impacts of state-level pollution budgets and planning on national grid management; (2) the high costs of compliance with the plan; and (3) the technical barriers to complying with the "front loaded timeline" of the Clean Power Plan. *See* Letter from Phillip D. Moeller, Comm'r, FERC, to Gina McCarthy, Adm'r, EPA (Dec. 1, 2014), http://www.eenews.net/assets/2014/12/02/document_pm_02.pdf [https://perma.cc/D8XY-ECKM].

168. *See FERC Perspectives*, *supra* note 161, at 20–22 (written statement of Philip D. Moeller, Comm'r, Fed. Energy Regulatory Comm'n).

169. *See id.* at 42–45 (written statement of Tony Clark, Comm'r, Fed. Energy Regulatory Comm'n).

Figure 2: ISOs/RTOs Operating in the United States[170]



At the same time, NERC has designated regional entities charged with managing grid stability.[171] Unlike ISOs/RTOs, NERC regions do not manage wholesale markets; rather, they are responsible for ensuring the reliability of the electric grid. The boundaries of NERC regional entities roughly track ISO/RTO boundaries where they exist; in the non-RTO areas, the Mountain West's regional reliability entity is the Western Electric Coordinating Council ("WECC"), and in the Southeast that responsibility is shared by the Florida Reliability Coordinating Council ("FRCC," managing the Florida grid) and the SERC Reliability Corporation ("SERC," overseeing most of the rest of the Southeast).[172]

170. Figure 2 was created by the authors and adapted from FERC's map of RTOs, which is available at FERC's website. *Regional Transmission Organizations (RTO)/Independent System Operators (ISO)*, FED. ENERGY REG. COMM'N, http://www.ferc.gov/industries/electric/indus-act/rto.asp [https://perma.cc/R2TS-6MGR] (last updated Oct. 20, 2016).

171. *See Regional Entities*, *supra* note 146.

172. *Id.* SERC covers some states that exist entirely outside of ISOs/RTOs (Alabama, Florida, Georgia, South Carolina, and Tennessee) as well as portions of other states that are within ISOs/RTOs (Arkansas, Illinois, Iowa, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, Texas, and Virginia). *See* SERC, SERC REGIONAL BOUNDARIES 2–3 (2009), https://www.serc1.org/docs/default-source/about-serc/landing-page/serc-regional-boundaries.pdf?sfvrsn=6 [https://perma.cc/VSM8-7NYV].

The regulatory authority of ISOs/RTOs derives from FERC's statutory authority, and like FERC, their principal mandates are ensuring that wholesale power and transmission prices are just and reasonable[173] and that the grid remains in balance.[174] Among other responsibilities, ISO/RTO oversight centers on facilitating investment in the maintenance and expansion of the grid to meet changing market conditions. They achieve this goal by using either or both of two mechanisms: (1) allowing wholesale electricity prices to float freely to encourage investment when prices are very high, which is the approach taken in the restructured ERCOT market[175] or (2) creating a separate capacity market through which electric utilities are paid to construct new capacity, as is done in PJM Interconnection, the New England ISO ("ISO-NE"), and the New York ISO ("NYISO").[176] This responsibility to facilitate investment in the grid is of particular relevance here because it gives ISOs and RTOs a large stake in maintaining grid stability and provides a critical perspective on system management at the regional level.

173. *See* 16 U.S.C. § 824d (2012). Indeed, it is this requirement that justifies the SCED rule. *See supra* note 39 and accompanying text.

174. The electric grid must be maintained at a frequency of 60 Hz or else the grid can fail, resulting in outages. *See* JACK CASAZZA & FRANK DELEA, UNDERSTANDING ELECTRIC POWER SYSTEMS 47–48 (2d ed. 2010). Since electricity cannot be economically stored, grid operators must ensure that the amount of electricity being dispatched to the grid is roughly equal to the amount being taken off of the grid by consumers at any given moment. In the jargon of grid management, they must "balance loads." Keeping the grid in balance requires scheduling ancillary services: reserves, spinning reserves, and regulation. "Reserves" refers to generating capacity that is currently unused but available to serve load. If that capacity is already running, allowing the operator to dispatch its electricity to the grid on very short notice, it is a "spinning reserve." "Regulation" services are the very short-term grid management activities that maintain voltages at their proper level to ensure grid reliability. *See* Willett Kempton & Jasna Tomić, *Vehicle-to-Grid Power Fundamentals: Calculating Capacity and Net Revenue*, 144 J. POWER SOURCES 268, 271 (2005).

175. *See* WILLIAM W. HOGAN, ON AN "ENERGY ONLY" ELECTRICITY MARKET DESIGN FOR RESOURCE ADEQUACY 34 (2005), http://www.ercot.com/content/meetings/ltstf/keydocs/2007/0423/Hogan_Energy_Only1.pdf [https://perma.cc/K7KJ-QZLF]. This system attempts to address the inadequate incentives to invest in infrastructure resources such as generation capacity by addressing the imperfections in the market's design. "The resulting 'energy only' market [does] not remove the need for regulatory interventions, but . . . substantially change[s] the [nature] of those interventions." *See id.*

176. For an overview of these capacity markets, see *Electric Power Markets: New England (ISO-NE)*, FED. ENERGY REG. COMM'N (Mar. 10, 2016), http://www.ferc.gov/market-oversight/mkt-electric/new-england.asp [https://perma.cc/ZN53-TF8G]; *Electric Power Markets: New York (NYISO)*, FED. ENERGY REG. COMM'N (Mar. 10, 2016), http://www.ferc.gov/market-oversight/mkt-electric/new-york.asp [https://perma.cc/X7WQ-7H8J]; *Electric Power Markets: PJM*, FED. ENERGY REG. COMM'N (May 25, 2016), http://www.ferc.gov/market-oversight/mkt-electric/pjm.asp [https://perma.cc/Q6RY-XEKN].

Among regional grid managers, PJM and the Midcontinent ISO ("MISO") have a heightened interest in the EPA rules because together they are home to about fifty-three percent of the nation's coal-fired power plants.[177] Both have submitted detailed and carefully considered comments on the EPA rules. In 2011, PJM analyzed the impact of the CSAPR and MATS rules within its region and concluded that, while the rules would hasten coal plant retirements, they would not jeopardize generation resource adequacy.[178] Similar to NERC, PJM also stopped short of opposing the CPP by instead proposing changes it viewed as essential to ensuring the reliability of the grid.[179] The most important of these changes is inclusion of the aforementioned reliability safety valve that would release a state from its compliance obligations in the event that grid reliability is seriously threatened.[180]

MISO's 2011 analysis of four EPA rules, including CSAPR and MATS, also raises substantial reliability questions. Among other findings, it projects that retirements of coal plants would necessitate extensive investment in transmission capacity that could increase electricity rates by as much as 7.6%.[181] In support of its comments on the CPP, MISO prepared a preliminary analysis of the plan. It concluded that replacement of coal plants with gas-fired units would be the most cost-effective method of meeting the CPP's emissions goals, but warned that building new gas-fired capacity within the proposed timetable would be difficult.[182] Consistent with this finding,

177. *See* Adelman & Spence, *infra* note 208.

178. *See* PJM INTERCONNECTION, COAL CAPACITY AT RISK FOR RETIREMENT IN PJM: POTENTIAL IMPACTS OF THE FINALIZED EPA CROSS STATE AIR POLLUTION RULE AND PROPOSED NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS 32–33 (2011), http://pjm.com/~/media/documents/reports/20110826-coal-capacity-at-risk-for-retirement.ashx [https://perma.cc/NYJ6-FQHD].

179. *See* PJM Interconnection, L.L.C., Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generation Units 4–5 (Dec. 1, 2014), http://www.pjm.com/~/media/documents/other-fed-state/20141201-epa-hq-oar-20130602-pjm-comments-epa-rule-111d.ashx [https://perma.cc/AP8N-DBQF].

180. *See id.* at 13–14 ("[T]he Final Rule should incorporate the ability . . . to suspend the implementation of a particular aspect of an accepted State Plan if necessary to address any adverse unforeseen reliability impacts that may arise prior to or during the compliance period.").

181. MISO, EPA IMPACT ANALYSIS: IMPACTS FROM THE EPA REGULATIONS ON MISO 6, 10 (2011), https://www.misoenergy.org/Library/Repository/Study/MISO%20EPA%20Impact%20Analysis.pdf [https://perma.cc/7838-84EC].

182. MISO, ANALYSIS OF EPA'S PROPOSAL TO REDUCE CO_2 EMISSIONS FROM EXISTING ELECTRIC GENERATING UNITS 3, 17 (2014), https://www.misoenergy.org/Library/Repository/Communication%20Material/EPA%20Regulations/AnalysisofEPAs

MISO's comments to EPA are silent on the framework and goals of the proposed rule but urge a slower timetable for compliance to ensure system reliability.[183]

In addition to their individual comments, regional managers submitted joint comments on the CPP through the ISO/RTO Council.[184] The comments expressed optimism about grid management, conditional on EPA making certain changes to the rule to facilitate interstate and regional coordination.[185] The council proposed revisions that it claims "will give EPA and the states the tools needed to avoid negative reliability impacts . . . by ensuring that appropriate state, multi-state, and/or regional reliability reviews occur at all relevant stages."[186] The proposed revisions also included a reliability safety valve.[187] Thus, similar to the comments from national regulators, the ISO/RTO Council strikes a balance between caution about ensuring grid reliability and optimism about the options available to mitigate such risks within the CPP framework.

This optimism is not universal among ISOs/RTOs, however, and skepticism is particularly strong with respect to the CPP. For example, the Southwest Power Pool ("SPP") issued an analysis in 2011 of several EPA rules, including MATS, finding that while unlikely, EPA's rules could significantly impact reliability "if larger generators are shut down or have significantly curtailed generation."[188] ERCOT has expressed fewer reservations about the MATS rule[189] but projected significant rate increases from complying

ProposaltoReduceCO2EmissionsfromExistingElectricGeneratingUnits.pdf [https://perma.cc/5EWC-AM3E].

183. MISO, Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines For Existing Stationary Sources: Electric Utility Generation Units 1–2 (Nov. 25, 2014), https://www.misoenergy.org/Library/Repository/Communication%20Material/EPA%20Regulations/MISO%20Comments%20to%20EPA%20on%20Proposed%20CPP%2011-25-14.pdf [https://perma.cc/K84J-YPTA].

184. The Council includes all seven American ISOs/RTOs, as well as two Canadian members that did not sign on to the Council's comments on the Clean Power Plan. ISO/RTO Council, Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines For Existing Stationary Sources: Electric Utility Generation Units 1 (Dec. 1, 2014), http://www.pjm.com/~/media/documents/other-fed-state/20141201-epa-hq-oar-20130602-irc-comments.ashx [https://perma.cc/2HKV-K9X9].

185. *See id.* at 2–3.

186. *Id.* at 3.

187. *Id.* at 2.

188. SOUTHWEST POWER POOL, CONCERNS IN LIGHT OF EXPECTED EPA REGULATIONS 3 (2011), https://www.spp.org/documents/16152/20111213%20eswg%20epa%20reg%20concerns%20-%20endorsed.doc [https://perma.cc/3XEN-5QCS (staff-uploaded archive)].

189. ERCOT projects that compliance costs for the MATS rule will represent about $0.75 per MWh, or less than one-tenth of one cent per kWh. *See* ERCOT, IMPACTS OF

with CSAPR.[190] Both organizations have raised much graver concerns about the CPP. In a recent analysis, SPP warns that the CPP could cause "extreme" electricity shortages and "violations of NERC reliability standards" if coal plant retirements in its region occur prior to deployment of necessary infrastructure improvements.[191] ERCOT's analysis goes even further, arguing that more coal plants will retire than EPA projects and that the CPP will threaten reliability "in and around major urban centers, and will strain ERCOT's ability to integrate new intermittent renewable generation resources."[192]

C. *State Regulators*

The MATS rule and the CPP have also generated substantial comment from state public utilities commissions. Consistent with the intuition that those who object to proposed rules are more likely to comment than those who support them,[193] most of the PUC comments were critical. Six state commissions commented on the MATS rule, and most of them were unequivocally negative.[194] The Public Utility Commission of Texas, for example, contended that EPA's MATS rule fails to address the impacts on grid reliability,[195] while the Indiana

ENVIRONMENTAL REGULATIONS IN THE ERCOT REGION 4 (2014), http://www.ercot.com/content/news/presentations/2014/Impacts%20of%20Environmental%20Regulations%20in%20the%20ERCOT%20Region.pdf [https://perma.cc/DFN4-WMWH].

190. ERCOT projects compliance costs with CSAPR to be as high as $7.75 per MWh. *Id.* at i–ii. Regional haze rules are also projected to have significant impacts within ERCOT. *Id.*

191. Southwest Power Pool, Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generation Units 4 (Oct. 9, 2014), http://www.spp.org/publications/2014-10-09_SPP%20Comments_EPA-HQ-OAR-2013-0602.pdf [https://perma.cc/D863-HLDQ].

192. ERCOT, ERCOT ANALYSIS OF THE IMPACTS OF THE CLEAN POWER PLAN 1 (2014), http://www.ercot.com/content/news/presentations/2014/ERCOTAnalysis-ImpactsCleanPowerPlan.pdf [https://perma.cc/8UNT-KKVQ].

193. For a discussion of loss and risk aversion, see *infra* notes 307–08 and accompanying text.

194. The commenting state commissions were from Alabama, Florida, Indiana, Oregon, Pennsylvania, and Texas. *See National Emission Standards for Hazardous Air Pollutants for Coal- and Oil-Fired Electric Utility Steam Generating Units*, REGULATIONS.GOV, https://www.regulations.gov/docketBrowser?rpp=50&so=ASC&sb=commentDueDate&po=0&s=state%2Bcommission&dct=PS&D=EPA-HQ-OAR-2009-0234&docst=Government+State [https://perma.cc/RL5W-GQW2 (staff-uploaded archive)] (filtering comments to include submissions by state government entities).

195. Pub. Util. Comm'n of Tex., Comment Letter on Proposed Rule for National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units 2 (Aug. 4, 2011), https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2009-0234-18538&attachmentNumber

Utility Regulatory Commission warned that the rule would cause "massive . . . rate increases."[196] By comparison, the comments from the commission in Oregon were relatively benign, with Oregon only seeking a special exemption for a particular plant.[197] The comments on the CPP are more numerous and critical: twenty-six state commissions submitted comments, many of which are modestly or strongly negative.[198] Some, like the Florida Public Service Commission, questioned the legality of EPA's proposal.[199] Others, like the Georgia commission, challenged the fairness of the methods EPA used to derive the emissions budgets for each state.[200] And most of the state commissions alleged that the CPP would impair electricity supplies and reliability. The Texas[201] and North Dakota[202]

=2&disposition=attachment&contentType=pdf [https://perma.cc/PK87-VMAM (staff-uploaded archive)].

196. Ind. Util. Regulatory Comm'n, Comment Letter on Proposed Rule for National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units 2 (Aug. 2, 2011), https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2009-0234-19212&attachmentNumber=2&disposition=attachment&contentType=pdf [https://perma.cc/KJB2-Q885 (staff-uploaded archive)].

197. Or. Pub. Util. Comm'n, Comment Letter on Proposed Rule for National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units 1–2 (Aug. 2, 2011), https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2009-0234-18019&attachmentNumber=2&disposition=attachment&contentType=pdf [https://perma.cc/9YQQ-EHSF (staff-uploaded archive)].

198. For a full list of commenting state PUCs, see *Standards of Performance for Greenhouse Gas Emissions from Existing Sources: Electric Utility Generating Units*, REGULATIONS.GOV, https://www.regulations.gov/docketBrowser?rpp=50&so=ASC&sb=organization&po=200&dct=PS&D=EPA-HQ-OAR-2013-0602&docst=Government+State [https://perma.cc/K7CV-ZGGA (staff-uploaded archive)] (filtering comments to include submissions by state government entities).

199. *See, e.g.*, Fla. Pub. Serv. Comm'n, Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines for Existing Sources: Electric Utility Generating Units 5 (Dec. 1, 2014), http://www.floridapsc.com/Files/PDF/Dockets/Federal/Comments_EPA_12_1_2014.pdf#search=HQ-OAR-2013-0602 [https://perma.cc/V698-B7W9].

200. *See, e.g.*, Ga. Pub. Serv. Comm'n, Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units 14 (June 18, 2014), http://www.psc.state.ga.us/GetNewsRecordAttachment.aspx?ID=497 [https://perma.cc/5NV9-F3XB].

201. Pub. Util. Comm'n of Tex., Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Emissions from Existing Stationary Sources: Electric Utility Generating Units 15–34 (Dec. 1, 2014), http://www.puc.texas.gov/agency/topic_files/PUCT_Comments.pdf [https://perma.cc/4SBC-8J7W].

202. N.D. Pub. Serv. Comm'n, Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Emissions from Existing

commissions were especially critical on this point, asserting that the CPP posed a major threat to the reliability of the electric grids in their regions.

In sum, many (but not all) of the federal, regional, and state regulators responsible for maintaining the reliability of electricity markets have objected to one or more of EPA's rules aimed at controlling emissions from coal-fired power plants. Among their objections are claims that the rules would force the closure of existing coal-fired plants, thereby jeopardizing the reliability of the electric system. Although their comments vary substantially in tone, the overarching message that emerges is of significant, technically grounded anxiety about the potential impacts of EPA's rules on the adequacy of electricity supplies and grid stability. Further, while a number of the comments identify straightforward measures to mitigate, if not eliminate, such risks, virtually all of them conclude that grid stability is a significant issue that is not satisfactorily addressed in the proposed rules. Thus, what is left are conflicting claims from regulators about these EPA rules: EPA's claim that the rules' benefits dwarf their costs, versus grid regulators' claims that the rules are likely to jeopardize the reliability of electric service. We delve more deeply into this conflict in Part III.

III. THE COSTS, BENEFITS, AND DISTRIBUTIONAL EQUITY OF EPA'S REGULATIONS

This Part examines the geographic variation in costs and benefits associated with these three EPA rules, with a few caveats. Assessing the impacts of EPA rules is challenging, in part, because the intersection of electric utility and environmental regulation is unusually complex. As noted in Part II, multiple regulators exercise overlapping jurisdiction, both geographical and in terms of subject matter, over the targeted power plants.[203] Further, the environmental impacts of air emissions from electric utilities can span local, regional,

Stationary Sources: Electric Utility Generating Units 10–11 (Nov. 25, 2014), http://www.psc.nd.gov/public/newsroom/2014/docs/11-25-14NR-EPACarbonEmissionsComments.pdf [https://perma.cc/73GD-SNKU].

203. Some ISOs/RTOs oversee wholesale markets covering multiple states, whereas others cover just a single state; at the same time, regulation of retail markets by public utility commissions is entirely intrastate. State regulation, in turn, falls into either of two distinct categories—regulated retail markets with vertically integrated utilities, or restructured markets based on competitive retail pricing of electricity generation. Environmental regulations, which are set at the federal level but implemented largely at the state level, are superimposed over these blended layers of electricity regulation, and incorporate a wide range of policy instruments.

and global scales. GHGs responsible for climate change and the major conventional pollutants emitted by power plants are each part of global cycles, but also have local and regional impacts to varying degrees. It is this complex intermeshing of regulations that has allowed mismatches to persist between competing claims about regulatory impacts.

As described in Part II, when assessing the impacts of EPA regulations on grid management and reliability, commentators tend to focus on the regional level.[204] Much of this work has focused on the potential for EPA regulations to impede ISO/RTO operators from reliably managing subgrid regions due to projected losses of power generation capacity and declines in reserve margins.[205] While EPA considers these issues, its regulatory impact analyses ("RIAs") for the CSAPR, MATS, and CPP regulations center on national costs and benefits.[206] The resulting failure to engage in a debate at a common spatial scale has led to confusion and allowed the opposing camps to talk past each other. We hope to bridge these gaps and, in doing so, to highlight the value of examining regulatory impacts at multiple scales when environmental harms and regulation do not occur at a single spatial scale.

This analysis allows the consideration of regional distributions of impacts that are obfuscated by regulatory analyses based on national averages. It also provides an antidote to the prevailing focus on national social welfare in RIAs, which is striking given the prominence of environmental justice concerns at the local level and the importance of debates about equity and fairness in global negotiations over national commitments to mitigate GHG emissions.[207] Distributional concerns are salient at the local and global levels, but they are marginalized at spatial scales between these levels. A virtue of EPA's clean air regulations for electric utilities is that their impacts are felt from the local to the global level; they thus provide an opportunity to bring together the divergent scales of distributional debates over environmental regulation.

204. *See supra* Part II.

205. *See, e.g.*, PJM INTERCONNECTION, *supra* note 178, at 32–33.

206. *See infra* note 271 and accompanying text.

207. *See, e.g.*, David E. Adelman, *The Collective Origins of Toxic Air Pollution: Implications for Greenhouse Gas Trading and Toxic Hotspots*, 88 IND. L. REV. 273, 279–81 (2014) (outlining the origins and types of distributional concerns raised by environmental justice advocates); Nicholas Stern, *What is the Economics of Climate Change?*, 7 WORLD ECON. 1, 6, 8 (2006) (highlighting the importance of addressing distributional issues associated with the impacts of climate change and the costs of mitigating it).

Section A of this Part draws on a range of EPA and other data[208] to examine the geographic distribution of coal-fired power plants throughout the country; Section B explores the compliance costs and human-health benefits of the EPA regulations at the regional level. We find that (1) most of the generating plants projected to retire in response to the EPA rules are old plants, near the end of their useful lives, which pollute at higher rates, and (2) the plants projected to retire are typically spread across the country in rough proportion to each region's reliance on coal-fired power. Section C focuses on the distribution of pollution reduction benefits; the EPA data reveal that the benefits of these rules tend to be concentrated in the regions experiencing the most plant retirements.

A. *The Geographic Distribution of U.S. Coal-Fired Electricity Generation*

As of 2012, the United States had 460 operational coal-fired power plants with a total generation capacity of 321 GW,[209] but these plants are not evenly distributed around the country. Western and northeastern states each accounted for less than 10% of the electricity generated from coal despite together accounting for about 30% of the electricity generated nationally from all sources.[210] Twenty states collectively accounted for 80% of the coal generation in 2010, but just eight of them (Texas, Indiana, Ohio, West Virginia, Pennsylvania, Missouri, Illinois, Kentucky) accounted for 50% of that generation.[211]

208. Most of the data originate from EPA's Integrated Planning Model ("IPM") datasets for the MATS rule and CSAPR—IPM 4.10—and the more recent IPM dataset for the CPP—IPM 5.13 & 5.15. *Integrated Planning Model (IPM) Base Case v.4.10*, U.S. ENVTL. PROTECTION AGENCY, https://www.epa.gov/airmarkets/integrated-planning-model-ipm-base-case-v410 [https://perma.cc/Q4JU-6CL5] [hereinafter *IPM 4.10*] (last updated Aug. 15, 2016); *Power Sector Modeling Platform v.5.13*, U.S. ENVTL. PROTECTION AGENCY, https://www.epa.gov/airmarkets/power-sector-modeling-platform-v513 [https://perma.cc/U3SQ-9PVB] [hereinafter *IPM 5.13*] (last updated Aug. 5, 2016); *Power Sector Modeling Platform v.5.15*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/airmarkets/power-sector-modeling-platform-v515 [https://perma.cc/RL3E-6QHV] [hereinafter *IPM 5.15*] (last updated Aug. 15, 2016). Data was analyzed from the IPM 4.10, IPM 5.13, and IPM 5.15 Base Cases, which estimate baseline emissions levels in the absence of the regulation under review, as well as the datasets derived from EPA's modeled emissions projections for each rule after it is implemented. For more information regarding the analysis of this data, see David E. Adelman & David B. Spence, EPA Dataset Analysis (2016) (on file with the North Carolina Law Review).

209. *IPM 4.10*, *supra* note 208. In terms of individual units, collectively the U.S. fleet has 1,121 operational coal-fired boilers. *Id.* This number drops somewhat with the new EPA IPM 5.13 to 1,033 plants, and the total capacity drops to about 290 GW. *IPM 5.13*, *supra* note 208.

210. Adelman & Spence, *supra* note 208.

211. *Id.*

As this list suggests, most of the coal-fired generation capacity is located in the Midwest and South, with just three regions—MISO and PJM, each managed by RTO/ISOs, and the southeastern SERC grid—accounting for two-thirds of coal generation nationally.[212]

The geographic concentration of coal generation raises the specter that EPA regulations will disproportionately impact certain regions and states, which could be compounded by plant characteristics (such as age and size) in the areas most reliant on coal. Table 2 below summarizes the percentage of national coal-fired power emissions for key pollutants from each of the six regions with the largest fleets of coal plants.[213]

Table 2: Regional Coal Generation Capacity & Emissions in 2012[214]

	Emissions Nationally (%)				
ISO/RTO Regions	**Capacity (%)**	**SO_2**	**NO_x**	**Mercury**	**CO_2**
ERCOT (n=42)	7.2	3.4	5.4	9.2	8.2
MISO (n=399)	31.0	37.1	29.5	35.3	30.8
PJM (n=253)	21.5	25.8	18.7	19.1	19.6
SERC (n=207)	20.1	23.9	17.9	18.5	19.6
SPP (n=44)	4.5	3.3	6.5	6.7	5
WECC (n=111)	10.6	3	17.3	8.8	12.4
Total (n=1,121)	95.0	96.5	95.3	97.6	95.6

While the percentages of emissions are comparable to the relative generating capacities within each region, there are several examples of significant divergence. Most glaringly, mercury emissions in ERCOT are about 30% greater than the region's share of generation capacity.[215] There are lesser, but still significant,

212. These calculations are based on EPA's IPM 5.13 Base Case dataset, which among other assumptions is premised on mercury rules being implemented and grid conditions projected for 2016. *IPM 5.13*, *supra* note 208. Coal plants also generate a substantial portion of the power in these regions—72% in MISO, 46% in PJM, and 38% in SERC. *Id.*

213. *See infra* Table 2. When interpreting the data, it is important to recognize that if emissions levels were the same throughout the six regions, the percentage of total power generation or (roughly) capacity in each region would be comparable to the corresponding percentages for each of the pollutants. The data are based on unit/boiler-level information for each coal-fired power plant; this additional level of data is needed because units within a power plant can have widely divergent operating characteristics.

214. Based on EPA IPM 4.10 Base Case data for 2012. *See IPM 4.10*, *supra* note 208.

215. The divergence is even greater relative to the amount of coal generation in ERCOT. Reliable power generation data are only available under EPA's IPM 5.13

divergences for SO_2 (MISO emissions are about 20% higher than its share of generation capacity) and NO_x (emissions in SPP and WECC are about 40% and 60% higher, respectively). These results indicate that apart from the exceptions noted above, *regional emissions rates roughly track regional reliance on coal-fired generation*.

Of course, the degree to which new regulations will impose additional costs on individual plants will depend in large part on each plant's preexisting pollution control equipment. This ranges from state-of-the-art equipment controlling SO_2 and mercury emissions at many plants to nonexistent equipment for CO_2 emissions (given the absence of federal regulations until recently).[216] Adoption rates of SO_2 controls are similar across the regions, with two notable exceptions: (1) WECC, where state and regional haze regulations[217] have driven up adoption rates, and (2) SPP, where adoption rates are substantially lower.[218] The prevalence of pollution controls in WECC

database, but the earliest estimates from those data are for 2016, which is after several of the key environmental regulations are already in effect. Despite this, the IPM 5.13 Base Case data indicate that mercury emissions in ERCOT will be sixty percent greater than its share of electricity generation in 2016. *See IPM 5.13*, *supra* note 208.

216. The control technologies for emissions of SO_2 and NO_x are relatively straightforward, with two primary options available for each pollutant. In the case of SO_2, the two most common technologies are wet and dry scrubbers, which remove 96% and 92%, respectively, of the SO_2 emitted by a coal generation plant. CSAPR RIA, *supra* note 89, at 230. Dry Sorbent Injection is a less-common third alternative that is much less expensive, but it must be combined with either a fabric filter ("FF") or electrostatic precipitator ("ESP") that is typically used to remove particulate emissions. *See id.* For NO_x emissions, two technologies exist with substantially different levels of effectiveness: (1) Selective Non-Catalytic Reduction ("SNCR"), which removes up to 40% of NO_x emissions, and (2) Selective Catalytic Reduction ("SCR"), which removes about 90% of NO_x emissions. *Id.* at 231. Control of mercury emissions is substantially more complicated because it involves a mix of control technologies and the effectiveness of a given control technology varies with different types of coal (bituminous, subbituminous, lignite). *See* U.S. ENVTL. PROT. AGENCY, CONTROL OF MERCURY EMISSIONS FROM COAL FIRED ELECTRIC UTILITY BOILERS: AN UPDATE 3, 5 (2005), https://www3.epa.gov/airtoxics/utility/ord_whtpaper_hgcontroltech_oar-2002-0056-6141.pdf [https://perma.cc/97WG-498E]. A principal control technology for mercury is Activated Carbon Injection ("ACI"), which must be used in conjunction with some kind of particulate matter controls (either FF or ESP) and may be further enhanced when used with an SCR system. MATS RIA, *supra* note 106, at 2–9.

217. EPA's regional haze rule aims to improve visibility in national parks and wilderness areas, and is part of EPA's regulation of particulate matter under the Clean Air Act. *See* Regional Haze Regulations, 64 Fed. Reg. 35,714, 35,714–15 (July 1, 1999) (to be codified at 40 C.F.R. pt. 51). EPA revised its regional haze rules in 2012. *See* Regional Haze: Revisions, 77 Fed. Reg. 33,642, 33,643 (June 7, 2012) (to be codified at 40 C.F.R. pts. 51–52).

218. All of the data discussed here were taken from EPA IPM 5.13 NEEDs database for the year 2010; the analysis excludes units that were not generating electricity in 2010 as well as several classes of plants. *See IPM 5.13*, *supra* note 208, at ch. 4-1 to -2.

illustrates the influence of overlapping regulatory standards, while experience in SPP highlights the effectiveness of fuel switching.[219] Adoption rates of mercury controls are lowest in ERCOT, SERC, and SPP; however, the absence of federal regulation for the oldest plants has permitted adoption rates for strict controls to remain low in every region. Finally, the eastern focus of prior EPA NO_x regulations is evident in adoption rates of NO_x controls, which decline as one moves from PJM in the East to SPP and WECC in the West. Thus, regional patterns of existing pollution controls suggest that *(1) grid management regions in the east are less likely to be negatively impacted by CSAPR than those in the Midwest, and that (2) the MATS rule is likely to have greater impacts in ERCOT and SERC*.

To the extent that new pollution controls or other measures are required, the average age and size of a power plant will place limits on the costs that it can economically bear. By virtue of their shorter remaining lifetime, older plants have less time to amortize the costs of new pollution controls. Similarly, smaller plants rely on relatively low levels of generation to recoup the costs of pollution controls, and they do not benefit from potential economies of scale. Thus, older and smaller coal plants are at greater risk of being shut down because the range of regulatory costs that they can incur while still remaining economically viable is smaller.

The United States has among the oldest fleets of coal-fired power plants globally; its age distribution lags that of countries such as Russia and Poland and is much older than those in either India or China.[220] The EPA data reveal that older (and smaller) coal-fired plants are geographically concentrated in just a few regions. MISO, PJM, and SERC together account for about seventy-two percent of the nation's pre-1980 coal generation capacity.[221] Further, roughly two-thirds to three-quarters of the coal generation capacity in each region is derived from plants more than thirty-five years old.[222] These statistics suggest that a significant potential exists for regional disparities in the number of plant closures associated with the EPA

219. Despite relatively low adoption rates, SO_2 emissions in SPP are below the national average, which is likely attributable to greater reliance regionally on low-sulfur coal. Fuel choice has the opposite effect in ERCOT, which—despite having relatively high rates of adoption for mercury controls—has high emissions rates. This apparent inconsistency is driven by reliance on lignite coal, for which emissions controls are less effective.

220. FINKENRATH ET AL., *supra* note 55, at 34 (detailing that in India and China almost 40% and 70%, respectively, of coal plants were less than ten years old as of 2012).

221. Adelman & Spence, *supra* note 208. The numbers of pre-1980 plants in MISO and PJM are striking on their own—186 and 126, respectively.

222. *Id.*

rules. The seriousness of the risks to grid stability will hinge, however, on the contribution of older plants to actual electricity *generation*, as opposed to the levels of electricity generating *capacity*.[223]

The geographic distribution of smaller coal-fired plants overlaps substantially with the older plants. More than three-quarters of the smallest units (0 to 50 MW) were located in the MISO and PJM regions in 2012;[224] however, collectively these units account for only a few percent of the coal-based electricity generated in either region.[225] Among the next tier (50 to 100 MW), the MISO and PJM regions are home to seventy percent of the coal-fired units,[226] but once again, these units account for a small share of coal-fired generation. Thus, because their generating capacities and levels are low, it is unlikely that retirements of smaller coal-fired units alone could pose a threat to grid stability in either MISO or PJM.[227]

It is nevertheless important to recognize that older and smaller coal-fired plants typically emit air pollutants at relatively high rates. Coal plants that went online prior to 1960 have dramatically higher SO_2 and NO_x emissions, about 100% and 50% higher, respectively, than newer plants and substantially higher mercury emissions at about 25%.[228] Coal plants constructed post-2000, by contrast, emit on average 50% lower quantities of SO_2 and about 60% less NO_x than

223. All of the data discussed here are based on the EPA IPM 4.10 Base Case data for 2012. *See IPM 4.10*, *supra* note 208.

224. MISO and PJM account for 112 out of 145 units nationally. Within MISO, 69 coal boilers, with a mean size of just 19 MW, had a combined capacity of 1.37 GW in 2012; similarly, within PJM, 43 boilers had a mean size of 38 MW and a combined capacity of 1.64 GW. *Id.*

225. In 2012, 1.5% in MISO and 1.5% in PJM. *Id.*

226. In MISO there were 73 boilers, and in PJM 41, each with aggregate capacities of 5.4 GW and 3.03 GW, respectively; collectively they accounted for about 68% of the aggregate capacity of boilers in the range of 50 to 100 MW. SERC was a distant third with 18 plants and an aggregate capacity that accounted for about 11% of the national total. *Id.*

227. The analysis is conducted at the regional level and, thus, cannot foreclose smaller-scale impacts on grid stability at the subregional level. We are not alone in this respect, however, as other leading reports acknowledge the same types of limits in their analyses. *See, e.g.*, METIN CELEBI, FRANK GRAVES & CHARLES RUSSELL, THE BRATTLE GRP., POTENTIAL COAL PLANT RETIREMENTS: 2012 UPDATE 7 (2012), http://www.brattle.com/system/publications/pdfs/000/004/678/original/Potential_Coal_Plant_Retirements_-_2012_Update.pdf?1378772119 [https://perma.cc/PJH9-4R7L] (acknowledging that retirements could cause problems for subregions heavily reliant on specific units); JURGEN WEISS ET AL., THE BRATTLE GRP., EPA'S CLEAN POWER PLAN AND RELIABILITY 29 (2015), http://www.brattle.com/system/publications/pdfs/000/005/121/original/EPAs_Clean_Power_Plan_and_Reliability_-_Assessing_NERC's_Initial_Reliability_Review.pdf?1427375637 [https://perma.cc/W5RQ-3Y5W] (noting similar potential problems).

228. The discussion in this paragraph is based on the authors' analysis of the EPA data. *See* Adelman & Spence, *supra* note 208.

the fleet averages. The higher annual emissions from the oldest coal units follows from their low adoption rates of emissions control technologies. Approximately 70% to 85% of the plants that went online prior to 1970 have no or weak controls for SO_2, NO_x, and mercury, compared with about 25% of plants brought online during the 1960s and 1980s and less than 15% otherwise.[229] The low adoption rates of pollution controls are clearly evident in these statistics: older and particularly smaller plants have dramatically higher emission levels than newer and larger facilities.

One expected association that was observed only weakly was the inverse correlation between *age and efficiency of coal-fired power plants*. Significant improvements in efficiency are evident in the units constructed after 1960, as well as the most recent post-2000 generation of coal plants. Further, the variation in efficiency for the oldest units is much larger and extends to much lower levels of efficiency than those of plants constructed after 1960. However, only incremental gains were made in power plant efficiency during the intervening years, and average efficiency gains for coal-fired power plants were in the range of about 10% to 15% over the fifty-year period covered by the data.[230] Perhaps in part because of this, there was relatively little variation in the annual operation rates (capacity factors) for coal plants irrespective of their age or size: slightly lower for 1990 to 2000 and slightly higher for 1940 to 1960 and 2000 to 2015.[231]

The overall impression these statistics leave of U.S. coal-fired power plants is quite mixed. The most consistent attribute of the U.S. fleet is its age—less than 10% of the generation capacity in 2012 was constructed in the prior two decades, and almost 70% of the units were more than thirty years old.[232] There are also a large number of

229. The highest percentages of weak pollution controls were: 1940 to 1960 (45% capacity and 38% generation), 1960 to 1970 (23% capacity and 20% generation), and 1980 to 1990 (25% capacity and 23% generation); weak pollution control percentages were less than 15% for other year categories. *IPM 4.10*, *supra* note 208; Adelman & Spence, *supra* note 208.

230. *IPM 4.10*, *supra* note 208. The median capacity factor for plants of widely varying ages is roughly 75% to 85%, with somewhat larger variances in capacity factors for plants that went online between 1980 and 2000. *Id.*

231. The one notable exception was the low capacity factors for small plants in certain regions, particularly 50 MW to 100 MW plants in PJM and 0 MW to 50 MW plants in SERC, and, to a lesser extent, 0 MW to 50 MW plants in MISO. These differences are also reflected in the generation data by size of plant. For older plants with None/SNCR/DSI controls, capacity factors are substantially lower for 1960 to 1980. If a plant has scrubber, which many do, capacity factors are consistently above 80%. *Id.*

232. Adelman & Spence, *supra* note 208.

coal-fired units (almost 209 in 2012) with capacities below 100 MW and disproportionately large emissions rates—although collectively their emissions are small relative to those from much larger, higher-generating units. Yet, it is also true that from a global perspective the generation capacity of these smaller units—about 17 GW in 2012—is significant in comparison to grid capacities in many midsize countries; Chile had a total grid capacity of about 18 GW in 2014,[233] and even larger developed countries such as Australia have total capacities of about 45 GW.[234]

Another major pattern that emerges from the data is the geographic concentration of coal-fired power generation in midwestern and southeastern states, while many states in the West and Northeast have very little coal generation. Regions in the Midwest and Southeast have benefitted from inexpensive coal-fired generation (benefitting in part from regulatory grandfathering under the CAA) and have leveraged these assets by maximizing their operational life.[235] Thus, while regions with the highest coal-fired power generation capacity may experience more plant closures than other regions, their losses will be mitigated by the fact that the plants most likely to be shut down typically will be less valuable and, in any event, fully amortized given their age and size.

Finally, the preceding analysis shows that while the regions with the largest numbers of coal plants will have the greatest number threatened by EPA regulations, those regions will not face disproportionate generation losses; in short, while the numbers may appear large in absolute terms, they are modest when considered relative to regional generation capacity. This means that regional grid management can mitigate the potential impacts of EPA regulations by spreading the costs and risks over larger areas.

B. *Economic and Technical Drivers of Vulnerable Coal-Fired Power Plants*

The characteristics of a power plant and of its regional electricity market will ultimately determine whether a plant either shuts down

233. JUAN PABLO CARVALLO, PATRICIA HIDALGO-GONZALEZ & DANIEL M. KAMMEN, ENVISIONING A SUSTAINABLE CHILE 3 (2014), https://www.nrdc.org/sites/default/files/envisioning-sustainable-chile-report.pdf [https://perma.cc/KUS6-J4L6].

234. *Generation Capacity and Peak Demand*, AUSTL. ENERGY REGULATOR, https://www.aer.gov.au/node/9772 [https://perma.cc/QC9Y-U3ES].

235. *See* David B. Spence, *Coal-Fired Power in a Restructured Electricity Market*, 15 DUKE ENVTL. L. & POL'Y F. 187, 195–96 (2005); JOYCE MCLAREN, NAT'L RENEWABLE ENERGY LAB., SOUTHEAST REGIONAL CLEAN ENERGY POLICY ANALYSIS 6–7, 79 (2011), http://www.nrel.gov/docs/fy11osti/49192.pdf [https://perma.cc/NQ6H-YK3Y].

or substantially reduces its annual output. In addition to the plant-level data on heat rates, plant emissions levels, and pollution control equipment discussed above,[236] the EPA database contains information on the costs of pollution control equipment; variable and fixed operations; and maintenance, fuel, and capital investments.[237] This information is essential to evaluating the impacts of EPA's rules and is an integral part of the regulatory impact analyses the agency conducts. Thus, for the CSAPR and MATS rules, there are direct EPA projections of retirements at the unit level.[238] Table 3 displays the number, regional capacity, and median size and age of the plants that are projected to retire as a result of the CSAPR and MATS rules.[239] As expected, the units projected to retire in response to the CSAPR are overwhelmingly older and smaller, with median ages typically of more than fifty years and sizes well under 100 MW. The MISO and SPP regions, which host many smaller, older plants lacking the relevant control technologies, are projected under EPA's models to have substantial numbers of retirements. In these projections, it appears that the age of a unit is the single most important factor driving retirements, presumably because the costs of emissions control upgrades cannot be fully amortized over its remaining life. This pattern is also evident for the retirements in the PJM and SERC regions, where the median online year (original year of operation) of retired units is 1952 and 1953, respectively. In terms of grid reliability concerns, it is hard to see much of a threat posed by the CSAPR, since the total capacity at risk is just 6.6 GW, and the highest relative loss in any of the regions is only about 4% of coal-fired power generation capacity and 2% of total regional generation capacity.[240]

236. The EPA datasets IPM 4.10 and IPM 5.13 both contain this information. *See supra* note 208 and accompanying text.

237. Only the EPA IPM 5.13 dataset contains a complete set of plant-level cost information. *See IPM 5.13*, *supra* note 208.

238. The CSAPR data are based on the "retrofits SO_2/NO_x controls" variable in the CSAPR Remedy database. *See IPM 4.10*, *supra* note 208. For the MATS estimate, we used the IPM 5.13 Base Case data, *see IPM 5.13*, *supra* note 208, but removed the plants that were attributable to the CSAPR; the IPM 5.13 Base Case data start with the assumption that the MATS rule has been implemented, and since the MATS rule is very costly, it is reasonable to assume that most retirements will be attributable to it. These estimates are likely overinclusive and will thus err conservatively on the side of being too high.

239. Note that CSAPR covers a limited number of states and thus only four regions. *See supra* note 87 and accompanying text.

240. Adelman & Spence, *supra* note 208. As noted above, this analysis is conducted at the regional level and thus cannot foreclose smaller-scale impacts on grid stability at the subregional level.

Table 3: Projected Coal-Fired Unit Retirements for the CSAPR and MATS Rules[241]

CSAPR Retirements							
Region	**No. of Units**	**Retirements (MW)**	**Median Size (MW)**	**Median Online Year**	**No. Post-1980 Units**	**Retirements (%)**	**U.S. Capacity (%)**
MISO	13	904	70	1969	2	13.79	31.02
PJM	26	3,087	94	1952	4	47.11	21.54
SERC	23	2,214	106	1953	0	33.79	20.13
SPP	6	348	54	1961	0	5.31	4.52
All Regions	68	6,553	82	1957	6	100.00	77.21
MATS Retirements							
Region	**No. of Units**	**Retirements (MW)**	**Median Size (MW)**	**Median Online Year**	**No. Post-1980 Units**	**Retirements (%)**	**U.S. Capacity (%)**
ERCOT	3	1,262	435	1978	1	2.92	7.21
FRCC	4	1,236	304	1975	2	2.86	3.37
ISO-NE	10	2,128	178	1966	2	4.92	0.84
MISO	80	10,071	86	1961	4	23.30	31.02
NYISO	15	1,561	84	1958	3	3.61	0.79
PJM	32	5,627	145	1963	7	13.02	21.54
SERC	82	15,629	135	1958	9	36.16	20.13
SPP	8	1,948	140	1971	3	4.51	4.52
WECC	17	3,759	51	1979	8	8.70	10.57
All Regions	251	43,221	140	1966	39	100.00	100.00

The data suggest that the MATS rule has the potential to have a much greater impact on coal generation, and thus on grid stability; yet, here too there are mitigating factors and considerations. First, similar to the CSAPR, the coal-fired units projected to retire in response to the MATS rule are older and smaller, except in ERCOT and Florida,[242] where the median size is larger and the median age younger. However, even in those two regions, the numbers of units projected to retire are small, representing a capacity of about one GW in each region. Second, a large number of units projected to retire date back to the 1960s or earlier—the data for MISO and SERC illustrate this correlation vividly. Third, the total capacity lost in any given region, whether in absolute or relative terms, is small.[243]

241. *See IPM 4.10*, *supra* note 208; *IPM 5.13*, *supra* note 208; Adelman & Spence, *supra* note 208; *supra* note 238.

242. *See supra* note 171 and accompanying text.

243. Adelman & Spence, *supra* note 208. For example, while ISO-NE and NYISO experience large drops in coal generation, the losses represent only about 5% of total

Finally, it is not evident from the table, but SERC—the only region disproportionately[244] impacted by the MATS rule—is in a strong position to absorb capacity lost due to retirements. In addition to having a fleet of coal plants nearing the end of their lifetimes (including the oldest one in the country), SERC has a reserve margin that amounts to an excess capacity above twenty-five percent.[245]

As noted previously, estimating the number of retirements and their geographic distribution is much more challenging for the CPP because of the flexibility it gives states to employ measures other than reducing CO_2 emissions from coal and gas plants. EPA and other commentators are limited to using "illustrative examples" to estimate the impacts on generation sources and grid reliability, as no one can be sure of the specific mix of policies that states will ultimately adopt.[246] These uncertainties have not stopped independent analysts from projecting likely retirements at the regional level, and we too draw on the EPA data to make rough estimates ourselves. One must be especially careful, however, as any such estimates are necessarily imprecise given the myriad options states have in complying with the CPP.[247]

capacity because coal is a minor generation source in those regions. Conversely, the regions with the largest capacity losses in absolute terms (MISO, SERC) have the highest power generation capacities, resulting in relative losses of about 8%.

244. Disproportionately impacted in this context means that a region's share of projected retirements (based on capacity) significantly exceeds its share of total power generation. Note that the reserve margins in MISO are low relative to other regions (about 15%), but still above the NERC reference margin level. N. AM. ELEC. RELIABILITY CORP., *supra* note 149, at 2. Similar to SERC, the region with the third-highest capacity losses from retirements, PJM, has high reserve margins in the range of 25%. *Id.*

245. Adelman & Spence, *supra* note 208. SERC also has relatively low electricity prices, and is dominated by the traditional model of vertically integrated utilities earning a guaranteed return on their capital investments.

246. *See* CPP RIA, FINAL RULE, *supra* note 121, at ES-3.

247. The other point to keep in mind is that while the MATS rule primarily impacted coal plants, the CPP is projected to have significant impacts on gas plants, particularly older, less-efficient gas plants (so-called "oil/gas steamers"). According to EPA estimates, oil/gas steamers will account for about sixteen percent of the retirements associated with implementation of the CPP by 2030. These data come from the CPP Rate-Based SSR file in the IPM 5.13 dataset. *See IPM 5.13*, *supra* note 208.

Table 4: Projected Coal Generation Losses from the CPP[248]

Region	Generation U.S. 2018 (%)	Retirements 2025 (MW)	Retirements 2025 (%)	Retirements 2030 (MW)	Retirements 2030 (%)
ERCOT	7.80	291	1.36	600	2.29
FRCC	2.90	570	2.66	1,407	5.36
ISO-NE	0.04	2	0.01	2	0.01
MISO	21.84	4,624	21.61	4,624	17.62
NYISO	0.24	68	0.32	68	0.26
PJM	22.89	6,590	30.79	7,640	29.12
SERC	20.57	6,703	31.32	8,881	33.85
SPP	10.24	1,259	5.88	1,719	6.55
WECC	12.02	1,295	6.05	1,295	4.93
U.S. Total	100	21,402	100	26,236	100

EPA projections for retirements of coal plants resulting from the CPP are displayed in Table 4 above.[249] The most striking feature of the data is the degree to which the retirements are proportional to regional generation levels. While the share of retirements in PJM and SERC is higher than those regions' percentages of U.S. generation in 2018, and the losses in ERCOT, SPP, and WECC are lower, these differences are relatively small. Moreover, each region experiencing retirements that exceed their share of annual generation has robust reserve margins in the range of 25% or higher, and the losses amount to 10% to 15% of each region's total generation capacity.[250] Particularly given the complexity of the CPP and the range of factors EPA is balancing, the geographic distribution of retirements effectively mitigates potential problems with grid reliability. The only potential outlier is ERCOT, which has struggled to sustain a sufficient reserve margin,[251] but, as the analysis shows, the initial concerns have

248. *Id.*

249. EPA does not provide separate estimates for retirements of coal and natural gas power plants at the regional level. However, EPA does not predict any net losses of power generation capacity nationally from either combined-cycle or combustion turbines fueled by natural gas. *Id.* Oil/gas steamers are the only power plants with significant retirements of generation capacity other than coal-fired power plants through 2030 under the CPP rate-based scenario. *Id.*

250. N. AM. ELEC. RELIABILITY CORP., *supra* note 149, at 2.

251. *See* SAMUEL A. NEWELL ET AL., THE BRATTLE GRP., ESTIMATING THE ECONOMICALLY OPTIMAL RESERVE MARGIN IN ERCOT 1 (2014), http://www.brattle.com/system/publications/pdfs/000/004/978/original/Estimating_the_Economically_Optimal_Reserve_Margin_in_ERCOT_Revised.pdf?1395159117 [https://perma.cc/LXH6-3ETS]. ERCOT's market is the only wholesale market characterized by both retail competition and the absence of a capacity market, which means that prospective investors in new plants lack any sort of revenue guarantee. *See* SAMUEL NEWELL ET AL., THE BRATTLE GRP., ERCOT

been defused by the final CPP, which is projected to cause only about a 2.5% drop in coal-fired power generation capacity by 2030.

To gain a rough sense of the coal plants that are most likely to retire as a result of the CPP, we modified unit-level data from EPA's database to incorporate the costs of all anticipated emissions controls.[252] Similar to other studies, such as those of the Brattle Group,[253] we evaluated a series of cutoffs for electricity prices above which coal plants were presumed to be uneconomic. The cutoffs were set regionally and then adjusted to generate an aggregate capacity of coal plant retirements that was comparable to the lower end of the range derived by EPA for each region.[254] Table 5 displays the regional distribution and key characteristics of the coal plants projected to retire. While there is substantial interregional variation, much of this is associated with a small number of plants in a few regions.[255] Once again, most of the projected retirements involve older and smaller

INVESTMENT INCENTIVES AND RESOURCE ADEQUACY 11 (2012), http://www.brattle.com/system/publications/pdfs/000/004/820/original/ERCOT_Investment_Incentives_and_Resource_Adequacy_Newell_Spees_Pfeifenberger_Mudge_ERCOT_June_2_2012.pdf?1378772132 [https://perma.cc/XFP8-UBNQ].

252. We identified plants requiring emissions control equipment to meet the CSAPR and MATS that remained uncontrolled under EPA's IPM 5.13 Base Case; in effect, this ensured that the cost of emissions controls were integrated into the generation costs of all coal-fired units in the database. The costs factored into the analysis included fixed operations and maintenance ("O&M") costs, variable O&M costs, capital costs, and fuel costs. We were not able to use the IPM 5.15 used in the final rule for the CPP because the data released did not include parsed data; we do not expect this to materially affect our results. *See IPM 5.13*, *supra* note 208.

253. CELEBI ET AL., *supra* note 227, at 5–7 (using the cost of different pollution control retrofits to calculate the cost implications of proposed EPA rules and then setting aggregate cutoffs for costs to estimate the total generation capacity of coal plants that are likely to retire). The Brattle Group used a more complex methodology to assess the CPP in a more recent study that we do not attempt to replicate here. METIN CELEBI ET AL., THE BRATTLE GRP., EPA'S PROPOSED CLEAN POWER PLAN: IMPLICATIONS FOR STATES AND THE ELECTRIC INDUSTRY 4–5 (2014), http://www.brattle.com/system/publications/pdfs/000/005/025/original/EPA's_Proposed_Clean_Power_Plan_-_Implications_for_States_and_the_Electric_Industry.pdf [https://perma.cc/GU3S-XUKS].

254. EPA estimates that the CPP will cause 23 GW to 29 GW of additional coal-fired power generation capacity to retire by 2025. CPP RIA, FINAL RULE, *supra* note 121, at 3-30. The regional cutoffs varied between $0.045 per kWh for the WECC region and $0.065 per kWh for the FRCC region. If we had attempted to lower the cutoffs further, the estimates would begin to overlap substantially with the middle of the cost distribution, making the projections subject to far greater variances.

255. Our simple model for projected retirements reveals that in ERCOT and FRCC only a handful of larger coal-fired power plants are at risk (this is in part because the regions themselves are relatively small), which accounts for the larger average size of the at-risk plants for these regions displayed in Table 5. The patterns of projected retirements in SERC are more complicated; they turn largely on relatively higher operational costs and the large installed capacity of coal-fired power plants in the region.

coal-fired units, with 67% more than 35 years old and 65% of the units having capacities below 100 MW.[256] By design, the results follow the regional patterns observed in the EPA projections for retirements of coal units, with the regions having the largest capacities experiencing the greatest losses.[257] The results are, however, substantially lower than the results of other independent analyses, but those analyses were all based on EPA's proposed rule, which was projected to have much higher coal plant retirements than the final rule[258]—both because EPA increased the number of coal plants projected to retire prior to the CPP going into effect and because EPA relaxed the goals for several key states.[259]

256. Adelman & Spence, *supra* note 208.

257. The analysis shows MISO bearing a larger burden of retirements than EPA projects; and we project WECC bearing a smaller share, particularly given that the EPA estimates include natural gas plants. These differences are undoubtedly reflective of the very simple framework that we are using, as well as the difficulty EPA acknowledges in making projections below the national level. We don't expect our estimates to be precise, but instead to provide an indication of the general patterns with respect to unit size and age that are illustrative of the facilities likely to be at a greater risk of retirement.

258. EPA's and our estimates of the net loss coal-fired power generation capacity are consistent with those found in several recent reports. *See, e.g.*, ERCOT, *supra* note 192, at 6 (projecting 4.1 GW of coal plant retirements in ERCOT from the CPP, which is about 35% higher than our crude projection for ERCOT); U.S. ENERGY INFO. ADMIN., ANALYSIS OF THE IMPACTS OF THE CLEAN POWER PLAN 17 (2015), http://www.eia.gov/analysis/requests/powerplants/cleanplan/pdf/powerplant.pdf [https://perma.cc/5N9J-9ZEC] (estimating that the CPP will cause 50 GW coal-fired power generation capacity to be shut down nationally); WEISS ET AL., *supra* note 227, at 13 (describing SPP estimate that the CPP will cause about 6 GW of coal plant retirements in the SPP, which is about 30% higher than our estimate).

259. *Compare* CPP RIA, FINAL RULE, *supra* note 121, at 3-6 to -7, 3-27 (listing state goals for the final CPP and providing the base case generation capacity of coal to be 1.462 million gigawatt-hours ("GWh") in 2020), *with* U.S. ENVTL. PROT. AGENCY, REGULATORY IMPACT ANALYSIS FOR THE PROPOSED CARBON POLLUTION GUIDELINES FOR EXISTING POWER PLANTS AND EMISSION STANDARDS FOR MODIFIED AND RECONSTRUCTED POWER PLANTS 3-6 to -7, 3-27 (2014) [hereinafter CPP RIA, PROPOSED RULE], http://www2.epa.gov/sites/production/files/2014-06/documents/20140602ria-clean-power-plan.pdf [https://perma.cc/V73Q-3AG4] (listing state goals for the proposed CPP and providing the base case generation capacity of coal to be 1.665 million GWh in 2020).

Table 5: Projected Coal-Fired Unit Retirements by 2030 for the CPP[260]

Region	No. of Units	Capacity Lost (MW)	Median Unit Size (MW)	Median Online Year	No. Post-1980 Units	Capacity Lost (%)	Generation U.S. 2018 (%)
ERCOT	2	729	365	1983	2	2.78	7.80
FRCC	8	1,459	122	1995	8	5.56	2.90
MISO	65	4,654	21	1958	5	17.75	21.84
PJM	61	7,595	40	1965	24	28.97	22.89
SERC	31	8,212	249	1983	18	31.32	20.57
SPP	19	1,923	30	1968	8	7.33	10.24
WECC	22	1,647	33	1976	4	6.28	12.02
All Regions	208	26,219	30	1965	69	100	100

Overall from the standpoint of grid stability and the distribution of the regulatory burdens, the preceding analysis, illustrated by Tables 3 through 5, shows that the scale of the retirements from the CSAPR, MATS rule, and CPP are modest compared with regional generation capacities, and that large reserve margins exist in most regions to offset the anticipated losses.[261] Projected retirement rates are largely proportional across regions, relative to either coal generation capacity or annual generation, and few regions bear a disproportionate share of the regulatory burdens. Moreover, the characteristics of the at-risk coal units suggest that the great majority of the plants that are likely to retire are close to the end of their life cycles and long ago recouped their capital costs.

Finally, compliance with these rules, while costly in absolute terms, is low relative to the annual operating expenses and revenue of the electric utility sector. The compliance costs of the MATS rule and the CPP have been projected to be $9.6 billion and $8.4 billion, respectively.[262] Yet these costs represent less than 5% of the industry's expenses and revenue, which in 2012 were $235.7 billion and $270.9 billion, respectively.[263] For the MATS rule, which is the

260. *See IPM 5.13*, *supra* note 208. For simplicity of review, only the regions with significant reductions in generation capacity are included in Table 5.

261. The most highly impacted regions all also have large numbers and capacities (about 75 GW) of combustion turbines and combination oil/gas steamers that are either in reserve or operating at very low capacity factors, and thus could further offset lost capacity from retirements of coal-fired power plants.

262. MATS RIA, *supra* note 106, at ES-1; CPP RIA, FINAL RULE, *supra* note 121, at ES-22.

263. CPP RIA, FINAL RULE, *supra* note 121, at 2-42.

most costly of the three, the projected yearly price increases for electricity peak at 3.1% above the base case nationally according to EPA.[264] The projected rate increases for the CPP are slightly higher, with the national average peaking in 2020 at 3.2% above the base case and regional increases in NYISO, PJM, and ISO-NE running as high as 6%.[265] However, the projected impact on the average annual cost of electricity is lower—with increases peaking below 3% in 2020 and going negative by 2025—because of reductions in demand associated with energy efficiency.[266] In short, overall the projected impacts on retail electricity prices and annual expenditures are very modest, particularly in comparison to their benefits—a subject to which we turn next.[267]

C. Distribution of Compliance Benefits

The analysis thus far has focused exclusively on the *costs* of EPA's rules; this Section evaluates the environmental and health *benefits* of these rules. One of the defining characteristics of regulations under the CAA is their favorable benefit-to-cost ratios,[268]

264. MATS RIA, *supra* note 106, at 3-24 (listing the increases by corresponding NERC reliability regions, which amounts to less than a third of a cent per kWh). The highest increase in cost regionally is projected to occur in SPP, at 6.3% or about half a cent per kWh, but electricity prices in the region would still be below the national average, even in the absence of the MATS rule. *Id*. The estimates for the CSAPR predict increases of less than 2% nationally in 2012 and dropping below 1% by 2014; the highest regional increase from 2012 to 2020 is roughly 3% or about a third of a cent per kWh. CSAPR RIA, *supra* note 89, at 266.

265. CPP RIA, FINAL RULE, *supra* note 121, at 3-37 to -39 (this amounts to about 0.3 cents per kWh). The EIA estimates that electricity prices will peak at 3% to 7% above business as usual, and in many regions return to baseline levels by 2030. U.S. ENERGY INFO. ADMIN., *supra* note 258, at 21. In some regions, such as the Southwest and the Southeast, prices are projected to increase 10% to 11% by 2030, but even in those areas electricity prices typically drop under 5% above baseline by 2040. *Id.* at 21, 41–43.

266. In its final rule, EPA estimates that average annual electricity bills will rise by 2.7% in 2020 above the base case, and then fall below it by 3.8% by 2025 and 7% by 2030. CPP RIA, FINAL RULE, *supra* note 121, at 3-40. According to the EIA, residential expenditures on electricity will peak at 3.4% in 2020 and fall to 0.03% by 2040; for commercial customers, they peak at 3.9% in 2020 and fall to –1.3% by 2040; and for industrial customers, they peak at 4.6% in 2020 and fall to 0.2% by 2040. U.S. ENERGY INFO. ADMIN., *supra* note 258, at 44.

267. The more plausible claim is that these rules threaten the coal industry, but this perspective gets things backwards. The coal industry has benefited for years from shifting its enormous environmental externalities to society. If what matters is social welfare, protecting the coal industry in its current state is not in the national interest. However, recognition of the impact of these rules on the coal industry may explain some of the political opposition to the rules. *See infra* Part IV.

268. *See Benefits and Costs of the Clean Air Act from 1990 to 2020, the Second Prospective Study*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/clean-air-act-overview/benefits-and-costs-clean-air-act-1990-2020-second-prospective-study [https://perma.cc/RKL6-

and these rules are no exception.[269] The MATS, CSAPR, and CPP all boast benefits greatly exceeding their costs, despite EPA's omission of numerous difficult-to-monetize benefits.[270] However, EPA's primary focus is on national-level costs and benefits—state and regional numbers are only of secondary concern.[271] This Section examines the regional distribution of the regulatory benefits.[272] We find that the benefits tend to be concentrated in the regions where electric utilities will be most impacted by EPA rules. This really

7EVG] (last updated Sept. 6, 2016); *see also* Michael A. Livermore & Richard L. Revesz, *Rethinking Health-Based Environmental Standards*, 89 N.Y.U. L. REV. 1184, 1236–47 (2014) (illustrating that the benefits of rules establishing NAAQS standards almost always exceed costs and, even then, the standards fall short of maximizing net benefits).

269. This characteristic has been demonstrated in a broad range of analyses, ranging from long-term cost-benefit assessments of the CAA, to examinations of specific market sectors, to regional and state-level assessments using a mix of economic indicators. *See* Ben Machol & Sarah Rizk, *Economic Value of U.S. Fossil Fuel Electricity Health Impacts*, 52 ENVT. INT'L 75, 78 (2013); Nicholas Z. Muller, *Boosting GDP Growth by Accounting for the Environment*, 345 SCI. 873, 873–74 (2014); Muller et al., *supra* note 45, at 1664–65. *See generally* Tammy M. Thompson et al., *A Systems Approach to Evaluating the Air Quality Co-Benefits of US Carbon Policies*, 4 NATURE CLIMATE CHANGE 917 (2014) (presenting a systems approach to quantify air quality co-benefits of U.S. policies to reduce carbon emissions and finding that "monetized human health benefits associated with air quality improvements can offset 26% to 1,050% of the cost of US carbon policies"). About 87% of the GED associated with coal-fired power plants is attributable to SO_2 emissions, with $PM_{2.5}$ and NO_x each accounting for about 6.5% of the total GED; about 94% of the GED is attributable to increased mortality. Muller et al., *supra* note 45, at 1669.

270. *See, e.g.*, CPP RIA, FINAL RULE, *supra* note 121, at ES-10 to -14. For MATS, net benefits are $27 to $80 billion per year, compared to total annual costs of $9.6 billion. MATS RIA, *supra* note 106, at ES-1. For CSAPR, net benefits are $120 to $280 billion per year compared to total annual costs of $0.81 billion. CSAPR RIA, *supra* note 89, at 1–2. For the CPP, the net benefits are projected to be $17 to $27 billion per year by 2025 and rise to $26 to $45 billion per year by 2030, while total expected annual costs for those years are $1.0 and $8.4 billion, respectively. CPP RIA, FINAL RULE, *supra* note 121, at ES-22 to -23.

271. Simply finding the state-level data in the RIAs takes time and persistence, as they are buried hundreds of pages into the analyses and are not mentioned or discussed in the executive summaries for the rules. Nor are they made available as separate data files along with the detailed emissions data and modeling that EPA very effectively (and transparently) posts on its website. Instead, the data must be extracted from the PDF versions of the RIAs and then imported into spreadsheet or statistical programs.

272. The regional numbers we calculate are based on state-level estimates EPA derived for the CSAPR and MATS rules. *See* U.S. ENVTL. PROT. AGENCY, COMBINED NATIONAL AND STATE-LEVEL HEALTH BENEFITS FOR THE CROSS-STATE AIR POLLUTION RULE AND MERCURY AND AIR TOXICS STANDARDS 8 (2011), http://www.epa.gov/ttnecas1/regdata/Benefits/casprmats.pdf [https://perma.cc/D536-F3UZ]. As discussed further below, state-level estimates are not available for the CPP. *See supra* notes 288–92 and accompanying text. It is important to note that all of the state and regional estimates are based on the distribution of benefits overall from the EPA rules—none of the estimates distinguishes between benefits from emissions reductions that occur within a state or region versus those that occur outside a state or region.

should not be surprising, as regulatory costs naturally track reductions in emissions of air pollutants regionally. The analysis continues to focus on regional data because they are more tractable to evaluate regional than state data,[273] and are consistent with the scale at which electric grids are actually managed.

1. Benefits of the Mercury and Air Toxics Standards

The MATS rule is widely criticized for requiring installation of the most expensive pollution controls on coal-fired plants.[274] As noted above, its benefits nevertheless exceed its costs by a factor of three to eight.[275] Table 6 below disaggregates the national statistics into regional data, but focuses on the regions with the largest fleets of coal-fired power plants. The percentage of coal-fired power generation capacity regionally is provided as a benchmark for a distribution of the emissions reductions and benefits that is proportional to the size of the coal fleets regionally.[276] The benefits of the MATS rule are given both in terms of lives saved (the overriding driver of benefits) and total monetized benefits of the rule within each region.

273. That is, comparing six or eight regions is easier than comparing data for forty-eight states.

274. *See* David Siegel, *23 States Tell High Court EPA's Mercury Regs Too Costly*, LAW360 (July 21, 2014, 3:03 PM), http://www.law360.com/articles/559109/23-states-tell-high-court-epa-s-mercury-regs-too-costly.

275. *See supra* Section I.B.2. After the Supreme Court's decision in *Michigan v. EPA*, EPA will need to justify imposing such significant compliance costs on industry when it revisits mercury regulation. 135 S. Ct. 2699, 2705–06, 2711–12 (2015). As noted in Section I.B.2, the benefits of mercury regulation include co-benefits associated with reduced emissions of pollutants other than mercury. *See Michigan v. EPA*, 135 S. Ct. at 2706, 2711. The Court's *Michigan* decision has created some uncertainty about whether EPA may reasonably base its decision to regulate on an analysis that credits these co-benefits, real though they may be.

276. As previously noted, this statement assumes that an equitable sharing of the regulatory burdens would require each region to reduce its emissions to a level that is proportional to its contribution to the air pollution externalities. Here, power generation capacity is used as a proxy for each region's relative contribution, which, as Table 2 shows, tracks the emissions of the major pollutants at the regional level. This is not the only basis upon which to assess the equity of EPA's regulations (emissions reductions could be proportional to the difference between a region's average emissions rate and the national average), but by erring conservatively on the side of regions more reliant on coal, our findings below that EPA's rules are generally fair at the regional level are less vulnerable to challenges of bias.

Table 6: Regional Benefits of MATS Regulations: Emissions, Lives Saved, Value[277]

Region	Capacity Coal (%)	Drop in Emissions (%)			No. of Lives Saved	Valuation ($Millions 2007)
		NO_x Total	SO_2 Total	$PM_{2.5}$ Summer		
ERCOT	7.21	5.04	10.16	7.68	460–1,200	$4,000–9,700
MISO	31.02	11.79	25.93	16.22	642–1,649	$5,583–13,650
PJM	21.54	31.93	9.65	19.71	1,025–2,618	$8,850–21,660
SERC	20.13	31.99	30.65	36.78	1,452–3,750	$12,500–30,900
SPP	4.52	4.59	11.03	5.54	208–522	$1,760–4,400
WECC	10.57	13.58	10.33	13.04	119–309	$1,020–2,484
Total	94.99	98.92	97.75	98.97	4,207–10,819	$36,337–89,277

Two broad patterns emerge from the data. First, as previously mentioned, emissions reductions in most cases are roughly proportional to the regional generation capacity. For example, ERCOT has about 7% of the coal-based generation capacity, and its share of emissions reductions for the three pollutants ranges from 5% to 10%. Only minor disparities exist with respect to the application of the MATS regulations regionally. The Southeast (SERC) is arguably an exception, but this reflects the fact that SERC coal plants substantially lag other regions in their adoption of mercury controls.[278] Second, benefits closely track local emissions reductions (and thus costs) because, as the EPA data show, most of the harms associated with air pollution from coal plants occur regionally.

Thus, the case for regulation based on economic efficiency holds at the regional level—benefits substantially exceed costs at both the national and regional levels. Importantly, this is true even when a region bears a higher share of the costs precisely because regional

277. *See supra* note 272. For simplicity of review, only the regions with significant benefits from reductions in mercury emissions are included in Table 6.

278. Fifty-nine percent of the coal-fired units in SERC have low or no emissions controls for mercury, whereas the national average is 42%. The reduction of SO_2 emissions in SPP was also disproportionate to its generation capacity, but this is a byproduct of the mercury controls, which also impact SO_2 emissions, and the low rate of adoption for SO_2 controls in SPP (43% versus the national average 72%).

benefits rise with regional costs. This correlation is evident in the starkest example from the data: the relatively larger emissions reductions in SERC (30% to 37% versus its 20% of generation capacity) results in greater benefits that account for roughly 35% of the aggregate benefits nationally. In sum, while mercury and co-pollutants such as $PM_{2.5}$ have national and even global impacts, the *regional* health benefits of the MATS rule offset the *regional* costs of complying with it by a substantial margin.

2. Benefits of the Cross-State Air Pollution Rule

Because the CSAPR is designed to mitigate interstate air pollution (specifically, to remedy the problem of midwestern and southern plants sending pollution to downwind states to the east), there *ought* to be regional disparities between the respective distributions of its costs and benefits. Table 7 confirms that this is true for certain regions: SPP receives about 2% of the monetized benefits but accounts for 25% of the reduction in NO_x emissions, and MISO receives 15% of the monetized benefits but accounts for 26% and 21% of the reductions in NO_x and SO_2 emissions, respectively. By contrast, SERC comes out ahead, with SERC responsible for about 15% of the emissions reductions while receiving approximately 23% of the monetized benefits. In the case of MISO, although the region receives a lower share of the benefits, its emission reduction burden is very close to its share of generation capacity. While SPP bears a disproportionately large burden of reducing NO_x emissions (about five times greater than its share of capacity), that is because the region has been a laggard in the adoption of NO_x control technologies.[279]

279. In SPP, just 36% of coal units have some kind of NO_x controls versus 52% nationally.

Table 7: Regional Benefits of CSAPR Regulations: Emissions, Lives Saved, Value[280]

Region	Capacity Coal (%)	Drop in Emissions (%)			No. of Lives Saved	Valuation ($Millions 2007)
		NO_x Total	SO_2 Total	NO_x Summer		
ERCOT	7.21	2.7	7.3	4.4	700–1,800	$6,100–15,000
FRCC	2.54	7	0	13.9	630–1,600	$5,400–13,000
MISO	31.02	25.9	37.4	21.1	2,397–6,168	$20,628–50,668
PJM	21.54	25.8	33	20.7	4,917–12,470	$41,800–104,000
SERC	20.13	13.6	17.9	14.4	3,110–7,950	$26,800–64,900
SPP	4.52	25.3	4.1	26	275–711	$2,400–5,870
Total	94.99	99.8	99	99.9	13,234–33,736	$113,523–278,988

Despite disparities in the distribution of CSAPR's costs and benefits, the compliance costs for the CSAPR nationally are relatively low—less than $1 billion annually—while the benefits are enormous—more than a hundred times greater than its costs.[281] Accordingly, although the benefits are not equally shared across different regions of the country, the large magnitude of the benefits ensures that costs will be more than offset even in the regions receiving a smaller share of the national total. For example, even if electric utilities in SPP bear 26% of the annual costs (i.e., costs are roughly proportional to emissions reductions), the regional costs would amount to $211 million annually,[282] which is less than 10% of the lower bound of the benefits SPP would receive.

The CSAPR powerfully illustrates how the enormous benefits of Clean Air Act rules promote Pareto improvements (i.e., no one is worse off on a region by region basis), even when the costs of a rule

280. *See supra* note 272. For simplicity of review, only the regions with significant benefits from emissions reductions are included in Table 7.

281. For a discussion regarding CSAPR costs and benefits, see *supra* note 270 and accompanying text.

282. For a discussion regarding CSAPR costs and benefits, see *supra* note 270 and accompanying text.

are unevenly spread.[283] In each wholesale market, the monetized benefits of CSAPR dwarf the costs (despite the few regional cost disparities), even using quite conservative assumptions.[284] Thus, these rules go far beyond the Pareto condition—the net benefits in each region are large and effectively nullify any unevenness in the distribution of costs. Moreover, the CSAPR is forcing upwind utilities to internalize costs they had previously shifted to downwind communities. Indeed, before the rule, people in the upwind states enjoyed inexpensive electricity partly *because* they could shift those costs to people in the downwind states.

3. Benefits of the Clean Power Plan

Recall that pursuant to CAA section 111(d), EPA has proposed guidelines according to which *states* will set standards reflecting the "best system of emissions reduction" ("BSER") that take into account costs and any non-air quality health, environmental, and energy impacts.[285] In particular, EPA's approval guidelines establish state-by-state emission reduction goals based on the "emission reduction opportunities and existing state programs and measures, and characteristics of the electricity system."[286] Thus, EPA assigns more aggressive goals to those states that have a broader range of cost-effective options for reducing GHG emissions; conversely, it assigns less aggressive goals to those states that have fewer options. These differential objectives reflect EPA's attempt to equalize compliance costs across states, thereby mitigating potential inequities between states with respect to the economic burdens of the CPP.[287]

One of the challenges for this analysis is that, as EPA acknowledges, "[g]iven the flexibilities afforded states in complying with the emission guidelines, the benefits, cost and economic impacts reported in [its] RIA are not definitive estimates [but] are instead illustrative of approaches that states may take."[288] One consequence

283. This is not to say that these rules produce Pareto improvements on subregional grid stability. *See supra* note 227. But their huge benefit-cost ratios do mean that these rules yield Kaldor-Hicks improvements (i.e., overall social welfare whereby aggregate benefits outweigh the aggregate costs) both nationally and regionally. *See supra* note 271.

284. For a discussion regarding CSAPR costs and benefits, see *supra* note 270 and accompanying text.

285. *See* CPP RIA, FINAL RULE, *supra* note 121, at ES-1 to -2; text accompanying *supra* note 116.

286. CPP RIA, PROPOSED RULE, *supra* note 259, at ES-2.

287. The CPP offers states additional flexibility to achieve emissions reductions through a variety of methods. *See* CPP RIA, FINAL RULE, *supra* note 121, at ES-1 to -4.

288. *Id.* at ES-3. EPA has translated the state-level BSER standards into "rate-based" and "mass-based" approaches that enhance the flexibility of the rule. *Id.* at ES-3 to -5.

of this uncertainty is that the most granular level of EPA's analysis is conducted at a broad super-regional level, which divides the country into "East" and "West," as well as singling out California for its own analysis.[289] EPA's super-regional East-West analysis exposes one unmistakable geographic pattern of the rule's benefits—roughly 95% of the benefits associated with reducing the emissions of conventional co-pollutants occur in the East.[290] And as with the MATS rule, a majority of those benefits are co-benefits attributable to reductions in SO_2 and NO_x emissions from coal-fired power plants.[291] Indeed, co-benefits account for 48% to 69% of the CPP's monetized benefits, which suggests the rule's benefits will be distributed unevenly around the country.[292]

To try to estimate the regional distribution of CPP benefits, we used a mix of proxies, estimates of emissions reductions by state for conventional pollutants, and independent analyses from a study of the health benefits by state for an analogous regulatory program; the analyses were conducted by an independent group of researchers from Harvard University, Boston University, and Syracuse University ("Health Co-Benefits Study").[293] The picture that emerges from this analysis is mixed. As indicated by EPA's super-regional data, there are clear interstate and regional disparities evident in the emissions reductions projections. The ERCOT and MISO regions each are responsible for a disproportionate share of GHG emissions reductions when measured against their projected annual generation in 2018, whereas the standards for SERC and WECC are relatively

Each of the approaches is premised on states employing mitigation measures drawn from three classes or "building blocks," but the specific mix is left up to the states and the regulations allow them to develop plans with other states regionally. *Id.* at ES-1 to -4.

289. *Id.* at 4-20 to -24.

290. *Id.* at 4-24 to -25.

291. *Id.* at ES-6 to -7.

292. For a discussion regarding CPP costs and benefits, see *supra* note 270. By contrast, one would expect the climate benefits from the rule to be distributed relatively evenly, or to be subject to such large uncertainties at the subcontinental level that estimates of benefits will only be possible at large scales, thereby effectively precluding reliable assessment of interstate disparities.

293. *See generally* CHARLES DRISCOLL ET AL., CO-BENEFITS OF CARBON STANDARDS, PART 1: AIR POLLUTION CHANGES UNDER DIFFERENT 111D OPTIONS FOR EXISTING POWER PLANTS (2014), https://pdfs.semanticscholar.org/c9a5/bef702ec5920c5d0f99f1e697589b661d1d1.pdf [https://perma.cc/L8WQ-NWUC] (estimating state-level effects in multiple policy scenarios). The Health Co-Benefits Study includes a scenario, Scenario 2, that was designed to resemble the regulatory framework for the CPP. *See* JOEL SCHWARTZ ET AL., HEALTH CO-BENEFITS OF CARBON STANDARDS FOR EXISTING POWER PLANTS: PART 2 OF THE CO-BENEFITS OF CARBON STANDARDS STUDY 1–2 (2014), http://www.chgeharvard.org/sites/default/files/userfiles2/Health%20Co-Benefits%20of%20Carbon%20Standards.pdf [https://perma.cc/VC45-R9UZ].

relaxed, as illustrated in Table 8 below.[294] However, similar to the other rules, the correlation between emissions of CO_2 and conventional pollutants implies that those states with more stringent emissions goals will also reap greater co-benefits. And because EPA has a legal mandate to equalize the cost burden across states, these greater reductions should be achievable at a cost that is not markedly higher than costs incurred by states subject to weaker goals.

Table 8: Regional Emissions Reductions from the CPP Using State Plans[295]

Region	Generation†	Reductions Nationally by 2025 (%)			Reductions Nationally by 2030 (%)		
	(%)	CO_2	NO_x	SO_2	CO_2	NO_x	SO_2
ERCOT	9.1	21.8	16.5	29.0	18.9	13.4	19.3
FRCC	6.3	4.1	4.2	3.7	5.5	6.1	11.5
MISO	12.0	26.1	26.6	23.5	23.4	25.9	22.2
PJM	19.1	15.3	24.7	21.8	15.1	22.4	18.9
SERC	20.4	15.3	15.6	15.2	20.0	17.8	21.0
SPP	7.1	3.3	5.2	2.1	4.3	6.7	3.0
WECC	18.2	11.9	6.7	4.8	10.4	7.0	4.1
Total	92.2	97.8	99.5	100.0	97.6	99.4	100.0

†Percent of generation nationally from all sources based on IPM 5.15 Base Case for 2018.

The Health Co-Benefits Study complicates this picture insofar as it suggests that co-benefits of the CPP may not be so localized. As summarized in Table 9, its results suggest that the ERCOT region is likely to bear a disproportionate share of the burden for reducing CO_2 emissions, *and* is likely to receive much less in the way of countervailing health co-benefits. Conversely, the states in the PJM region are subject to relatively weaker emissions reduction goals, and yet they receive a disproportionate share of the benefits—30% of the total, which is almost double their relative contribution to reducing emissions of CO_2 and about 30% greater than their share of annual power generation nationally. These results suggest that the distribution of health co-benefits has the potential to exacerbate, rather than offset, regional or interstate disparities in compliance costs.

294. The estimates in Table 8 are limited to the years 2025 and 2030 because these are dates that overlap with the three-stage "glide path" that EPA established for meeting emissions goals under the final BSER standards. CPP RIA, FINAL RULE, *supra* note 121, at ES-3.

295. This analysis is based on EPA's IPM 5.15 Base Case and Rate Case projections. *See IPM 5.15*, *supra* note 208. For simplicity of review, only the regions with significant emissions reductions are included in Table 8.

Table 9: Harvard Study of Health Co-Benefits from CPP[296]

Region	Average No. Lives Saved	Average Lives Saved (%)	Lives Saved (CI)	Average No. Hospital Visits Avoided	Hospital Visits Avoided (CI)
ERCOT	230	6.4	52–410	79	38–120
FRCC	110	3.1	24–190	38	18–58
MISO	873	24.5	195–1,538	273	137–401
PJM	1,092	30.6	242–1,916	292	154–424
SERC	660	18.5	150–1,178	215	105–326
SPP	122	3.4	28–217	43	21–65
WECC	185	5.2	43–323	59	27–91
Total	3,568	91.7	799–6,288	1,073	540–1,593

A few caveats are in order here. First, as noted earlier, since EPA designed the CPP rule to spread costs evenly across states and regions, the magnitude of emissions reductions is a poor proxy for compliance costs. Second, the CPP may still represent a Pareto improvement (on a region-by-region basis) even if costs and benefits are distributed unevenly, so long as benefits exceed costs within each region. Although not as dramatic as those under the CSAPR, EPA estimates for the monetized benefits of the CPP are significantly higher than the regulatory costs—by at least a factor of four.[297] Accordingly, even for regions such as ERCOT, if we were to assume (conservatively and incorrectly) that costs are directly proportional to emissions reductions, the benefits would still outweigh the costs—for ERCOT the benefits would be 1.8 to 2.6 times greater than the costs by 2030.[298]

296. The data are taken from Scenario 2 of the Harvard study, which is the closest analogue to the CPP. *See* JOEL SCHWARTZ ET AL., *supra* note 293, app. 5, at 7–12. For simplicity of review, only the regions with significant benefits from emissions reductions are included in Table 9. *Id.* Confidence intervals ("CI") are used with respect to lives saved and hospital visits avoided in this table.

297. CPP RIA, FINAL RULE, *supra* note 121, at ES-22 to -23. For the rate-based approach (3% discount rate), EPA estimates are as follows: (1) 2025: climate benefits of $10 billion, health benefits of $7.4 to $18 billion, compliance costs of $1.0 billion (a ratio of 7.4 to 18); (2) 2030: climate benefits of $20 billion, health benefits of $26 to $45 billion, compliance costs of $8.4 billion (a ratio of 5.5 to 7.7). *Id.*

298. This calculation is based on multiplying total costs by the region's percent share of CO_2 emissions reductions to obtain the regional share of costs, and by multiplying the climate and health co-benefits by the region's share of health co-benefits from the Health Co-Benefits Study. This estimate is conservative both on the cost side, as costs will not be directly proportional to emissions reductions, and the benefits side, as the distribution of climate benefits will not track the health co-benefits and will in all likelihood be higher for regions such as ERCOT. In 2025, the calculation for ERCOT is as follows:

Thus, each of the EPA rules enhances welfare nationally and within each regional wholesale electricity market. In most regions, the geographic distribution of the benefits from emissions reductions is roughly commensurate with the distribution of compliance costs. Depending on the EPA rule, some regions capture more of the benefits than others, and some regions bear more of the costs than others. However, each rule produces positive net benefits within each region, and in most cases where cost disparities exist, they are projected to be small relative to the total benefits at the regional level. While the analysis stops short of state-by-state comparisons, it suggests that for most states (coal-producing regions may be exempted[299]) the net benefits of these rules will be positive—and typically by large margins as well.

IV. REASSESSING THE POLITICAL ECONOMY OF THE ENERGY POLICY DEBATE

The preceding analysis aims to bridge the gap between the perspectives of grid managers and environmental regulators by scaling down EPA's cost-benefit information to the regional (grid) level. In so doing, it undermines many of the distributional objections to EPA rules raised by critics: that regional cost disparities (where they exist) are almost always modest and are dwarfed in most cases by the regional benefits of each rule. Moreover, the data indicate that, while subregional reliability disruptions cannot be ruled out, very few regions are likely to be disparately vulnerable to the unquantified risk of disruptive grid instabilities at the local level. Thus, while the findings do not negate the concerns raised by many energy regulators about the potential for significant subregional threats to electricity supplies and reliability, they do put regional reliability concerns into

Regional costs = 0.218 × 1.0 = $218 million
Regional benefits = 0.064 × 17.4 / 28 = ~$1.11–1.79 billion.

See supra notes 295–97 and accompanying tables. In 2030, the calculation for ERCOT is as follows:

Regional costs = 0.189 × 8.4 = $1.59 billion
Regional benefits = 0.064 × 46 / 65 = ~$2.94–4.16 billion.

See supra notes 295–97 and accompanying tables.

299. We have not examined the net benefits of these rules in coal-producing states, nor have we attempted a broader analysis of costs and benefits beyond those associated with power sector changes effected by these rules. Rather, one might speculate that in such an analysis, costs associated with job losses in the power and coal sectors in coal-producing states might outweigh the benefits of emissions reductions. Similarly, a broader analysis might also suggest that the benefits to natural gas-producing states (like Texas) might be significant, as gas-fired power generation replaces coal-fired power generation.

their larger context, and should give pause to a Trump administration inclined to repeal or weaken these rules.

The common spatial scale of regional data thus resolves the apparent inconsistencies between concerns raised by grid managers about stable electricity supplies and EPA's highly favorable cost-benefit analyses. They are not so much inconsistent with each other as they are operating on distinct sets of starting assumptions that are dictated by the differences in their respective spatial scales and criteria. This is an important distinction because it shows that the perspectives of grid managers should not be read as a challenge to EPA's analyses but instead as augmenting them—the debate cannot and should not be reduced to a dichotomy with EPA on one side and grid managers on the other. Neither the substance of grid managers' concerns discussed above nor, in most cases, the concerns they raise about EPA's rules are consistent with such a view. While we have no illusions that more detailed and nuanced cost-benefit analyses will neutralize the ideological battles between the political parties and the powerful interest group influence on regulatory policymaking, this information can help reduce the polarizing influence of such political forces. EPA might use subnational analyses of the distributional effects of rules to further strengthen its conclusion that the benefits of its rules exceed the costs. Moreover, the availability of such analyses could influence conflict between EPA and the states over the implementation of these rules by educating voters about the impacts of rules in their neighborhoods. That is, careful consideration of the regional data allows one to disentangle the valid technical concerns from the political demagoguery.

These observations suggest two questions. First, if the analysis shows that the EPA rules represent Pareto improvements nationally and regionally,[300] what accounts for the preponderance of opposition

300. Putting this Article's analysis and the EPA analysis aside, many other studies support the notion that the net benefits of the rules are positive. *See, e.g.*, JOHN LARSEN ET AL., REMAKING AMERICAN POWER: POTENTIAL ENERGY MARKET IMPACTS OF EPA'S PROPOSED GHG EMISSION PERFORMANCE STANDARDS FOR EXISTING ELECTRIC POWER PLANTS 46–48 (2014), http://csis.org/files/publication/141107_Ladislaw_RemakingAmerPower_Web.pdf [https://perma.cc/3WQW-NS59] (discussing how states can best realize the benefits of the CPP); CONRAD SCHNEIDER, CLEAN AIR TASK FORCE, POWER SWITCH: AN EFFECTIVE, AFFORDABLE APPROACH TO REDUCING CARBON POLLUTION FROM EXISTING FOSSIL-FUELED POWER PLANTS 4 (2014), http://www.catf.us/resources/publications/files/Power_Switch.pdf [https://perma.cc/ZP62-7FT9]. Because the rules trigger emissions reductions that avert thousands of premature deaths, the dollar value of the benefits of the rules is very large. *See supra* note 270 and accompanying text. Moving beyond the air impacts, even Texas—the regional market that combines relatively low reserve margins with significant numbers of plant retirements—

to the rules and for the litigation that they have generated? Second, putting aside the benefits of the rules and focusing only on costs, what explains the weak correlation between the regional impacts of the rules and the positions taken by market regulators (and particularly the state public utility commissions ("PUCs") within them)? These inconsistencies highlight not only the divergence between valid technical concerns and politics but also the variability of political forces at play in different regional energy markets.

As to the first question, there are several possible answers. The first and most obvious answer is that for the coal industry, these rules do not produce Pareto improvements. To the contrary, the EPA rules are archetypes of policies for which costs are borne by a few industries while the benefits are diffusely shared by the general public—conditions in which the bearers of the costs are much more likely than the beneficiaries to participate in the policymaking process. EPA rules threaten the profitability of coal mining companies and coal-fired power plants. Those companies and their employees are identifiably at risk, can easily coordinate their lobbying efforts,[301] and have compelling economic reasons to oppose these rules. The beneficiaries of these rules, by contrast, are the tens of thousands of Americans who will be protected against the illnesses and premature deaths associated with uncontrolled air emissions, or who will (decades from now) avoid harms resulting from climate change. Not only are these beneficiaries far flung and difficult to organize, most of them cannot yet be identified,[302] and thus are not directly represented in the policymaking process.[303] Therefore, politicians (including governors, state attorneys general, and public

benefits not only from pollution reduction but also from the projected increased sales of natural gas to generators in other markets as more gas-fired plants operate more often as a result of these rules. *See* LARSEN ET AL., *supra*, at 42.

301. Interest group theorists have long posited this basis for outsized influence of business groups in the political process. *See* MANCUR OLSON, JR., THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS 33–34 (Schocken ed., 1969) (1975); E.E. SCHATTSCHNEIDER, THE SEMISOVEREIGN PEOPLE: A REALIST'S VIEW OF DEMOCRACY IN AMERICA 34–35 (1960) ("The flaw in the pluralist heaven is that the heavenly chorus sings with a strong upper-class accent.").

302. That is, most who get sick and die prematurely from ingesting pollutants from coal-fired power plants do not know that it is coal-fired power that killed them or hastened their death.

303. To the extent they are represented, they are represented by proxies—NGOs and other groups standing in their stead. Some scholars argue that groundswells of public interest can and have overcome this interest group bias in the policy process. *See, e.g.*, Daniel A. Farber, *Politics and Procedure in Environmental Law*, 8 J.L. ECON. & ORG. 59, 60 (1992); James Gray Pope, *Republican Moments: The Role of Direct Popular Power in the American Constitutional Order*, 139 U. PA. L. REV. 287, 294 (1990).

utility commissioners in some states) have an electoral incentive to represent the economic interests on which costs are concentrated and less incentive to represent the broader public. Politicians can influence unelected public utility commissioners through the power of appointment; state actors, in turn, may be able to influence regional organizations (like ISOs/RTOs and NERC regions) of which they are members. This bias can influence politicians and decision makers in either (or both) of two ways—one cynical and one innocent. The innocent way is that politicians and decision makers, hearing from one side and not the other, sincerely conclude that the net benefits of the rules are negative, and so oppose them; the cynical way is that politicians and decision makers are aware of the highly favorable cost-benefit ratios, but ignore them to enhance the likelihood of their reelection or reappointment.[304] Given the overwhelming support for the notion that the net benefits of these rules are positive, developing a sincere belief to the contrary strains credulity or requires turning a blind eye to the clear balance of the evidence.[305]

Second, many of the organizations registering objections to these rules are charged with ensuring the reliable and efficient operation of electricity markets. While general principles of administrative law may require them to consider all elements of the public interest,[306] their core missions do not include environmental protection, or even the broad maximization of net benefits; rather, their job is to keep the lights on. Therefore, they have an institutional incentive to object to policies that might introduce reliability risks, even if a comprehensive cost-benefit analysis shows that these risks are small compared to the rules' environmental benefits. NERC, regional reliability organizations, FERC, ISOs/RTOs, and state PUCs all fall into this category and thus may be biased towards safeguarding their institutional mandates. This bias may be exacerbated by the phenomenon of loss aversion,[307] which holds that people and

304. Indeed, James Coleman suggests an additional layer of cynicism with his finding that regulated companies tend to reassure investors that regulatory costs are manageable while complaining to regulators that those costs are not manageable. *See* Coleman, *supra* note 134, at 47.

305. The psychological processes that lead to climate denial and science denial in environmental policy debates are beyond the scope of this Article. For a discussion of these issues, see, for example, Jeffrey J. Rachlinski, *The Psychology of Global Climate Change*, 2000 U. ILL. L. REV. 299, 303–13 (2000).

306. *See* Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 57 (1983); Citizens to Preserve Overton Park, Inc. v. Volpe, 401 U.S. 402, 419–21 (1971).

307. For a more general discussion of the phenomena of loss aversion and risk aversion in the behavioral sciences, see generally JAMES MONTIER, BEHAVIOURAL INVESTING: A PRACTITIONER'S GUIDE TO APPLYING BEHAVIOURAL FINANCE 447–52 (2007); Antoine Bechara, Hanna Damasio & Antonio R. Damasio, *Role of the Amygdala in Decision-*

institutions are more likely to comment on regulatory proposals they oppose than those they support.[308]

A third explanation is grounded not in interest group politics, but in the broader ideological conflicts that have come to dominate twenty-first century policymaking at the state and federal levels. The ideological homogeneity of the two major parties, and their increasing ideological distance from one another, have gridlocked Congress and placed states at the center of regulatory policy conflict.[309] In such an environment, federal policy initiatives tend to be initiated by the executive branch (because Congress cannot act), and states dominated by the party opposing the president actively resist them. Some politicians and decision makers may oppose the EPA rules because they do not believe that government should intervene in markets to address pollution externalities, or because they distrust the science behind the rules.[310]

Thus, Republicans' and coal-state Democrats' anti-EPA rhetoric may reflect the sincere belief that electricity producers *ought* to be able to shift the pollution externalities of coal-fired power to society, or that those externalities pose a much smaller risk than commonly thought. This occurrence is unlikely. Even the most virulent EPA opponents in Congress stop short of calling for the repeal of most environmental protection laws. In 2011, Senate Republicans sponsored a bill to fold EPA into the Department of Energy; however, those Republican senators based their case not on the absence of a need for environmental protection, but on efficiency grounds.[311]

Partisan or ideological differences can also work simultaneously with interest group politics to motivate policymakers. They can work in tandem, as in solidly Republican coal states like Wyoming, or they can work at cross purposes, as in traditionally Democratic coal states

Making, 985 ANN. N.Y. ACAD. SCI. 356 (2003); Antoine Bechara et al., *Deciding Advantageously Before Knowing the Advantageous Strategy*, 275 SCI. 1293 (1997).

308. *See, e.g.*, Dorit Rubinstein Reiss, *Tailored Participation: Modernizing the APA Rulemaking Procedures*, 12 N.Y.U. J. LEGIS. & PUB. POL'Y 321, 330–32 (2009) ("Most empirical studies of rulemaking, as well as articles that draw on them, demonstrate limited participation in rulemaking and rare participation beyond involved interest groups (and especially business interest groups) . . . .").

309. *See* Jessica Bulman-Pozen & Heather K. Gerken, *Uncooperative Federalism*, 118 YALE L.J. 1256, 1258–64 (2009) (documenting this trend); Freeman & Spence, *supra* note 11, at 8.

310. *See* Rachlinski, *supra* note 305, at 303–13. For additional discussion on these forces, see also *supra* Part I.

311. Brad Johnson, *Richard Burr Introduces Bill to Abolish the EPA*, HILL HEAT (May 6, 2011), http://www.hillheat.com/articles/2011/05/06/richard-burr-introduces-bill-to-abolish-the-epa [https://perma.cc/B9V8-WR99].

like Illinois. These dynamics may help us to understand the variation among market regions and states in the positions they have taken on the EPA rules and suggest that, in some states and regions, ideology is driving position taking to these rules. Just as Republican appointees to the FERC were more critical of the Clean Power Plan than Democratic appointees, regional and state institutions in more conservative or Republican parts of the country seem more likely to be critical than their counterparts in more liberal or Democratic parts of the country.

As noted in Part II, two of the market regions facing the largest numbers of projected plant retirements (MISO, PJM) have been relatively circumspect and qualified in their comments on the rules compared to other regions facing much smaller losses (SPP, ERCOT).[312] MISO and PJM expressed concerns about the reliability impacts of the EPA rules, but did so in specific ways that suggested solutions. For example, MISO's reaction to the CSAPR and MATS rules noted the need for transmission investment to adjust to probable losses of capacity; it then embarked on a plan for additional transmission investment.[313] Likewise, both MISO and PJM emphasized the need for longer compliance periods in their comments on the CPP.[314] By contrast, the comments of SPP and ERCOT were far more antagonistic of the proposed rule.[315]

To explore how ideology might influence grid managers' position taking, Figure 3 depicts average ideology (specifically, average percentages of people identifying as conservative) in wholesale market regions.[316] These data come from Gallup, which reports state-by-state percentages of people who identify as conservative or liberal. As Figure 3 shows, these data offer only weak support for the idea that ideology drives position taking by market regions on EPA rules. Interestingly, ERCOT, SPP, SERC, and MISO all score above the national average on the "percent conservative" measure, and PJM

312. *See supra* notes 180–82, 188–90 and accompanying text.

313. For a description of the MISO "multi value" transmission project program, see Alexandra B. Klass & Elizabeth J. Wilson, *Interstate Transmission Challenges for Renewable Energy: A Federalism Mismatch*, 65 VAND. L. REV. 1801, 1834–35 (2012).

314. *See supra* notes 180–82 and accompanying text.

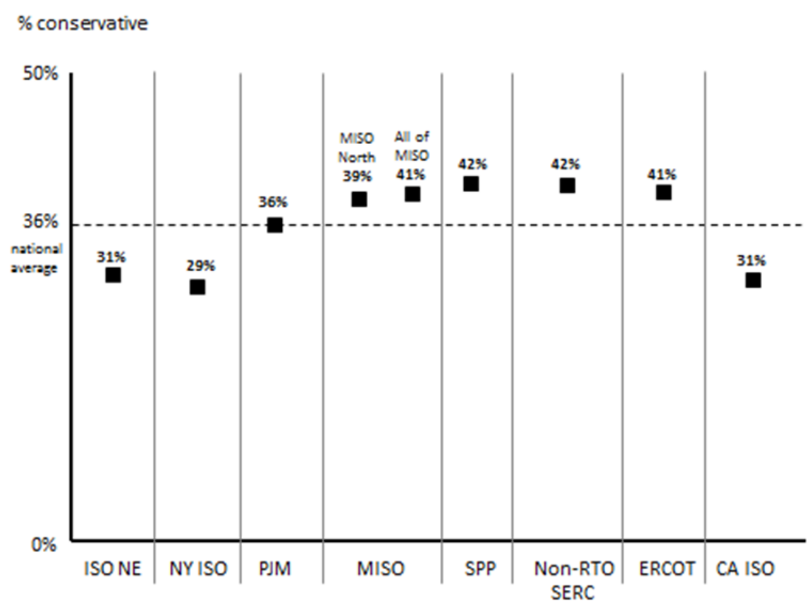
315. *See supra* notes 188–90 and accompanying text.

316. The data come from Gallup's "State of the States" polling series. *See State of the States*, GALLUP, http://www.gallup.com/poll/125066/state-states.aspx [https://perma.cc/TZ3T-A7FX]. Specifically, the numbers in the figure average state ideologies for the states in each market region. We chose not to weight the state ideology scores by state population because states qua states are part of the client base (and membership) of ISOs/RTOs.

scores at the national average. PJM and MISO North[317] are less conservative than ERCOT, SPP, and SERC, but not strikingly so. The other regions depicted on Figure 3, CA ISO, ISO-NE, and NYISO, are strikingly less conservative than the others, which may explain the more conciliatory tone of the ISO/RTO Council's comments on the CPP (in which they all participated),[318] and why the remaining ISOs/RTOs felt the need to submit separate comments on the proposal. The weakness of these effects, however, may be a function of the technocratic (less politically accountable) nature of ISOs/RTOs. ISOs/RTOs are further removed from political influence than public utility commissions, whose commissioners are either elected or appointed by elected governors. We might hypothesize that as nonprofit membership organizations composed of private sector actors, ISOs/RTOs ought to be less susceptible to ideological shifts.[319]

Figure 3: Average of State Ideology Scores—Market Regions[320]

(Percent Conservative, Gallup data, 2015)



317. The southern zone of MISO was added only within the last eighteen months, and so MISO ideology prior to 2014 is best reflected by the "MISO North" score depicted in Figure 3.

318. *See* ISO/RTO Council, *supra* note 184, at 1–3.

319. We might also hypothesize that decision making within multistate ISOs/RTOs whose territory covers an ideologically diverse set of states, like MISO and PJM, ought to be more technocratic and less ideologically driven than decision making within single state RTOs/ISOs, or RTOs/ISOs covering more ideologically homogenous groups of states. Thanks to Elizabeth Wilson for helping us with this observation.

320. *State of the States*, *supra* note 316.

Partisanship and ideology loom larger, however, in state position taking on EPA rules. As noted in Part II, state PUC comments on the MATS rule and the CPP[321] were mostly critical, but tended to be less critical coming from PUCs dominated by Democratic members. Most of the PUC comments on the MATS rule were unambiguously critical, and one was relatively neutral; all of the critical comments came from Republican-dominated PUCs, while the neutral comment came from the only Democrat-dominated PUC in the sample (Oregon).[322] Similarly, of the many unambiguously negative comments submitted by PUCs in response to the CPP, only one (from a Republican New Mexico commissioner) came from a Democrat-dominated PUC;[323] of the several neutral or positive comments, most came from PUCs dominated by Democrats.[324]

Partisan influence shows up even more strongly when examining states' participation in court cases challenging EPA actions addressing coal-fired power plant pollution under the CAA. This occurrence is perhaps because those decisions are made by state attorneys general (most of whom are elected) or governors. As noted in Part II, when EPA rules have been challenged in court, some states have intervened in support of the rules, and some have intervened in opposition to the rules. Table 10 summarizes the party affiliations of governors and state attorneys general of states intervening in recent cases challenging EPA Clean Air Act rules that (1) reached the Supreme Court and (2) impact coal-fired power plants. The data show that states with Democratic governors and attorneys general are overwhelmingly more likely to intervene in support of (and less likely to intervene in opposition to) EPA rules being challenged in court. This fact is true for each of the five court cases examined, and the differences are fairly striking.

321. Again, these rules are the focus because they entail the highest compliance costs—i.e., the most salient losses.

322. *See supra* notes 193–97 and accompanying text.

323. *See* Patrick H. Lyons, N.M. Pub. Regulation Comm'n, Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Emissions from Existing Stationary Sources: Electric Utility Generating Units 2–5 (Nov. 24, 2014), https://www.regulations.gov/document?D=EPA-HQ-OAR-2013-0602-24311 [https://perma.cc/BX2U-22ZE (staff-uploaded archive)].

324. *See, e.g.*, N.H. Dep't of Envtl. Servs. & N.H. Pub. Utils. Comm'n, Comment Letter on Proposed Rule for Carbon Pollution Emission Guidelines for Existing Sources: Electric Utility Generating Units 2–5 (Dec. 1, 2014), http://des.nh.gov/organization/divisions/air/tsb/tps/climate/rggi/documents/20141201-comments-epa-cpp.pdf [https://perma.cc/5CQS-AXGH]; *see also supra* notes 198–202 and accompanying text.

Table 10: Party Affiliations of Attorneys General and Governors in States Litigating EPA Rules Addressing Emissions from Coal-Fired Power Plants[325]

Regulatory Action (Case name before the U.S. Supreme Court)	**For Regulation**		**Against Regulation**	
	GOP AG (Gov)	**DEM AG (Gov)**	**GOP AG (Gov)**	**DEM AG (Gov)**
Endangerment Finding (GHGs) (*Massachusetts v. EPA* (2007))	1(8)	19[a](11)	10(8)	0(2)
CSAPR (ozone transport) (*EPA v. EME Homer City Generation, L.P.* (2014))	0(1)	10(9[b])	20(19)	3(4)
Tailoring Rule (GHGs) (*Util. Air Regulatory Grp. v. EPA* (2014))	0(3)	15(12)	12(12)	0(0)
MATS rule (mercury) (*Michigan v. EPA* (2015)[c])	0(7)	16(9)	17[d](18[e])	4(3)
CPP (GHGs) (*West Virginia v. EPA* (pending))	6(0)	11(18)	24(23)	4(5)

[a] Includes data from the District of Columbia, whose attorney general was appointed by the mayor at the time the litigation was initiated.
[b] Includes Rhode Island's governor, who was elected as an independent but subsequently changed his party affiliation to Democrat.
[c] Iowa's attorney general and governor each intervened on opposite sides of this case.
[d] Includes two attorneys general appointed by Republican governors.
[e] Includes Alaska, which had an elected independent (formerly Republican) governor at the time the case was initiated.

The trends are only slightly less striking when focusing on the party affiliation of governors. These data seem to support the notion that partisanship and ideology play a role in debates over EPA's regulation of coal-fired power plants. All eighteen states supporting the CPP have Democratic governors; twenty-four of the twenty-eight states opposing that rule have Republican governors. (These data echo anecdotal evidence of state pledges not to comply with the CPP once it is in effect.[326]) The table shows that the other recent cases

325. To access the underlying data referenced in Table 10, see Michigan v. EPA, 135 S. Ct. 2699, 2702–04 (2015); Util. Air Regulatory Grp. v. EPA, 134 S. Ct. 2427, 2432–34 (2014); EPA v. EME Homer City Generation, L.P., 134 S. Ct. 1584, 1590–92 (2014); Massachusetts v. EPA, 549 U.S. 497, 502–04 (2007); West Virginia v. EPA, No. 15-1363 (D.C. Cir. Oct. 23, 2015); *E&E's Power Plan Hub*, *supra* note 120; Partisan Affiliation Dataset (2016) (on file with the North Carolina Law Review).

326. Senate majority leader Mitch McConnell has urged states not to comply with the EPA guidelines once they become final, and state legislatures have expressed their opposition to the rule in a variety of ways. *See* Jocelyn Durkay, *States' Reactions to EPA Greenhouse Gas Emissions Standards*, NAT'L CONF. ST. LEGISLATURES (Apr. 18, 2016), http://www.ncsl.org/research/energy/states-reactions-to-proposed-epa-greenhouse-gas-emissions-standards635333237.aspx [https://perma.cc/HGD6-Q7X8] (summarizing state legislation); Niels Lesniewski, *McConnell Discourages States from Crafting Clean Power Plans*, ROLL CALL

involving CAA regulation of the power sector reflect similar partisan splits. These data offer further support for arguments in legal scholarship that states have become the locus of partisan conflict in the face of congressional gridlock.[327]

Thus, it appears that ideology and interest group politics are combining to magnify political opposition to EPA rules, even though those rules bring positive net benefits across the country. However, the power of interest groups may be waning in this regulatory "war on coal." Public attitudes can change, sometimes quickly, thereby disrupting the political calculus for politicians.[328] Public opinion is supportive of clean energy technologies and decreasingly skeptical of climate science;[329] at the same time, the price of alternative electric generation technologies (relative to coal-fired power plants) continues to decline. The coal industry will undoubtedly continue to fight aggressively against EPA regulations, but the broader political and economic context increasingly exhibits signs of shifting around them.[330]

CONCLUSION

The elevation of Donald Trump to the presidency places special focus on EPA's efforts to address the environmental and health harm

(Mar. 4, 2015, 3:59 PM), http://www.rollcall.com/news/home/mitch-mcconnell-discouraging-states-from-crafting-clean-power-plans [https://perma.cc/8PMC-PWNS].

327. *See, e.g.*, Jessica Bulman-Pozen, *Partisan Federalism*, 127 HARV. L. REV. 1077, 1123–25, 1127–28 (2014); Heather K. Gerkin, *Dissenting by Deciding*, 57 STAN. L. REV. 1745, 1785 (2005); *cf.* Hari M. Osofsky & Jacqueline Peel, *Energy Partisanship* 65 EMORY L.J. 695, 722–24 (2015) (arguing that energy policymakers can circumvent partisan gridlock by focusing on policy subsets over which there is less disagreement and by making policy in arenas other than Congress); Hari M. Osofsky & Hannah J. Wiseman, *Hybrid Energy Governance*, 2014 U. ILL. L. REV. 1, 9–10 (2014) (exploring hybrid governance solutions to energy problems).

328. Indeed, there is growing evidence that public attitudes, even among conservative voters, are shifting in favor of EPA's regulations. *See, e.g.*, Davis Burroughs, *Republican Voters Generally Support Clean Power Plan*, MORNING CONSULT (Aug. 7, 2015), http://morningconsult.com/2015/08/republican-voters-generally-support-clean-power-plan-fundamentals/) [https://perma.cc/T2ZW-QGEG].

329. Both of these trends are evident from the Spring 2016 University of Texas Energy Poll. *See* UNIV. OF TEX. AT AUSTIN, ENERGY POLL 11–12, 19 (2016), http://www.utenergypoll.com/wp-content/uploads/2014/04/Topline-Wave-10.pdf [https://perma.cc/BWM3-TTUT] (posting poll answers to questions 126a and 126b regarding climate change and question 171ec regarding renewable energy).

330. For a discussion of how groundswells of public opinion can overcome interest group opposition to regulation, see Pope, *supra* note 303, at 297–98. *See also* MARK A. SMITH, AMERICAN BUSINESS AND POLITICAL POWER: PUBLIC OPINION, ELECTIONS, AND DEMOCRACY 89–114 (2000) (asserting that business does not prevail over an interested public).

created by coal combustion. A Trump administration EPA may well have the elimination of these rules at the top of its agenda. The evolving political landscape and the promising trend away from coal-fired generation make it all the more important that politicians and the general public have a clear understanding of the salient technical issues. This Article is intended to help dispel misperceptions about the alleged conflicts between grid security, regional impacts, and EPA regulations. Our findings suggest an evolving political economy of EPA regulation, particularly related to climate change. Despite the continuing opposition of energy managers to EPA rules, there is considerable variation in the nature and degree of their opposition. Indeed, their constructive engagement with EPA in response to the three rules examined suggests that there is room for adjustment on both sides. More broadly, as these rules are implemented and the utility sector continues to adapt to changing market and regulatory pressures, the politics will change—albeit incrementally—as well. Recognizing the valid technical concerns and separating them from the prevailing political debates is critically important to appreciating and taking advantage of the opportunities for facilitating change in energy systems today and going forward.