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## Remember the Essentials: Nuclear Power's Place in U.S. Electricity Markets

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## I. INTRODUCTION

From New Orleans to Chicago, New York City to San Francisco, U.S. energy companies emphasize the production of reliable, clean, and affordable power among their top priorities.<sup>1</sup> These increasingly diversified companies continue to provide an essential service by generating the electricity that Americans depend on to run their daily lives. We all function with a blind trust that the lights will switch on, our smartphones will charge overnight, and the coffee maker will fire up in the morning. America's electricity dependence coincides with consistent public support for clean sources of power that limit environmental harms, especially air pollutants.<sup>2</sup> Moreover, in a time of global concern about climate change and how to respond, energy companies have a central role to play to advance solutions that provide clean and reliable electricity. While not a "perfect" solution in all respects, nuclear power is in fact an emissions-free, highly reliable electricity source that currently stands as the most accessible, proven, and large-scale answer. But the marketplace tells a different tale.

By providing a service "clothed with a public interest,"<sup>3</sup> electric utilities throughout the country traditionally generated a reliable power supply at reasonable prices for all consumers based on a system

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1. See, e.g., ENTERGY CORP., 2016 ANNUAL REPORT 2 (Mar. 21, 2017), [http://www.entergy.com/content/investor\\_relations/pdfs/2016\\_Annual\\_Report.pdf](http://www.entergy.com/content/investor_relations/pdfs/2016_Annual_Report.pdf); PG&E CORP. & PAC. GAS & ELEC. CO., 2016 JOINT ANNUAL REPORT TO SHAREHOLDERS, at ii (2017), [http://www.pgecorp.com/investors/financial\\_reports/annual\\_report\\_proxy\\_statement/ar\\_pdf/2016/2016\\_Annual\\_Report.pdf](http://www.pgecorp.com/investors/financial_reports/annual_report_proxy_statement/ar_pdf/2016/2016_Annual_Report.pdf).

2. See, e.g., Cary Funk & Brian Kennedy, *Public Divides Over Environmental Regulation and Energy Policy*, PEW RES. CTR. (May 16, 2017), <http://www.pewinternet.org/2017/05/16/public-divides-over-environmental-regulation-and-energy-policy/> (noting that, although neither nuclear nor renewables emit air pollutants, only 55% of U.S. adults find nuclear power at least somewhat effective at minimizing air pollution, while more than 80% said the same of solar and wind power); Brian Kennedy, *Two-Thirds of Americans Give Priority to Developing Alternative Energy Over Fossil Fuels*, PEW RES. CTR. (Jan. 23, 2017), <http://www.pewresearch.org/fact-tank/2017/01/23/two-thirds-of-americans-give-priority-to-developing-alternative-energy-over-fossil-fuels/>.

3. *Munn v. Illinois*, 94 U.S. 113, 126 (1876).

of regulated rates referred to as the regulatory contract.<sup>4</sup> This regime, however, has lost its dominance as the national movement toward competitive markets has grown since the 1980s with mixed results for the power sector.<sup>5</sup> Competitive markets value costs over electricity's other main attributes of reliability and environmental externalities.<sup>6</sup> This dynamic presents particular difficulties for nuclear power plants, which struggle to remain financially viable when electricity generated from renewable sources and low-cost natural gas is increasing in the United States.<sup>7</sup> Energy companies face the unenviable challenge of making sound business decisions about whether to invest in long-term nuclear power assets in an inherently volatile marketplace for primary energy sources. These conditions jeopardize the benefits provided by a stable and clean nuclear power supply.

This Comment examines several critical challenges facing the U.S. nuclear power industry in a competitive and volatile marketplace and assesses the legal options to address them. Part II examines legal challenges over the tension between federal and state roles to regulate nuclear power. Part III explores the generational shift from regulated electric utilities to competitive electricity markets and analyzes the impacts of key legal changes. Part IV assesses benefits and drawbacks of nuclear power. Part V discusses nuclear power as a national issue that remains largely below the radar despite its substantial implications for power companies and customers. Part VI analyzes conditions facing energy companies that are responsible for making reasonable business decisions in volatile markets and explores these challenges through the experience of Louisiana-based Entergy Corporation, the country's second largest nuclear power generator. Part VII recommends solutions to help nuclear power overcome distortions in competitive markets. Based on this outlook for U.S. nuclear power, this Comment suggests that tying the financial success of electric utilities that generate reliable, emissions-free nuclear power to the whims of a volatile market is an irresponsible risk to take. An

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4. Emily Hammond & David B. Spence, *The Regulatory Contract in the Marketplace*, 69 VAND. L. REV. 141, 142 (2016).

5. See David B. Spence, *Can Law Manage Competitive Energy Markets?*, 93 CORNELL L. REV. 765, 765-66, 770-71 (2008) (discussing the trend toward competitive energy markets).

6. Hammond & Spence, *supra* note 4, at 215-16 (using a three-part framework of cost, reliability, and environmental externalities to examine changes in the electricity marketplace).

7. Brian Mann, *Unable to Compete on Price, Nuclear Power on the Decline in the U.S.*, NPR (Apr. 7, 2016, 5:28 PM), <http://www.npr.org/2016/04/07/473379564/unable-to-compete-on-price-nuclear-power-on-the-decline-in-the-u-s>.

analysis of legal doctrine and recent court decisions identifies obstacles to avoid and paths forward to help nuclear power generators temper this risk and provide an essential service.

## II. FEDERAL-STATE TENSION OVER ELECTRICITY REGULATION

Tension between federal and state legal authority to regulate electricity is well established in the United States. The United States Supreme Court addressed the issue of regulatory authority over electricity sales in its 1927 “Attleboro Gap” decision, holding that only the federal government had power to regulate electricity sales between states.<sup>8</sup> Aspects of this early debate over the allocation of legal and regulatory authority in the electricity industry remain evident in the tension between federal and state governments over nuclear power regulation. The Atomic Energy Act of 1946 (AEA) established the first federal agency tasked with promoting nuclear power,<sup>9</sup> and Congress first authorized private industry to develop nuclear power when it substantially amended the AEA in 1954.<sup>10</sup> Since then, the Supreme Court has recognized that “[t]here is little doubt that a primary purpose of the Atomic Energy Act was, and continues to be, the promotion of nuclear power.”<sup>11</sup> This federal objective can conflict with state concerns over nuclear power costs, safety, and nuclear waste storage, as well as states’ rights under the Tenth Amendment to protect their citizens from high costs and environmental risks.<sup>12</sup>

The Supreme Court’s first federal preemption decision regarding nuclear power came in 1983 over a California law preventing nuclear plant construction because of cost uncertainties related to the lack of a federal solution for permanent nuclear waste disposal.<sup>13</sup> In *Pacific Gas & Electric Co. v. State Energy Resources Conservation & Development Commission*, the Court concluded that the AEA did not

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8. Pub. Utils. Comm’n v. Attleboro Steam & Elec. Co., 273 U.S. 83, 89-90 (1927).

9. See Atomic Energy Act of 1946, ch. 724, § 2(a), 60 Stat. 755, 756 (codified as amended at 42 U.S.C. § 2012 (2012)).

10. See 42 U.S.C. § 2013.

11. Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm’n, 461 U.S. 190, 221 (1983).

12. See U.S. CONST. amend. X; Sheldon L. Trubatch, *How, Why, and When the U.S. Supreme Court Supports Nuclear Power*, 3 ARIZ. J. ENVTL. L. & POL’Y 1, 3 (2012); see also discussion *infra* Part III.C (explaining ways that utilities recover costs).

13. *Pac. Gas*, 461 U.S. at 194-95. Legislators in California were concerned about the full costs of nuclear power once the cost of a federally approved permanent nuclear waste disposal solution was included. *Id.* at 213-14. More than thirty years later, no such solution has been approved.

disturb California's authority to regulate power plants for economic reasons and upheld the state's moratorium on nuclear plant construction using this rationale.<sup>14</sup> The Court found that under the AEA, federal preemption applied to all safety aspects of nuclear plant construction and operations, and states retained their traditional role of determining the need, reliability, and cost of electricity for their residents.<sup>15</sup> *Pacific Gas* demonstrated some of the tensions that U.S. federalism creates in the power sector. For nuclear power plant operators attempting to manage their risks in electricity markets, navigating different and sometimes conflicting federal and state authorities and agendas presents difficult challenges.

The national shift to competitive electricity markets was in its infancy when the Supreme Court decided *Pacific Gas*. The economic landscape was far different thirty years later, when, in 2013, the United States Court of Appeals for the Second Circuit held that federal law preempted a Vermont law from effectively shuttering the Vermont Yankee nuclear power plant based on safety reasons.<sup>16</sup> In *Entergy Nuclear Vermont Yankee, L.L.C. v. Shumlin*, the court examined the purpose and actual effect of Vermont's law with greater scrutiny than the Supreme Court applied to a state law in *Pacific Gas*.<sup>17</sup> Because the Supreme Court clearly found federal preemption applied to nuclear plant safety,<sup>18</sup> the court in *Vermont Yankee* reasoned that Vermont's law affecting nuclear plant operations "require[d] . . . a more searching review" to determine whether the state acted within its authority.<sup>19</sup> Vermont argued that its law supported policies to increase and diversify the state's renewable energy sources and promote cost-effective energy sources—both legitimate state purposes.<sup>20</sup> But the court found that Vermont's law would not advance these policies.<sup>21</sup>

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14. *Id.* at 216.

15. *Id.* at 205. The California Public Utilities Commission's decision in January 2018 to close the state's last nuclear power plant in 2025 offers clear evidence of this authority that states wield. Despite providing 9% of California's electricity without emitting carbon emissions, economic pressure related to lower-cost electricity from renewable sources and natural gas and longstanding opposition from environmentalists contributed to the decision to close the plant. David R. Baker, *California's Last Nuclear Plant to Close After Unanimous Vote by Regulators*, S.F. CHRON. (Jan. 11, 2018), <https://www.sfchronicle.com/bayarea/article/California-regulators-vote-unanimously-to-close-12491203.php>.

16. *Entergy Nuclear Vt. Yankee, L.L.C. v. Shumlin*, 733 F.3d 393, 428 (2d Cir. 2013).

17. *Compare id.* at 416 (rejecting rational basis review), with *Pac. Gas*, 461 U.S. at 212-13 (examining a California statute for preemption and noting the state's safety concerns).

18. *See Pac. Gas*, 461 U.S. at 205.

19. *Vt. Yankee*, 733 F.3d at 416.

20. *Id.*

21. *Id.* at 417-18.

Furthermore, the court relied on legislative history to conclude that “the Vermont Legislature was improperly motivated by concerns relating to radiological safety.”<sup>22</sup> Therefore, the court held that the AEA preempted Vermont’s law.<sup>23</sup>

Entergy prevailed in this legal battle only to lose the war as it closed Vermont Yankee amid unfavorable economic conditions less than two years after the Second Circuit’s decision.<sup>24</sup> Despite this decision providing energy companies with greater certainty over their ability to operate nuclear power plants in states with political opposition, nuclear plants are closing under the financial strain of competitive markets.<sup>25</sup> These circumstances demonstrate the uncertainty facing nuclear power operators forced to compete in an often volatile marketplace. The federal government and many states have continued to support nuclear power, but current market forces and shifting trends in the electricity industry will test this commitment. Energy companies need enough economic assurance to secure financing to make the substantial investments required to build and maintain nuclear plants. A look at the influence of certain statutory and regulatory changes involved in the national shift from a heavily regulated electricity sector to restructured, competitive markets provides an understanding of the current challenges and potential future opportunities for U.S. nuclear power.

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22. *Id.* at 422.

23. *Id.*

24. Mike Donoghue, *Vermont Yankee Winds Down Operations*, BURLINGTON FREE PRESS (Dec. 29, 2014, 7:30 AM), <http://www.burlingtonfreepress.com/story/news/2014/12/29/vermont-yankee-plant-prepares-shut-down/20992137/>.

25. See U.S. DEP’T OF ENERGY, STAFF REPORT TO THE SECRETARY ON ELECTRICITY MARKETS AND RELIABILITY 31 (2017). Since 2013, twelve of the sixteen nuclear plants that announced plans to close cited unfavorable market conditions as the reason. *Id.* Furthermore, in January 2018, the Federal Energy Regulatory Commission (FERC) demonstrated continued support for competitive electricity markets by rejecting a U.S. Department of Energy (DOE) proposal to subsidize coal and nuclear power. James Osborne, *Perry’s Grid Plan Blocked by F.E.R.C.*, HOUS. CHRON. (Jan. 9, 2018, 8:44 AM), <http://www.chron.com/business/energy/article/Perry-s-grid-plan-blocked-by-FERC-12483102.php>. The DOE proposal called for a comprehensive strategy to ensure the reliability and resilience of the electricity grid that would have established market rules to allow full recovery of costs for most coal and nuclear plants. Grid Resiliency Pricing Rule, 82 Fed. Reg. 46,940, 46,943, 46,945 (Oct. 10, 2017) (to be codified at 18 C.F.R. pt. 35). The issue, however, remains fluid, as the FERC initiated a new proceeding to examine whether additional action by the FERC and the markets is necessary to address grid resilience. Order Terminating Rulemaking Proceeding, Initiating New Proceeding, and Establishing Additional Procedures, 162 FERC ¶ 61,012, at 1 (Jan. 8, 2018).

### III. ELECTRICITY REGULATION AND THE SHIFT TO COMPETITIVE MARKETS

In more than half of all U.S. states, energy companies operate in competitive electricity markets to some degree.<sup>26</sup> This represents a distinct change from the landscape shaped by Thomas Edison's protégé, Samuel Insull, who took the helm at Chicago Edison Company in 1892 and expanded his control over most U.S. electric utilities by the 1920s.<sup>27</sup> Since then, vertical integration of power generation, transmission, and distribution service was seen as the most efficient method of electrifying the country.<sup>28</sup> Under this system, electric utilities held monopoly power that warranted price regulation to protect consumers from monopoly abuses.<sup>29</sup> In the 1930s, Great Depression-era reforms such as the Public Utility Holding Company Act of 1935 (PUHCA) and the Federal Power Act (FPA) established the legal foundations on which public electric utilities functioned for most of the twentieth century.<sup>30</sup> PUHCA forced public electric utilities to operate in a single state or in a limited geographic area, and the FPA created what is now the Federal Energy Regulatory Commission (FERC)<sup>31</sup> and vested it with the authority to maintain "just and reasonable" rates for interstate wholesale electricity sales.<sup>32</sup>

#### A. *The Regulatory Contract*

Federal laws like the PUHCA, the FPA, and their state analogs solidified cost-of-service ratemaking as the method for pricing electricity across the country.<sup>33</sup> Common law principles affecting the public utility with "the duty to serve, in return for its geographic franchise and expected recovery of its costs of service through regulated rates" formed the concept of a regulatory contract between

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26. JOHANNES PFEIFENBERGER, BRATTLE GRP., *ELECTRICITY MARKET RESTRUCTURING: WHERE ARE WE NOW?* (Dec. 6, 2016), [http://www.ncsl.org/Portals/1/Documents/energy/Energy\\_Pfeifenberger\\_Johannes\\_present.pdf](http://www.ncsl.org/Portals/1/Documents/energy/Energy_Pfeifenberger_Johannes_present.pdf).

27. JOEL B. EISEN ET AL., *ENERGY, ECONOMICS AND THE ENVIRONMENT* 34-37 (4th ed. 2015).

28. *Id.* at 626.

29. *Id.*

30. David B. Spence, *The Politics of Electricity Restructuring: Theory vs. Practice*, 40 WAKE FOREST L. REV. 417, 419-21 (2005).

31. *Id.* at 420-21.

32. 16 U.S.C. § 824d(a) (2012).

33. Spence, *supra* note 30, at 419-20.

the utility and the government.<sup>34</sup> To ensure a low-cost, safe, reliable electricity supply for *all* customers, the government set rates that allowed utilities to recover “reasonably incurred costs, including a fair rate of return on investment for the firm’s investors.”<sup>35</sup> Nearly all U.S. nuclear reactors came online between 1970 and 1990<sup>36</sup> before electricity restructuring upset the advantages provided by general price stability under the regulatory contract. Although federal and state regulators still use rate regulation methods to varying degrees,<sup>37</sup> competitive forces have been chipping away some of the core operating principles of the U.S. electricity industry for more than a generation.<sup>38</sup>

### B. National Movement to Competitive Markets

The U.S. movement to competitive electricity markets began in 1978 when Congress first introduced policies that directly supported electricity competition through the Public Utility Regulatory Policies Act (PURPA).<sup>39</sup> PURPA and the follow-on FERC rules stimulated independent power production, and in the late 1980s, the FERC began approving market-based rates for independent power producers (IPPs) to sell electricity to retail distributors.<sup>40</sup> From these early efforts to promote competition, IPPs now supply roughly 40% of U.S. electricity.<sup>41</sup> Although the Supreme Court has not weighed in, two federal appellate court decisions support the FERC’s position that its use of market rates falls within its authority to ensure just and reasonable electricity rates.<sup>42</sup>

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34. Jim Rossi, *The Common Law “Duty to Serve” and Protection of Consumers in an Age of Competitive Retail Public Utility Restructuring*, 51 VAND. L. REV. 1233, 1263-64 (1998).

35. EISEN ET AL., *supra* note 27, at 456 (explaining cost-of-service ratemaking).

36. *U.S. Commercial Nuclear Capacity Comes from Reactors Built Primarily Between 1970 and 1990*, U.S. ENERGY INFO. ADMIN. (June 30, 2011), <https://www.eia.gov/todayinenergy/detail.php?id=2030>.

37. EISEN ET AL., *supra* note 27, at 456.

38. See Hammond & Spence, *supra* note 4, at 149 (discussing the role of the regulatory contract and its evolution in electricity markets).

39. Public Utility Regulatory Policies Act of 1978, Pub. L. No. 95-617, § 210, 92 Stat. 3117, 3157-60 (1978) (codified as amended at 16 U.S.C. § 824a-3 (2012)).

40. See Dartmouth Power Assocs., 53 FERC ¶ 61,117, 61,360 (1990) (holding that the contracted rates based on market pricing were “within the legally mandated zone of reasonableness”).

41. U.S. ENERGY INFO. ADMIN., ELECTRIC POWER ANNUAL 2016, tbl.3.3A (2017).

42. See 16 U.S.C. §§ 824d, 824e; California *ex rel.* Lockyer v. FERC, 383 F.3d 1006, 1013 (9th Cir. 2004); La. Energy & Power Auth. v. FERC, 141 F.3d 364, 365 (D.C. Cir. 1998).

Congressional and FERC actions in the 1990s and 2000s continued the federal government's push toward competitive electricity markets. FERC Order 888 and the Energy Policy Act of 2005 were among the most notable. Order 888 solidified market-based pricing for wholesale electricity sales by requiring public utilities to provide open access transmission service to competing electricity producers.<sup>43</sup> Against a challenge by New York, the Supreme Court concluded that the FERC's authority extended to the regulation of interstate transmission and wholesale interstate sales of electricity, and "Order No. 888 does not even arguably affect the States' jurisdiction."<sup>44</sup>

The Energy Policy Act of 2005 (EPAAct 2005)<sup>45</sup> sparked the first new construction of U.S. nuclear power plants since the 1970s. Generous loan guarantees, regulatory risk insurance, and a production tax credit convinced energy companies with existing nuclear power facilities in Georgia and South Carolina to start construction on two reactors in each state.<sup>46</sup> Importantly, Georgia and South Carolina have regulated electricity markets.<sup>47</sup> Despite EPAAct 2005's substantial financial incentives, including loan guarantees of up to 80% of a plant's estimated costs and up to \$250 to \$500 million in risk insurance per reactor, it did not persuade an energy company to break ground on a nuclear plant in a competitive electricity market.<sup>48</sup> Promoting the expansion of U.S. nuclear power in competitive markets will likely require a plan that more accurately values nuclear power's advantage as a clean, reliability electricity source. Struggles with huge construction cost overruns and years-long delays at the new Georgia and South Carolina plants represent another critical area where the U.S. nuclear power industry must improve to be more competitive. In fact, these factors and unfavorable market conditions

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43. See 18 C.F.R. § 35.28 (2015).

44. *New York v. FERC*, 535 U.S. 1, 16-17, 22 (2002).

45. Energy Policy Act of 2005, Pub. L. No. 109-58, § 638, 119 Stat. 594, 793.

46. *Nuclear Regulatory Commission Approves Construction of First Nuclear Units in 30 Years*, U.S. ENERGY INFO. ADMIN. (Mar. 5, 2012), <https://www.eia.gov/todayinenergy/detail.php?id=5250>.

47. See *Map of Deregulated Energy States and Markets*, ELECTRIC CHOICE, <https://www.electricchoice.com/map-deregulated-energy-markets/> (last visited Apr. 11, 2018). Traditionally, electric utilities in regulated markets are vertically integrated, meaning the generation, transmission, and distribution of electricity is concentrated in one company. *Electric Power Markets: National Overview*, FERC, <https://www.ferc.gov/market-oversight/mkt-electric/overview.asp> (last updated Apr. 13, 2017).

48. See CONG. BUDGET OFFICE, FEDERAL LOAN GUARANTEES FOR THE CONSTRUCTION OF NUCLEAR POWER PLANTS 4 (2011), <http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/122xx/doc12238/08-03-nuclearloans.pdf>.

caused South Carolina utilities to abandon its unfinished nuclear reactors in July 2017.<sup>49</sup> Despite facing similar challenges, Georgia regulators voted in December 2017 to allow continued construction of the two reactors at Georgia Power's Vogtle plant.<sup>50</sup>

### C. *Financial Tools at Utilities' Disposal*

FERC Order 888 also allowed utilities to recover a substantial portion of their stranded costs, a regulated practice critical to help utilities with high-cost projects like a nuclear plant remain financially viable.<sup>51</sup> As long as utilities make prudent investments, most states allow at least some stranded cost recovery, which are commonly recouped through extra charges on customers' electricity bills.<sup>52</sup> But in *Duquesne Light Co. v. Barasch*, the Supreme Court provided a warning for utilities that seek to recover stranded costs for prudent expenditures in canceled projects.<sup>53</sup> The Court declined to adopt a prudent investment rule to determine whether two utilities were entitled to recover a \$45 million loss from the cancellation of several nuclear power plants following the Three Mile Island scare.<sup>54</sup> The Court denied the utilities' taking claim, finding one did not occur because the utilities' investments were not "used and useful in service to the public."<sup>55</sup> To balance their financial risk and attract investors, utilities often negotiate with state regulators to include construction work in progress (CWIP) in the base rate to provide payment for work as it takes place. An alternative mechanism, called allowance for funds used during construction (AFUDC), accumulates the same amount of money as CWIP, but the funds are transferred to the utility's base rate upon project completion rather than during the project.<sup>56</sup> These financial tools are regularly used by energy companies in compliance with the just and reasonable standard of ratemaking and offer important options to help companies offset the uncertainty of volatile competitive markets.

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49. Sammy Fretwell, *SCE&G, Santee Cooper Abandon Nuclear Power Project*, THE STATE (July 31, 2017, 12:50 PM), <http://www.thestate.com/news/local/article164544862.html>.

50. Anastacia Ondieki, *Georgia PSC Votes to Continue Construction at Plant Vogtle*, ATLANTA J.-CONST. (Dec. 21, 2017, 10:41 AM), <http://www.ajc.com/news/local-govt-politics/georgia-psc-votes-continue-construction-plant-vogtle/Tu0ja76KWtR3YG1haFLTeM/>.

51. See 18 C.F.R. § 35.26 (2015).

52. EISEN ET AL., *supra* note 27, at 707.

53. 488 U.S. 299, 301-02 (1989).

54. *Id.* at 302, 315 (quoting 66 PA. CONS. STAT. § 1315 (2018)).

55. *Id.* at 301-02 (quoting 66 PA. CONS. STAT. § 1315).

56. EISEN ET AL., *supra* note 27, at 490-92.

#### IV. ELECTRICITY GENERATION FROM NUCLEAR POWER: BENEFITS & DRAWBACKS

A brief comparison of nuclear power to competing electricity sources identifies key issues at play in this field. The dominant energy sources for U.S. electricity generation in 2017 were natural gas (32%), coal (30%), nuclear (20%), and non-hydropower renewables (10%).<sup>57</sup> Three key attributes of nuclear power generation—it is efficient, clean, and reliable—give it a distinct advantage compared to power generation from other energy sources.

Nuclear power plants are fueled by enriched uranium processed and packed in fuel rod assemblies that are replaced about every eighteen months to two years.<sup>58</sup> In the fuel assemblies, nuclear fission takes place in a chain reaction that releases heat that turns water to steam, drives a turbine, and generates electricity.<sup>59</sup> This process, which cannot be readily ramped up or down, results in the continuous generation of electricity and enables well-managed nuclear plants to operate at a capacity factor above 90%.<sup>60</sup> By comparison, combined cycle natural gas and coal plants run at 56% and 53% respectively, and renewable power at 38% or less.<sup>61</sup>

By operating continuously, nuclear power plants are designed for maximum efficiency as reliable sources of baseload power. According to data from 2015, most of the nation's largest power plants in terms of generation are nuclear plants.<sup>62</sup> The ability of nuclear plants to generate large amounts of power benefits the public by increasing electricity reliability. This advantage, however, is not valued in competitive markets.<sup>63</sup>

Nuclear power also provided nearly 60% of the country's emissions-free electricity generation in 2016.<sup>64</sup> With or without federal laws limiting carbon from power plants, nuclear power can play a critical role in realizing a cleaner U.S. power sector. While

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57. U.S. ENERGY INFO. ADMIN., SHORT-TERM ENERGY OUTLOOK 2 (Mar. 2018), [https://www.eia.gov/outlooks/steo/pdf/steo\\_full.pdf](https://www.eia.gov/outlooks/steo/pdf/steo_full.pdf) (illustrating U.S. electricity generation at utility-scale facilities in 2017).

58. EISEN ET AL., *supra* note 27, at 399.

59. *Id.*

60. *U.S. Capacity Factors by Fuel Type*, NUCLEAR ENERGY INST., <https://www.nei.org/resources/statistics/us-capacity-factors-by-fuel-type> (last updated Oct. 2017).

61. *Id.*

62. Sean Hackbarth, *These 10 Power Plants Produce the Most Electricity in America*, U.S. CHAMBER COM. (May 23, 2016, 3:15 PM), <https://www.uschamber.com/above-the-fold/these-10-power-plants-produce-the-most-electricity-america>.

63. See Hammond & Spence, *supra* note 4, at 162-63, 187-92.

64. *Air Quality*, NUCLEAR ENERGY INST., <https://www.nei.org/advantages/air-quality> (last visited Apr. 11, 2018).

other electricity sources share some of these three advantages, only nuclear power plants generate efficient, clean, and reliable electricity that can also serve as a source of baseload power for millions of U.S. homes, offices, and industrial facilities.<sup>65</sup>

But the high cost to build and maintain nuclear power plants puts them at a competitive disadvantage with other electric generating facilities.<sup>66</sup> The U.S. Energy Information Administration, based on its levelized cost projections, estimates the cost of electricity from advanced nuclear generation to be nearly twice as much as combined cycle natural gas, wind, and solar power generation.<sup>67</sup> Nuclear plant construction has been historically plagued by high cost overruns and years-long delays, a trend that continues for nuclear reactors currently under construction.<sup>68</sup> While regulated markets provide mechanisms to balance these costs with the value of nuclear power's benefits, competitive markets respond more harshly by rewarding the low-cost options at the expense of other market participants. Not surprisingly, more than 90% of new U.S. electricity generation in 2016 came from low-cost natural gas and competitively-priced wind and solar power.<sup>69</sup>

Safety risks and related public concerns are other significant drawbacks to nuclear power. These include concerns about plants' operational safety and vulnerability to attack or natural disasters like the tsunami that led to the 2011 Fukushima Daiichi nuclear plant meltdown.<sup>70</sup> The federal government holds exclusive jurisdiction over nuclear plant safety and the Nuclear Regulatory Commission (NRC) implements federal regulations that require strict safety measures.<sup>71</sup> Other major drawbacks include the lack of a permanent solution for

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65. *See id.*

66. U.S. ENERGY INFO. ADMIN., *supra* note 41, tbl.8.4 (showing that nuclear power plants have greater operations and maintenance costs than competing plants).

67. U.S. ENERGY INFO. ADMIN., LEVELIZED COST AND LEVELIZED AVOIDED COST OF NEW GENERATION RESOURCES IN THE ANNUAL ENERGY OUTLOOK 2017, at 7 (Apr. 2017), [https://www.eia.gov/outlooks/archive/aeo17/pdf/electricity\\_generation.pdf](https://www.eia.gov/outlooks/archive/aeo17/pdf/electricity_generation.pdf).

68. *See* Diane Cardwell, *The Murky Future of Nuclear Power in the United States*, N.Y. TIMES (Feb. 18, 2017), <https://nyti.ms/2m7bXmW>.

69. *U.S. Electric Generating Capacity Increase in 2016 Was Largest Net Change Since 2011*, U.S. ENERGY INFO. ADMIN. (Feb. 27, 2017), <http://www.eia.gov/todayinenergy/detail.php?id=30112>.

70. *See Safety of Nuclear Power Reactors*, WORLD NUCLEAR ASS'N, <http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/safety-of-nuclear-power-reactors.aspx> (last updated May 2016).

71. *See* Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm'n, 461 U.S. 190, 212 (1983) (finding that for nuclear power, "the Federal Government maintains complete control" of safety aspects); *Nuclear Security and Safeguards*, U.S. NUCLEAR REGULATORY COMM'N, <https://www.nrc.gov/security.html> (last updated Aug. 14, 2017).

spent fuel storage and concern over high-level waste being illegally obtained to make bombs,<sup>72</sup> despite long-standing and effective protections under the Nuclear Non-Proliferation Treaty.<sup>73</sup>

Decommissioning nuclear plants after they close is another costly, long-term process that requires substantial federal regulatory oversight.<sup>74</sup> Like all energy production, nuclear plants are not completely clean either. Carbon and other air pollutants are released during the construction and decommissioning phases, and high-level waste from spent fuel is highly toxic.<sup>75</sup> Although nuclear power is a topic below the radar of many Americans, its legitimate benefits and drawbacks raise important national concerns related to the economy, the environment, security, and public health.

## V. NUCLEAR POWER AS A NATIONAL ISSUE

With nuclear power plants in thirty states, the United States generates the most electricity from nuclear power in the world.<sup>76</sup> At the start of 2018, ninety-nine nuclear reactors operated at sixty-one power plants scattered across the country in states with regulated and restructured electricity markets.<sup>77</sup> These plants have consistently produced approximately 18-20% of total U.S. electricity generation since 1990 as the shift to competitive markets has gained momentum.<sup>78</sup>

### A. *Changes in Regulated vs. Restructured Electricity Markets*

In October 2016, a nuclear reactor began commercial operations at the Watts Bar power plant in Tennessee, marking the first new U.S.

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72. See *Nuclear Energy: Pros & Cons*, RENEWABLE RES. COAL. (Nov. 19, 2016), <https://www.renewableresourcescoalition.org/nuclear-energy-pros-con/>.

73. See Treaty on the Non-Proliferation of Nuclear Weapons, Mar. 5, 1970, 21 U.S.T. 483, 729 U.N.T.S. 161.

74. See *Decommissioning of Nuclear Facilities*, U.S. NUCLEAR REGULATORY COMM'N, <https://www.nrc.gov/waste/decommissioning.html> (last updated Feb. 21, 2018).

75. See *Nuclear Power and the Environment*, U.S. ENERGY INFO. ADMIN., [https://www.eia.gov/energyexplained/index.cfm?page=nuclear\\_environment](https://www.eia.gov/energyexplained/index.cfm?page=nuclear_environment) (last updated Jan. 10, 2017).

76. *Frequently Asked Questions: How Many Nuclear Power Plants Are in the United States, and Where Are They Located?*, U.S. ENERGY INFO. ADMIN., <https://www.eia.gov/tools/faqs/faq.php?id=207&t=3> (last updated Aug. 15, 2017) [hereinafter *FAQs*]; *Top 10 Nuclear Generating Countries*, NUCLEAR ENERGY INST., <https://www.nei.org/resources/statistics/top-10-nuclear-generating-countries> (last updated Apr. 2017).

77. *FAQs*, *supra* note 76.

78. *U.S. Nuclear Generating Statistics 1971-2016*, NUCLEAR ENERGY INST., <https://www.nei.org/resources/statistics/us-nuclear-generating-statistics> (last updated Apr. 2017).

reactor to come online in twenty years.<sup>79</sup> Two more nuclear reactors are under construction at the Vogtle plant in Georgia.<sup>80</sup> This growth, however, is countered by the closure of six nuclear plants since 2013.<sup>81</sup> Several other plants are scheduled to close within five years, including plants owned by Exelon Corporation and Entergy Corporation, the nation's top two nuclear power generators.<sup>82</sup> Several of these announced closures come a decade or more before the plants would require relicensing, and owners of other nuclear plants have indicated they will not seek license extensions, which would effectively lead to the plants' retirement.<sup>83</sup>

Importantly, all new nuclear reactor construction is taking place in states with regulated electricity markets. Most of the planned nuclear plant closures are in restructured states, including those owned by Exelon and Entergy.<sup>84</sup> This dynamic between regulated and restructured states raises serious concerns over whether nuclear power is economically viable in competitive power markets, which are inherently volatile. Competitive U.S. electricity markets put a premium on minimizing costs but "markets are blind to the costs nuclear power incurs to provide reliable base load [power] and to internalize its environmental impacts."<sup>85</sup>

However, nuclear power provides continuously reliable, clean electricity, which helps satisfy the country's federal policies to deliver a reliable electricity supply and protect air quality<sup>86</sup> and advances its international commitment to reduce pollution that contributes to climate change.<sup>87</sup> If the trend of nuclear plant closures in competitive

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79. Max Blau, *First New U.S. Reactor in 20 Years Goes Live*, CNN (Oct. 21, 2016, 7:51 AM), <http://www.cnn.com/2016/10/20/us/tennessee-nuclear-power-plant/>.

80. *See Vogtle*, U.S. DEP'T ENERGY, <https://www.energy.gov/lpo/vogtle> (last visited Apr. 11, 2018).

81. NUCLEAR ENERGY INST., *NUCLEAR COSTS IN CONTEXT 5* (Aug. 2017), <https://www.nei.org/CorporateSite/media/filefolder/resources/statistics/nuclear-costs-context-201708.pdf>.

82. *Id.* (mentioning also that Pacific Gas & Electric will close Diablo Canyon, California's last nuclear plant, by 2025).

83. *See id.*; *Three Mile Island Is the Latest Nuclear Power Plant to Announce Retirement Plans*, U.S. ENERGY INFO. ADMIN. (June 13, 2017), <https://www.eia.gov/todayinenergy/detail.php?id=31612>.

84. *See Nuclear Plants in Regulated/Deregulated States*, NUCLEAR ENERGY INST., <https://www.nei.org/resources/statistics/nuclear-plants-in-regulated-and-deregulated-states> (last updated July 2015) (listing regulated and deregulated states).

85. Hammond & Spence, *supra* note 4, at 191.

86. *See* 16 U.S.C. § 824o (2012) (providing electricity reliability); 42 U.S.C. § 7401 (protecting and enhancing air quality).

87. *See United States of America*, U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE: NDC REGISTRY, <http://www4.unfccc.int/ndcregistry/pages/Party.aspx?party=USA> (follow "USA First NDC" hyperlink) [hereinafter USA FIRST NDC].

markets continues, more states will look to fill this void with other electricity sources. These economic consequences put the future of U.S. nuclear power in question because once these plants close, they cannot easily be brought back online. This presents the question of whether federal and state governments should play greater roles to help nuclear power remain a financially viable electricity source.

Illinois and New York are the first states with zero-emissions credit programs to subsidize nuclear power plants, and other states are considering similar ways to ensure the economic viability of their nuclear power plants.<sup>88</sup> Two federal district court decisions in July 2017 upheld the Illinois and New York programs against challenges that they interfere with federal authority over wholesale electricity markets.<sup>89</sup> The cases are on appeal in the Second and Seventh Circuits, leaving unsettled the question of how far states can go to support nuclear power plants that struggle to remain competitive.<sup>90</sup>

### B. *Clean Power in a Climate-Conscious World*

Environmental impacts from electricity generation raise national issues particularly regarding the country's air quality and climate change responsibilities. Nuclear power offers the advantage of generating electricity without emitting carbon dioxide (carbon) or other greenhouse gases, but under current conditions, competitive markets undervalue this benefit. To comply with federal clean air laws and meet international commitments to mitigate climate change, the United States needs to achieve air pollution reductions in the electricity sector. Despite President Trump's vocal rejection of the Paris Agreement, it is not until November 2020 that the United States can exit the global climate change deal,<sup>91</sup> under which it pledged to reduce greenhouse gas emissions by 26-28% below 2005 levels by 2025.<sup>92</sup> Federal regulations under the Clean Air Act finalized under

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88. Amy C. Roma & Sachin Desai, *Year in Review—A New Generation of State Policies Towards Nuclear Power*, LEXOLOGY (Dec. 28, 2017), <https://www.lexology.com/library/detail.aspx?g=b395b8d2-b531-4ba4-b379-8710e1ff30a3>.

89. See *Coal. for Competitive Elec. v. Zibelman*, No. 16-CV-8164 (VEC), 2017 WL 3172866, at \*4 (S.D.N.Y. July 25, 2017), *appeal filed*, No. 17-2654 (2d Cir. Aug. 25, 2017); *Vill. of Old Mill Creek v. Star*, No. 17 CV 1163, 2017 WL 3008289, at \*18 (N.D. Ill. July 14, 2017), *appeal filed*, No. 17-2433 (7th Cir. July 17, 2017).

90. See *Zibelman*, 2017 WL 3172866; *Star*, 2017 WL 3008289.

91. U.N. Framework Convention on Climate Change, *Report of the Conference of the Parties on Its Twenty-First Session*, U.N. Doc. FCCC/CP/2015/10/Add.1, annex art. 28 (2016) [hereinafter Paris Agreement]; Brad Plumer, *The U.S. Won't Actually Leave the Paris Climate Deal Anytime Soon*, N.Y. TIMES (June 7, 2017), <https://nyti.ms/2rVZf0o>.

92. USA FIRST NDC, *supra* note 87.

President Obama to reduce carbon emissions from power plants, called the Clean Power Plan, were never enforced due to a Supreme Court stay<sup>93</sup> and remain in limbo, as the Trump Administration initiated the administrative process to repeal the rule to “clean[] the regulatory slate.”<sup>94</sup> The EPA plans to move forward with a replacement rule in 2018,<sup>95</sup> and a protracted legal battle over the future of power plant regulations is likely, as many states and environmental groups have pledged to fight the administration’s regulatory rollback efforts.<sup>96</sup>

### 1. Mandate to Regulate Carbon

Despite an uncertain legal and political future, the Supreme Court has determined that the EPA has the power to regulate carbon based on the EPA’s finding issued in 2009 that carbon endangers public health and welfare.<sup>97</sup> In 2007, the Supreme Court held in *Massachusetts v. EPA* that the EPA has the authority to regulate carbon for new vehicles “[b]ecause greenhouse gases fit well within the Clean Air Act’s capacious definition of ‘air pollutant.’”<sup>98</sup> The Court concluded that the EPA must regulate if it determines that “an air pollutant ‘cause[s], or contribute[s] to, air pollution which may reasonably be anticipated to endanger public health or welfare.’”<sup>99</sup> Efforts to promulgate federal carbon regulations for the power sector

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93. See *West Virginia v. EPA*, 136 S. Ct. 1000 (2016) (order granting stay).

94. Press Release, EPA, EPA Takes Another Step to Advance President Trump’s America First Strategy, Proposes Repeal of “Clean Power Plan” (Oct. 10, 2017), <https://www.epa.gov/newsreleases/epa-takes-another-step-advance-president-trumps-america-first-strategy-proposes-repeal>; see Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 82 Fed. Reg. 48,035 (proposed Oct. 10, 2017) (to be codified at 40 C.F.R. pt. 60).

95. Valerie Volcovici & David Shepardson, *Exclusive: Trump’s EPA Aims to Replace Obama-Era Climate, Water Regulations in 2018*, REUTERS (Jan. 9, 2018, 8:43 AM), <https://www.reuters.com/article/us-usa-epa-pruitt-exclusive/exclusive-trumps-epa-aims-to-replace-obama-era-climate-water-regulations-in-2018-idUSKBN1EZ079>.

96. Timothy Cama, *Dem AGs Warn Trump Against Repealing Obama’s Climate Rule*, THE HILL (Dec. 29, 2016, 11:07 AM), <http://thehill.com/policy/energy-environment/312095-dem-ags-warn-trump-against-repealing-obamas-climate-rule>; Lisa Friedman, *Trump Wants to Repeal Obama’s Climate Plan. The Next Fight: Its Replacement*, N.Y. TIMES (Sept. 28, 2017), <https://nyti.ms/2yuVSh8>.

97. *Massachusetts v. EPA*, 549 U.S. 497, 532 (2007); Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,494 (Dec. 15, 2009) (to be codified at 40 C.F.R. ch. 1).

98. *Massachusetts*, 549 U.S. at 532.

99. *Id.* at 532-33 (quoting 42 U.S.C. § 7521(a)(1) (2012)). The court in *Massachusetts* noted that “[i]f EPA makes a finding of endangerment, the Clean Air Act requires the Agency to regulate emissions of the deleterious pollutant from new motor vehicles.” *Id.* at 533 (citing 42 U.S.C. § 7521(a)(1)).

similar to those approved for automobiles in 2010 continued through the end of the Obama administration.<sup>100</sup> Similar risks to public health and welfare are attributable to carbon from the transportation and electricity sectors, as both represent about one-third of U.S. carbon emissions.<sup>101</sup> Thus, the power sector stands to benefit from maintaining its use of clean-generating electricity sources like nuclear power in part by being well positioned to respond to any future legal requirements to reduce carbon emissions from power plants.

It is not disputed here that renewable electricity from wind and solar power also represents a critical part of the solution to add more clean power to the U.S. electricity grid and achieve lasting carbon reductions. Wind and solar power combined are the country's largest-growing electricity sources, and they make up about 20% of emissions-free electricity.<sup>102</sup> But efforts to replace nuclear power with these renewable sources do so at the loss of nuclear power's benefits as a clean, reliable electricity source. In addition to avoiding carbon emissions, nuclear power helps the country meet the Clean Air Act requirements by producing electricity absent air pollutants like nitrogen oxides and sulfur dioxide that cause acid rain and increase public health risks.<sup>103</sup> Nuclear power also does not emit methane, a potent greenhouse gas, whereas natural gas systems are a leading source of U.S. methane emissions.<sup>104</sup>

## 2. A Carbon Price

Without some form of federal carbon regulations for power plants or a tax or other market mechanism that puts a price on

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100. See Bobby Magill, *Appeals Court Mulls Challenge to Clean Power Plan*, CLIMATE CENT. (Sept. 28, 2016), <http://www.climatecentral.org/news/appeals-court-mulls-challenge-clean-power-plan-20743> (discussing a 2016 United States Court of Appeals for the District of Columbia Circuit hearing on the Clean Power Plan).

101. Brad Plumer, *Power Plants Are No Longer America's Biggest Climate Problem*, *Transportation Is.*, VOX (June 13, 2016, 11:10 AM), <http://www.vox.com/2016/6/13/11911798/emissions-electricity-versus-transportation>.

102. Dennis Wamsted, *Trump Paris About-Face Likely to Hurt, Not Help Nuclear, Coal Sectors*, ENERGY COLLECTIVE (June 4, 2017), <http://www.theenergycollective.com/djwamsted/2406000/trump-paris-face-likely-hurt-not-help-nuclear-coal-sectors>; *Nearly Half of Utility-Scale Capacity Installed in 2017 Came from Renewables*, U.S. ENERGY INFO. ADMIN. (Jan. 10, 2018), <https://www.eia.gov/todayinenergy/detail.php?id=34472>.

103. *Emissions Avoided by the U.S. Nuclear Industry 1995-2016*, NUCLEAR ENERGY INST., <https://www.nei.org/resources/statistics/emissions-avoided-by-us-nuclear-industry> (last updated Apr. 2017). For more information on acid rain, see *What Is Acid Rain?*, EPA, <https://www.epa.gov/acidrain/what-acid-rain> (last updated Mar. 1, 2017).

104. See U.S. ENVTL. PROT. AGENCY, EPA 430-P-17-001, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS 1990-2015 (2017), [https://www.epa.gov/sites/production/files/2017-02/documents/2017\\_complete\\_report.pdf](https://www.epa.gov/sites/production/files/2017-02/documents/2017_complete_report.pdf).

carbon—none of which are likely during the Trump administration—nuclear power’s climate change benefits will continue to be undervalued by the marketplace.<sup>105</sup> Present economic conditions give low-cost U.S. natural gas a competitive advantage over higher-cost nuclear power, which increasingly threatens nuclear power’s financial viability. Natural gas is poised to take up the slack for near-term declines in nuclear power, which raises potential challenges in terms of reducing carbon. A recent Supreme Court decision may open the door for the FERC to explore new avenues to address the carbon price issue. In *FERC v. Electric Power Supply Ass’n*, the Supreme Court held that the FERC’s authority to set wholesale rates included setting demand response rates for consumers who reduce electricity use during peak periods at the same value as utility generators.<sup>106</sup> This broad, functionalist view of the FERC’s statutory authority<sup>107</sup> may allow the FERC to eventually expand its “just and reasonable” authority to include social costs like one for carbon in its ratemaking calculus.<sup>108</sup> For example, it has been argued that the FERC’s “just and reasonable mandate must evolve” to address interrelated issues of energy, economics, and the environment in the context of reducing carbon emissions.<sup>109</sup> Such action would disrupt the FERC’s traditional reluctance to get involved in environmental matters, and it is debatable as to whether the FERC’s authority extends to this field.<sup>110</sup> The political headwinds currently oppose such action, but future FERC action in pricing carbon would send an important market signal favorable to nuclear power.

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105. See, e.g., Jennifer A. Dlouhy, *How Trump Is Planning to Dismantle Obama-Era Policies on Carbon Emissions and Water Pollution*, BLOOMBERG (Feb. 17, 2017, 9:34 AM), <http://www.chicagotribune.com/news/nationworld/ct-trump-scott-pruitt-epa-climate-change-rules-20170217-story.html>.

106. *FERC v. Elec. Power Supply Ass’n*, 136 S. Ct. 760, 784 (2016).

107. Matthew R. Christiansen, Essay, *FERC v. EPSA: Functionalism and the Electricity Industry of the Future*, 68 STAN. L. REV. ONLINE 100, 104 (2016).

108. See 16 U.S.C. § 824d(a) (2012) (“All rates and charges made, demanded, or received by any public utility for or in connection with the transmission or sale of electric energy . . . and all rules and regulations affecting or pertaining to such rates or charges shall be just and reasonable . . .”).

109. Christopher J. Bateman & James T.B. Tripp, *Toward Greener FERC Regulation of the Power Industry*, 38 HARV. ENVTL. L. REV. 276, 333 (2014) (internal quotation marks omitted).

110. See *Grand Council of the Crees v. FERC*, 198 F.3d 950, 957 (D.C. Cir. 2000) (holding that environmental concerns over the impact of electricity uses were outside of the FERC’s statutory “zone of interests”).

C. *Nuclear Power's Reliability Advantage*

Reliability is fundamental to nuclear power because nuclear plants continuously generate electricity, which makes them an ideal source of baseload power.<sup>111</sup> Nuclear plants have generated roughly 20% of the country's electric power for more than two decades.<sup>112</sup> Nonetheless, without the protection of a traditional regulatory contract, utilities in competitive markets are not rewarded for the benefits customers gain from nuclear power's reliability and overall cleanliness.<sup>113</sup> With its key attributes undervalued, nuclear power struggles to compete in markets that often experience high price volatility.

The reliability advantage that nuclear power generators provide by continuously producing electricity also makes them price takers in the open market.<sup>114</sup> This means nuclear power producers must sell their electricity at the going market rate, or spot price, which may be below the cost to produce it.<sup>115</sup> When the average spot price is less than a plant's long-run average costs, the plant is not profitable.<sup>116</sup> Its operator must then decide whether to close the plant depending in large part on how long the plant's unprofitable position in an uncertain market is projected to last.

Such price volatility presents a significant risk to nuclear power generators in competitive electricity markets from which their counterparts in regulated states are immune. In general, regulators are required to set electricity rates that maintain "just and reasonable" costs for consumers, and at the same time ensure that the utility has an opportunity to run its plant efficiently and safely while attracting the investors necessary to operate a sound long-term business.<sup>117</sup> Windfall profits are not expected, but financial stability is preserved. Importantly, attributes like electricity reliability are accounted for in

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111. See *World Energy Needs and Nuclear Power*, WORLD NUCLEAR ASS'N, [www.world-nuclear.org/information-library/current-and-future-generation/world-energy-needs-and-nuclear-power.aspx](http://www.world-nuclear.org/information-library/current-and-future-generation/world-energy-needs-and-nuclear-power.aspx) (last updated Sept. 2017).

112. See *U.S. Nuclear Generating Statistics 1971-2016*, *supra* note 78.

113. See Hammond & Spence, *supra* note 4, at 215 (discussing how the move to competitive markets "has not provided us with an electric generation mix that satisfies all of the important attributes we seek").

114. *Id.* at 190.

115. *Id.*

116. *Id.*

117. See *Fed. Power Comm'n v. Hope Nat. Gas Co.*, 320 U.S. 591 (1944); *Bluefield Water Works & Improvement Co. v. Pub. Serv. Comm'n*, 262 U.S. 679 (1923). Commonly discussed as "*Hope* and *Bluefield*," these cases established the "end results" test for evaluating whether electricity rates satisfy the statutory standard of "just and reasonable." See *Hope*, 320 U.S. at 602.

regulated markets. But high capital costs, cost overruns, and long construction delays of nuclear plants are among the reasons why they are far riskier investments when subjected to the inherent price fluctuations of a competitive market.<sup>118</sup> Whereas regulated markets provide reasonable assurance to electric utilities that their capital costs will be recovered with a reasonable profit, competitive electricity markets must yield the “right price” for nuclear power generation to be cost effective. These concerns, among other matters, are key reasons why the U.S. nuclear reactors under construction are in a regulated state.<sup>119</sup>

Despite the risks, as competitive electricity markets penetrated about half of the country by the year 2000, energy experts remained optimistic about nuclear power’s future.<sup>120</sup> But the basis for this positive outlook rested on tenuous conditions, such as a lack of a major nuclear plant meltdown and high natural gas prices,<sup>121</sup> which did not pan out. The biggest domino to fall has been the price of natural gas.

#### *D. Competing Against Natural Gas*

As electricity restructuring gained greater traction, some industry experts saw market competition as “a tonic for existing nuclear plants” that helped spur greater productivity, enhance safety, and lower operating and maintenance costs.<sup>122</sup> These improvements made nuclear plants more valuable, and many were acquired by large energy corporations that produced power for customers across many states.<sup>123</sup> Nuclear power was also attractive to larger industrial customers interested in securing long-term supply contracts to hedge against the price volatility of natural gas-fueled electricity.<sup>124</sup> As a main peaking power source used to meet high electricity demand and now the dominant U.S. electricity source, natural gas strongly

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118. Benjamin K. Sovacool et al., *Construction Cost Overruns and Electricity Infrastructure: An Unavoidable Risk?*, 27 *ELECTRICITY J.* 112, 114-15 (2014).

119. See discussion *supra* Part III.C.

120. See Neil J. Numark & Robert D. MacDougall, Essay, *Nuclear Power in Deregulated Markets: Performance to Date and Prospects for the Future*, 14 *TUL. ENVTL. L.J.* 463, 463-66 (2001).

121. *Id.* at 483.

122. *Id.* at 464-65, 483.

123. *Id.* at 469-70.

124. *Id.* at 469.

influences electricity prices in competitive electricity markets.<sup>125</sup> High, volatile natural gas prices were common for much of the period from the mid-1990s up until the U.S. shale gas revolution made waves beginning in 2007.<sup>126</sup> Nuclear power producers in competitive markets profited during this period by providing a lower-cost product. For example, larger electricity users in California's competitive market sought protection against volatile wholesale market prices by agreeing to long-term contracts with nuclear power providers at above-market prices.<sup>127</sup> Nuclear industry analysts saw the potential for a bright future in competitive markets, but in addition to plans for reducing capital and operating costs, this outlook relied on conditions, including the absence of a major nuclear plant disaster, greater progress on nuclear waste storage, and continued high natural gas prices, which did not materialize.<sup>128</sup>

The 2011 Fukushima Daiichi nuclear plant meltdown in Japan and its aftermath, along with the lack of progress on a long-term solution for spent fuel storage, heightened public safety concerns.<sup>129</sup> Even more detrimental to nuclear power's financial viability in competitive markets is the dramatic drop in the price of natural gas.<sup>130</sup> Primarily because of the U.S. shale gas revolution, U.S. natural gas prices in 2016 hit their lowest point since the 1980s, and projections to 2019 show only relatively small increases.<sup>131</sup> Although highly sensitive to assumptions about, among other matters, domestic supply and demand, U.S. natural gas prices are projected to increase somewhat in the coming years before flattening at about \$5 per million British thermal units from 2030 to 2040.<sup>132</sup> This price is still

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125. Robert Walton, *Power & Gas Index: 8 Regional Charts Show the Link Between Gas and Electricity Markets*, UTIL. DIVE (Jan. 25, 2017), <https://www.utilitydive.com/news/power-gas-index-8-regional-charts-show-the-link-between-gas-and-electric/433468/>.

126. See Paul Stevens, *The "Shale Gas Revolution": Developments and Changes 2* (Chatham House, Briefing Paper No. EERG BP 2012/04 2012) (describing how public attention to the U.S. shale gas revolution began in 2007 when estimates of unproven U.S. gas reserves increased 45%). By 2010, shale gas provided 20% of U.S. natural gas production, up from 1% in 2000. *Id.*

127. Numark & MacDougall, *supra* note 120, at 469.

128. *Id.* at 483.

129. Toni Johnson, *Nuclear Power Safety Concerns*, COUNCIL ON FOREIGN REL. (Sept. 23, 2011), <https://www.cfr.org/background/nuclear-power-safety-concerns> (discussing nuclear power safety concerns, including the fallout from the Fukushima disaster and spent fuel storage challenges).

130. *See id.*

131. U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2017, at 28 (2017) [https://www.eia.gov/outlooks/aeo/pdf/0383\(2017\).pdf](https://www.eia.gov/outlooks/aeo/pdf/0383(2017).pdf); U.S. ENERGY INFO. ADMIN., *supra* note 57, at 1.

132. U.S. ENERGY INFO. ADMIN., *supra* note 131, at 28.

well below U.S. natural gas prices in much of early 2000s when nuclear power appeared more likely to succeed in competitive markets.<sup>133</sup> A steady increase in U.S. natural gas production is also projected, which will fuel 40% of U.S. energy production by 2040.<sup>134</sup>

Projections show U.S. nuclear power in a slight decline through 2040, but this trend is expected to accelerate after 2040 when most plants more than sixty years old are scheduled to be retired.<sup>135</sup> This expected market shift appears likely to put nuclear power at a growing and significant competitive disadvantage with no reasonably foreseeable near-term solution available.<sup>136</sup> Many energy companies today behave more like corporations in other markets than as the traditional public electric utility. These firms operate under constant pressure to compete and make decisions that attract investors. With today's markets unfavorable to nuclear power, these business decisions may risk sacrificing the country's largest source of emissions-free, reliable electricity in response to competitive market forces.

## VI. ENERGY COMPANIES' NUCLEAR OUTLOOK & THE VIEW FROM ENERGENCY

To remain competitive in the shale revolution era of low U.S. natural gas prices, energy companies are being pulled in directions that fifteen years ago were unimaginable. Moreover, the nature of competitive markets drives energy companies to pursue new technologies, such as battery storage and smart meters, which offer opportunities for new revenue streams that attract investors.<sup>137</sup> With such investments, energy companies can find themselves moving farther away from the role of providing an essential service. Yet electricity remains at the heart of the economy and our way of life. We need only look at a few catastrophic events in recent times to see the tremendous costs incurred in the rare instance of a major U.S. blackout or the public health and safety risks to communities left without electricity for long periods after a major storm.<sup>138</sup>

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133. *U.S. Natural Gas Electric Power Price 2002-2017*, U.S. ENERGY INFO. ADMIN. (Feb. 28, 2018), <https://www.eia.gov/dnav/ng/hist/n3045us3m.htm>.

134. U.S. ENERGY INFO. ADMIN., *supra* note 131, at 14.

135. *Id.*

136. *See, e.g.*, Hammond & Spence, *supra* note 4, at 215 (suggesting further research into policy options is necessary).

137. *See, e.g.*, Diane Cardwell, *Tesla Gives the California Power Grid a Battery Boost*, N.Y. TIMES (Jan. 30, 2017), <https://nyti.ms/2jNtYpC>.

138. *See* U.S.-CAN. POWER SYS. OUTAGE TASK FORCE, FINAL REPORT ON THE AUGUST 14, 2003 BLACKOUT IN THE UNITED STATES AND CANADA: CAUSES AND RECOMMENDATIONS 1 (2004), <https://perma.cc/P8DC-UWWE> (describing costs incurred in the United States

In the marketplace, however, energy companies are not rewarded for generating reliable, nonpolluting electricity when production costs exceed the market rate set by natural gas. Like in any competitive industry, energy firms cannot afford to sell at a loss for long periods and remain in business. In particular, these conditions put energy companies with nuclear power plants on shaky ground. Several nuclear plant closures since 2013 at facilities with ten or more years remaining on their operating licenses showed that companies will move on from these long-term assets.<sup>139</sup> Without some form of the regulatory contract as a backstop for nuclear power generators to withstand price shocks, it is difficult to justify forty- to sixty-year investments in high-cost nuclear plants. This raises the fair question: Are energy companies still responsible for providing what has traditionally been deemed an “essential service?”

*A. A Tough Market for Making Business Decisions*

Energy company executives must make business decisions that serve customers’ interests such that the company turns a profit to pay shareholder dividends and continue to attract investors.<sup>140</sup> As in other industries, power company executives owe a fiduciary duty to shareholders to make reasonable judgments regarding the firm’s investments. In markets subject to significant, relatively short-term price fluctuations like energy, making reasonable business decisions about long-term assets is extremely challenging, if not futile, despite the use of financial hedging products. Whether negotiating electricity contracts over the short or long term, energy companies face considerable risks because large price swings can turn a fair deal into a big loss. Energy companies profit when price volatility works to their benefit, but this is a gamble with a forty-year asset like a nuclear

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ranging from \$4 billion to \$10 billion due to a blackout across eight states and one Canadian province that impacted an estimated 50 million people over four days); Joanna Burger & Michael Gochfeld, *Health Concerns and Perceptions of the Central and Coastal New Jersey Residents in the 100 Days Following Superstorm Sandy*, 481 SCI. TOTAL ENV’T 611, 614-15 (2014) (discussing health concerns including illness derived from a lack of electricity experienced by Sandy victims in New Jersey); Josh Michaud & Jen Kates, *Public Health in Puerto Rico After Hurricane Maria*, HENRY J. KAISER FAM. FOUND. (Nov. 2017), <http://files.kff.org/attachment/Issue-Brief-Public-Health-in-Puerto-Rico-after-Hurricane-Maria> (discussing negative impacts on public health related to significant damage to key public systems like electricity infrastructure, as only 43% of the island had access to electricity two months after the storm);

139. NUCLEAR ENERGY INST., *supra* note 81.

140. EISEN ET AL., *supra* note 27, at 456-57.

power plant that provides an essential service.<sup>141</sup> Unpredictable change is all that can reasonably be predicted over forty years. Market shifts from the 1973 Arab oil embargo to the shale revolution of the past decade—and the other numerous regulatory, economic, political, and geopolitical changes in between—underscore this uncertainty. Nevertheless, energy companies must respond to market conditions to remain financially viable. Today, this reality is causing energy companies to close several nuclear plants, which provides near-term financial benefits but raises longer-term risks for the U.S. power sector and, arguably, for society as a whole.<sup>142</sup>

Should the business judgment of energy companies drive more widespread U.S. nuclear plant closures, the reduced diversity in electricity sources presents concerns of reliability and higher costs. Markets also help promote efficiency and foster innovation, which can certainly deliver benefits such as lower-cost rooftop solar power and advances in battery storage. Still, in a volatile overall energy market with reduced nuclear power capacity, should natural gas prices defy current projections and surge upward—a realistic possibility based on historical trends—companies' electricity generation costs will spike.<sup>143</sup> Customers without long-term power contracts can then expect to see higher electricity bills. An alternative, cheaper power source would help to offset a natural gas price spike, and growth in the renewable power supply offers promise. But concerns over intermittency and transmission of wind and solar power, along with the lack of a proven long-term electricity storage solution, raise considerable business and price risks. Thus, substantially reducing the role of nuclear power in the national energy mix could easily threaten electricity reliability and increase costs by removing a central source of baseload power without a guaranteed medium to long-term replacement. Yet this is a growing part of the country's electricity outlook as more energy companies are forced to survive in a competitive marketplace vulnerable to price volatility.

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141. Nuclear power plants are licensed for forty years and can be renewed for an additional twenty years. *See* 10 C.F.R. § 54.31 (2017); *see also Backgrounder on Reactor License Renewal*, U.S. NUCLEAR REG. COMM'N, <https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-reactor-license-renewal.html> (last updated Feb. 21, 2018).

142. *See* U.S. DEP'T OF ENERGY, *supra* note 25, at 10-14, 30-31 (discussing recent nuclear plant closures and long-term electricity reliability).

143. *See U.S. Natural Gas Wellhead Price*, U.S. ENERGY INFO. ADMIN. (Dec. 29, 2017), <https://www.eia.gov/dnav/ng/hist/n9190us3A.htm> (discussing license renewal for nuclear reactors).

*B. Entergy's Enexus Experience & Its Aftermath*

In January 2008, Entergy filed a petition with the New York Public Service Commission (NYPSC) seeking approval of a corporate reorganization plan to consolidate its six nonutility nuclear power plants in New York, Vermont, Massachusetts, and Michigan that sold power in competitive wholesale markets into a new, independent company.<sup>144</sup> The proposal to create Enexus Entergy Corporation (Enexus) was the first of its kind by an energy company and it received initial federal approval from the FERC and the NRC.<sup>145</sup>

When Entergy introduced this reorganization, the future of nuclear power had looked positive for several years due to conditions including lower operating costs, improved plant efficiencies, and high natural gas prices.<sup>146</sup> Notably, the lasting impact of the shale gas boom that has substantially lowered U.S. natural gas prices today was not known. But the NYPSC, which oversees half of the plants involved in the proposed spin-off, heard significant concerns from its staff and stakeholders about Enexus's long-term financial stability and whether it benefitted customers.<sup>147</sup> The NYPSC applied a "no net harm" standard to consider the validity of Enexus compared to the existing Entergy operations.<sup>148</sup> Entergy argued that Enexus's simplified structure and isolation from Entergy's other business risks would improve both the ability to finance nonutility nuclear plant operations and to perform in competitive wholesale energy markets.<sup>149</sup> Entergy also argued that Enexus would spur greater competition for nuclear power, which would strengthen electricity markets and benefit customers.<sup>150</sup> Opponents criticized Enexus as overly exposed to financial risks and "subject to the vagaries of the market and the

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144. Verified Petition for a Declaratory Ruling Regarding a Corporate Reorganization or in the Alternative an Order Approving the Transaction and an Order Approving Debt Financings at 1-2, Case 08-E-0077 (N.Y. Pub. Serv. Comm'n Jan. 28, 2008) [hereinafter Entergy Petition]; Press Release, N.Y. Pub. Serv. Comm'n, PSC Rejects Entergy Spin-Off Plan (Mar. 25, 2010) [hereinafter N.Y. PSC Press Release], <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BFA4ABD9E-4085-4F2A-8D4A-16036D4F11FE%7D>.

145. N.Y. PSC Press Release, *supra* note 144.

146. John Sillin, *Face-Off: The Renaissance of Nuclear Power*, FORTNIGHTLY MAG. (June 15, 2003), <https://www.fortnightly.com/fortnightly/2003/06-0/face-renaissance-nuclear-power>.

147. See Order Closing Proceeding and Instituting New Proceeding at 10-14, Case 08-E-0077 (N.Y. Pub. Serv. Comm'n Aug. 19, 2010) [hereinafter Closing Order].

148. *Id.* at 4.

149. Entergy Petition, *supra* note 144, at 8-9.

150. See *id.* at 9.

economics of its investment and management decisions.”<sup>151</sup> They noted that unlike investors’ expectations in regulated markets where Entergy can recover the cost of its investments from ratepayers, “[t]his shield will not exist for Enexus.”<sup>152</sup> The NYPSC agreed with its staff’s determination that Enexus would receive a “relatively weak” bond rating, due in part to a lack of fuel diversity, small number of power plants, and that it operated in highly competitive markets, which would threaten its ability to secure financing over the long term.<sup>153</sup> Thus, the NYPSC was unable to conclude that Enexus would be as financially strong as Entergy absent the proposed spin-off.<sup>154</sup> Ultimately, in March 2010, the NYPSC rejected Enexus, concluding that it “would not be in the public interest or meet our ‘no net harm’ standard.”<sup>155</sup> Shortly thereafter, Entergy dropped its Enexus plan.<sup>156</sup>

Since Enexus failed to materialize and market conditions have radically changed, Entergy closed, plans to close, or sold most of the plants involved in the proposed spin-off.<sup>157</sup> The influence of low natural gas prices, greater competition from renewable power, and ballooning capital costs puts nuclear power at a great disadvantage in competitive markets. Entergy attempted to make what it believed to be a sound business decision with the Enexus proposal. Despite initial approval from the federal agencies, Entergy ran into strong state opposition that challenged the reorganization for economic reasons.<sup>158</sup> Echoes of *Pacific Gas* are evident in this matter where state authority to tell the utility what it can and cannot do based on economic grounds proved decisive.<sup>159</sup> Economic considerations also played a major role in Entergy’s agreement with New York to close its Indian Point nuclear units, which provide much of New York City’s

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151. Letter from Joseph Lochner & Patrick Piscitelli, Office of Accounting & Fin., N.Y. Pub. Serv. Comm’n, to Gerald L. Lynch & David L. Prestemon, Admin. Law Judges, Dep’t of Pub. Serv. 5 (Mar. 18, 2010), <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={2FA11B14-1252-4292-8DBB-E44BD23E9A1D}>};

152. *Id.*

153. Closing Order, *supra* note 147, at 12.

154. *Id.*

155. *Id.* at 4.

156. See Steve Gelsi, *Entergy Scraps Spin-Off of Enexus Nuclear-Power Arm*, MARKETWATCH (Apr. 5, 2010, 12:30 PM), <https://www.marketwatch.com/story/entergy-wont-pursue-spin-off-of-nuclear-power-arm-2010-04-05>.

157. *Company History*, ENTERGY, [www.entergynewsroom.com/history/](http://www.entergynewsroom.com/history/) (last visited Apr. 11, 2018).

158. Gelsi, *supra* note 156.

159. See *Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm’n*, 461 U.S. 190, 216 (1983).

electricity.<sup>160</sup> However, just scratching the surface of this matter shows public safety concerns at the heart of New York's support for this plan, which the Second Circuit concluded in *Vermont Yankee* "falls squarely within the prohibited field" of state law.<sup>161</sup>

## VII. TOWARD MORE JUST AND REASONABLE ELECTRICITY MARKETS FOR NUCLEAR POWER

In today's technology-driven world, the concept of electricity as an essential service is as important as ever. In serving the public interest, governments are needed as market gatekeepers to ensure that all customers can access a continuous, reliable electricity supply at reasonable rates. The growing global imperative to limit carbon and other environmental externalities from electricity generation<sup>162</sup> also requires government action to put a price on carbon so markets more accurately reflect the total cost of electricity generation. Absent strict controls on carbon, a price signal is an efficient and necessary method to help achieve the country's national and international goals to significantly reduce carbon emissions by mid-century.<sup>163</sup> By rewarding low-cost electricity and giving short shrift to the value of electricity reliability and its environmental impacts, competitive markets create a distortion that can undervalue critical benefits to consumers and power companies traditionally protected by the regulatory contract. This distortion is causing significant disruptions for the U.S. nuclear power industry that deserves to be reexamined.

Steps to expand nuclear power in states with regulated electricity markets compared to the circumstance surrounding recent nuclear power plant closures and planned early retirements primarily in states with competitive markets illustrate this divide in electricity ratemaking that threatens to significantly curtail the role of U.S. nuclear-generated electricity. Because of its benefits as a reliable,

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160. See Patrick McGeehan, *Cuomo Confirms Deal to Close Indian Point Nuclear Plant*, N.Y. TIMES (Jan. 9, 2017), <https://nyti.ms/2i9Rf6Y>.

161. *Entergy Nuclear Vt. Yankee, L.L.C. v. Shumlin*, 733 F.3d 393, 416 (2d Cir. 2013) (quoting *Pac. Gas*, 461 U.S. at 213).

162. This global imperative is illustrated in a variety of international strategies aimed at reducing carbon emissions and adapting to climate change. See, e.g., Paris Agreement, *supra* note 91 (binding 197 developed and developing countries to address global climate change); Yana Jin, Henrik Andersson & Shiqiu Zhang, *Air Pollution Control in China: A Retrospective and Prospects*, INT'L J. ENVTL. RES. PUB. HEALTH, Dec. 2016, at 16-18, <http://doi.org/10.3390/ijerph13121219> (describing China's growing attention to air pollution and policies to address it).

163. See USA FIRST NDC, *supra* note 87 (stating that the U.S. greenhouse gas target puts the country on a path "to deep, economy-wide emission reductions of 80% or more by 2050").

emissions-free source of electricity and the sheer lack of acceptable baseload power alternatives currently available, it is not time to significantly reduce U.S. nuclear power. But maintaining nuclear power as an economically viable part of the U.S. electricity supply includes taking a series of steps to reduce its vulnerability to the risks of a volatile marketplace. The following recommendations present options for legal solutions to address this important issue affecting the entire U.S. electricity sector, especially the customers and energy companies relying on nuclear power in competitive markets.

First, long-term contracts, called power purchasing agreements (PPAs), are a financial hedging tool used to negotiate the sale of electricity at wholesale rates between electric generators and retail utilities or large end-users.<sup>164</sup> The Supreme Court has held that these freely negotiated rates are presumed to be fair under the *Mobile-Sierra* doctrine.<sup>165</sup> Only when the contract “seriously harms the consuming public” may the FERC declare the rate unjust and unreasonable.<sup>166</sup> PPAs offer stability in an otherwise volatile market that enables energy companies to secure investors and gives utilities certainty over the price of electricity. Electricity rates for PPAs today are often based on wholesale market rates approved by the FERC.<sup>167</sup> Once approved or filed, these market rates will control in a contract dispute unless they present serious harm to consumers, according to the filed-rate doctrine.<sup>168</sup> In *Vermont Yankee*, Entergy argued that Vermont’s proposed new PPA requiring Entergy to sell its power at a low rate “interfere[d] with the rates FERC . . . approved for the market, and so the PPA [was] ‘preempted’ under the filed-rate doctrine.”<sup>169</sup> Although the court found Entergy’s claim unripe because the new PPA had not yet been executed, the FERC’s exclusive authority over interstate wholesale rates is well established and indeed reinforced.<sup>170</sup> PPAs help manage risk but do not eliminate the risk from unexpected market changes that make a contracted price

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164. For a brief description of PPAs outside of the nuclear energy context, see *Power Purchase Agreements (PPAs) and Energy Purchase Agreements (EPAs)*, WORLD BANK GRP., <https://ppp.worldbank.org/public-private-partnership/sector/energy/energy-power-agreements/power-purchase-agreements> (last updated Feb. 15, 2017).

165. *Morgan Stanley Capital Grp. v. Pub. Util. Dist. No. 1*, 554 U.S. 527, 530 (2008).

166. *Id.* at 545-46; see 16 U.S.C. § 824d (2012) (stating that the FERC has exclusive jurisdiction to ensure wholesale electricity rates are just and reasonable).

167. EISEN ET AL., *supra* note 27, at 520.

168. See *Morgan Stanley*, 554 U.S. at 545-46.

169. *Entergy Nuclear Vt. Yankee, L.L.C. v. Shumlin*, 733 F.3d 393, 433 (2d. Cir. 2013).

170. *Id.* at 433; see *Fed. Power Comm’n v. Nat. Gas Pipeline Co.*, 315 U.S. 575, 585-86 (1942).

unfavorable. But where a market rate makes economic sense, PPAs can help shield nuclear power companies from the risks of large price swings and ensure greater stability to attract financing. Meanwhile, a PPA can insulate electricity retailers or large users from unwanted price fluctuations by providing reliable power at a consistent price.

Second, for energy companies, government agencies, and citizens, understanding the circumstances in which federal or state preemption applies can make the difference in a case involving nuclear power plants. While *Pacific Gas* demonstrated the Supreme Court's recognition of state authority over economic considerations, *Vermont Yankee* showed that courts may apply "a more searching review" in determining whether federal preemption over nuclear plant safety applies when the decision to close the facility is at issue.<sup>171</sup> Despite the strong indication of federal preemption in *Vermont Yankee*, states retain considerable authority over nonradiological matters, such as siting and setting retail rates.<sup>172</sup> Such conditions can present creative avenues for states and nuclear power plant owners to strike deals to sell electricity well above market rates in exchange for the benefits of reliable, emissions-free electricity.<sup>173</sup> But the NYPSC's denial of Entergy's Enexus Corporation serves as a cautionary tale of the powerful role states play in the nuclear power industry.<sup>174</sup>

Third, as an emissions-free source, nuclear power's competitive value stands to rise with a carbon price. Establishing a national carbon price during a Trump administration is beyond unlikely.<sup>175</sup> Nevertheless, the Supreme Court's decision in *Massachusetts v. EPA* requires the EPA to regulate carbon, and the country has international

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171. See *Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm'n*, 461 U.S. 190, 213 (1983); *Vt. Yankee*, 733 F.3d at 416.

172. *Northern Cal. Ass'n to Preserve Bodega Head & Harbor v. Pub. Utils. Comm'n*, 390 P.2d 200, 204 (Cal. 1964) (holding state had authority to restrict siting a plant near a fault line to protect the "public from hazards . . . other than radiation hazards"); see also *Pac. Gas*, 461 U.S. at 212 ("[T]he Federal Government maintains complete control of the safety and 'nuclear' aspects of energy generation; the States exercise their traditional authority over the need for additional generating capacity, the type of generating facilities to be licensed, land use, ratemaking, and the like.").

173. See Hammond & Spence, *supra* note 4, at 209-10 (describing a contract between Exelon and the NYPSC that allowed Exelon to sell its electricity at 80% above the wholesale rate because of the reliability and emissions benefits of nuclear-generated electricity).

174. *Closing Order*, *supra* note 147, at 4 (demonstrating the authority states can wield in finding that Entergy's nuclear plant spinoff plan went against the public interest).

175. Actions by the Trump administration, including its commitment to repeal the Clean Power Plan and to withdraw from the Paris Climate Agreement, provide no indication that it would consider putting a price on carbon. See *Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, 82 Fed. Reg. 48,035 (proposed Oct. 10, 2017) (to be codified at 40 C.F.R. pt. 60); Plumer, *supra* note 91.

commitments to reduce carbon emissions.<sup>176</sup> The FERC offers a somewhat unique pathway to price carbon using its “just and reasonable” authority, although it is not clear whether the FERC’s jurisdiction extends to pricing environmental externalities like carbon. In 2016, the Supreme Court broadened its interpretation of the FERC’s Federal Power Act authority to include the regulation of demand response in interstate wholesale electricity markets.<sup>177</sup> It remains unclear whether this decision moves the FERC in the direction of pricing carbon, but it may crack open the door into an area where the FERC is traditionally reluctant to tread.

Fourth, regulators should consider setting floor and ceiling prices for electricity “with a market price fluctuating in between.”<sup>178</sup> By combining elements of rate-regulated and competitive markets, this hybrid approach helps to limit severe price volatility in the marketplace. An argument can be made that competitive markets will yield prices too low to cover capital costs or so high that they harm customers and business. Instead, this hybrid model takes a practical approach for “dealing with the oxygen of life in a high-energy civilization.”<sup>179</sup> Competitive market supporters would likely contest the use of artificial price caps as unnecessary government interference in efforts to achieve market efficiency. But if this hybrid model can bring reasonable stability to the market and, in turn, help ensure just and reasonable rates over time, it deserves the attention of regulators. For nuclear power plant owners, this hybrid option has the potential to help attract investors and make better informed long-term investment decisions by providing greater certainty over the rates. But other tools, such as PPAs, would still be necessary for nuclear power to remain competitive with low-cost competing fuel sources like natural gas.

#### VIII. CONCLUSION

Among these recommendations to help secure nuclear power’s economic viability in competitive markets, long-term contracts are preferred for their price stability,<sup>180</sup> and courts consistently uphold

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176. See 549 U.S. 497, 532-35 (2007).

177. FERC v. Elec. Power Supply Ass’n, 136 S. Ct. 760, 774 (2016).

178. Spence, *supra* note 5, at 810 (quoting *Electricity Markets: California: Hearings Before the Subcomm. on Energy & Air Quality of the H. Comm. on Energy & Commerce*, 107th Cong. 111 (2001) (statement of S. David Freeman, L.A. Dep’t of Water & Power)).

179. *Id.*

180. See Numark & MacDougall, *supra* note 120, at 469.

these agreements under the filed-rate doctrine.<sup>181</sup> Establishing a price floor and ceiling can provide additional market stability, which creates conditions more suitable to setting just and reasonable rates over time. Putting a price on carbon also stands out as a potential game-changer.

To make prudent investments in nuclear power plants, companies need certainty that these long-term, high-cost assets will remain financially viable over time. Leaving these decisions to the short-term whims of a volatile market is an irresponsible risk. Instead, a lightly regulated approach of the sort this Comment has described provides a well-balanced alternative. It would appropriately value the reliability and emissions-free aspects of electricity generated by nuclear plants and help ensure the appropriate setting of just and reasonable rates for electricity so produced. Such an approach would put U.S. nuclear power generators in a more equitable position vis-à-vis low-cost natural gas and renewable sources of electricity, enabling them to continue to provide customers with an essential service in the highly challenging energy and economic framework currently in place.

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181. *See, e.g.,* Morgan Stanley Capital Grp. v. Pub. Util. Dist. No. 1, 554 U.S. 527, 530, 548 (2008) (“FERC may abrogate a valid contract only if it harms the public interest . . . .”); *Simon v. KeySpan Corp.*, 694 F.3d 196, 204 (2d Cir. 2012) (“The doctrine holds that any ‘filed rate’—that is, one approved by the governing regulatory agency—is per se reasonable and unassailable in judicial proceedings brought by ratepayers.” (quoting *Wegoland Ltd. v. NYNEX Corp.*, 27 F.3d 17, 18 (2d Cir. 1994))).