Brooklyn Law Review

Volume 82 | Issue 2 Article 9

1-1-2017

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INTRODUCTION

Change is at the center of today's debates regarding how to transition to a low-carbon energy infrastructure. Achieving an 80% reduction from 1990 carbon emission levels by the year 2050[1] will require increased renewables penetration,[2] near-term reliance on significant amounts of new natural gas power generation,[3] a potential major transition away from conventional baseload power plants,[4] significant investment in distributed generation and new technologies,[5] and increased focus on demand-side measures.[6] But given the industry's immobile

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[1] This is roughly the level of emissions reduction necessary to meet the commonly agreed upon goal in the international community of limiting the anthropogenic increase in global mean surface temperatures to less than two degrees Celsius. *See* JAMES H. WILLIAMS ET AL., PATHWAYS TO DEEP DECARBONIZATION IN THE UNITED STATES 1 (2014), http://unsdsn.org/wp-content/uploads/2014/09/US-Deep-Decarbonization-Report.pdf [https://perma.cc/F6JF-AUMX] [hereinafter PATHWAYS TO DEEP DECARBONIZATION].

[2] TRIEU MAI ET AL., NAT'L RENEWABLE ENERGY LAB., RENEWABLE ELECTRICITY FUTURES STUDY: EXECUTIVE SUMMARY 30 (M.M. Hand et al. eds., 2012), http://www.nrel.gov/docs/fy13osti/52409-ES.pdf [https://perma.cc/2J6P-5M3M] (estimating electricity demand could be met by 80% renewable sources by 2050).

[3] *Cf.* STEVE WEISSMAN, CTR. FOR SUSTAINABLE ENERGY, NATURAL GAS AS A BRIDGE FUEL: MEASURING THE BRIDGE 1 (2016), https://energycenter.org/sites/default/files/docs/nav/policy/research-and-reports/Natural_Gas_Bridge_Fuel.pdf [https://perma.cc/F2QH-NEXF] (noting near-term need but cautioning against long-term natural gas reliance).

[4] *See* LUCY JOHNSTON & RACHEL WILSON, STRATEGIES FOR DECARBONIZING THE ELECTRIC POWER SUPPLY 6–7 (2012), http://www.raponline.org/wp-content/uploads/2016/05/rap-gpbp-decarbonizingpowersupply-2012-nov-16.pdf [https://perma.cc/T95Y-2FD6] (noting that "more than 70 percent of [U.S.] coal-fired capacity is more than 30 years old"). "Baseload" power plants are those that must run at or near their full capacity to meet customer load, and typically include coal and nuclear plants, but not most natural gas or renewable power generation resources.

[5] *See, e.g.*, Amy L. Stein, *Distributed Reliability*, 87 U. COLO. L. REV. 887, 941–61 (2016) (considering regulatory needs for incorporating distributed generation into grid reliability policymaking); Amy L. Stein, *Reconsidering Regulatory Uncertainty: Making a Case for Energy Storage*, 41 FLA. ST. U. L. REV. 697, 751–65 (2014) (considering regulatory needs for emerging technologies like energy storage).

[6] *See* PATHWAYS TO DEEP DECARBONIZATION, *supra* note 1, at 73.

capital assets with financial and operational lives ranging from fifty to eighty years in length, energy infrastructure can change only at a slow pace. Path dependency threatens "carbon lock-in," which could thwart any successful transition to a low-carbon energy system.[7] To the extent that grid decarbonization adversely affects the economic value of a significant portion of current assets (such as older coal plants), some industry investors and analysts have even raised concerns that the impending disruptions of change could lead to financial distress, hardship, and, at the extreme, catastrophe.[8]

Energy law can deal with such change. On many occasions over the past half century, energy law has been forced to confront the "stranded costs" of transitions—that is, the value of a regulated firm's investments left shipwrecked by changing regulatory circumstances. From an accounting standpoint, stranded costs are the difference between an asset's book value—including such things as power generating equipment—and its market value.[9] As discussed in greater detail below, stranded

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7 As Gregory Unruh describes:

> [I]ndustrial economies have been locked into fossil fuel-based energy systems through a process of technological and institutional co-evolution driven by path-dependent increasing returns to scale. It is asserted that this condition, termed *carbon lock-in*, creates persistent market and policy failures that can inhibit the diffusion of carbon-saving technologies despite their apparent environmental and economic advantages.

Gregory C. Unruh, *Understanding Carbon Lock-In*, 28 ENERGY POL'Y 817, 817 (2000).

8 *See, e.g.*, Elisabeth Graffy & Steven Kihm, *Does Disruptive Competition Mean a Death Spiral for Electric Utilities?*, 35 ENERGY L.J. 1, 2 (2014); DELOITTE CTR. FOR ENERGY SOLS, THE NEW MATH: SOLVING THE EQUATION FOR DISRUPTION TO THE U.S. ELECTRIC POWER INDUSTRY 1–8 (2014), http://www2.deloitte.com/content/dam/Deloitte/us/Documents/energy-resources/us-energyandresources-the-new-math.pdf [https://perma.cc/5CYL-PY6E]; PETER KIND, EDISON ELEC. INST., DISRUPTIVE CHALLENGES: FINANCIAL IMPLICATIONS AND STRATEGIC RESPONSES TO A CHANGING RETAIL ELECTRIC BUSINESS 19 (2013), http://www.eei.org/ourissues/finance/documents/disruptivechallenges.pdf [https://perma.cc/D9N3-AC24]; *see also* Alex Morales, *'Stranded Assets': Will Efforts to Counter Warming Render Energy Reserves Worthless?*, WASH. POST (Dec. 5, 2014), https://www.washingtonpost.com/business/stranded-assets-will-efforts-to-counter-warming-render-energy-reserves-worthless/2014/12/05/ecbc73a6-7a45-11e4-9a27-6fdbc612bff8_story.html [https://perma.cc/87P5-QPZT] (describing a similar threat to the fossil fuel industry more generally). To underscore the significance of stranding impacts of the impending transition, one study envisions that the global stranded-cost impact of the impending transition is in the range of $25 trillion for the entire energy sector. *See* DAVID NELSON ET AL., CLIMATE POLICY INITIATIVE, MOVING TO LOW-CARBON ECONOMY: THE IMPACT OF POLICY PATHWAYS ON FOSSIL FUEL ASSET VALUES, at IV, 12–13 (2014), http://climatepolicyinitiative.org/wp-content/uploads/2014/10/Moving-to-a-Low-Carbon-Economy-The-Impacts-of-Policy-Pathways-on-Fossil-Fuel-Asset-Values.pdf [https://perma.cc/BA37-PWXK].

9 Charles G. Stalon, Consultant on Energy Regulation, Presentation for the Electric Industry in Transition Conference Session on What Are the Transition Costs to a More Competitive Market and Who Should Pay?: Stranded Investment Costs: Desirable and Less Desirable Solutions 2 (June 15, 1994), https://www.hks.harvard.edu/hepg/Papers/Stalon_Stranded_Costs_0694.pdf [https://perma.cc/8QGK-N44Z].

costs are those investments that a utility has incurred to meet its obligation to serve customers with an expectation of cost recovery through rates, but which can no longer be recovered due to a change in the industry.[10] This article's initial working definition of stranded costs is simple: Existing energy infrastructure that retains some useful life, but that can no longer generate initially expected revenue due to regulatory shifts, market forces, or innovation. In addition, this article emphasizes that in the transition to decarbonization, the stranded cost issue will be just as significant for new investments in energy resources as it is for existing infrastructure.

This article maintains that energy regulators' traditional approach to stranded cost compensation for existing resources during industry transitions suffers from myopia and must be reformed to address the transition to decarbonization. The traditional notion of stranded costs is rooted in an understanding of regulation known as the "regulatory compact (or contract),"[11] under which the utility takes on an obligation to serve customers and, in return, is guaranteed an opportunity to recover the costs of its investments. This approach worked for decades to provide *some* degree of certainty to investors, though its flaws are also well known.[12] In addressing new stranded cost challenges and opportunities, energy law can best facilitate a balance between promoting investor certainty and providing flexibility by being proactive, recognizing that past approaches to stranded cost recovery could just as easily thwart as facilitate decarbonization.

This article proceeds as follows. Part I argues that stranded cost recovery mechanisms over the past fifty years have fixated on honoring the "deal" of the regulatory contract for incumbent firms and their investors. Furthermore, regulators have seriously grappled with transition costs issues only after a change in conditions has occurred. Each time a new energy transition takes place, energy regulators have provided for significant stranded cost compensation, though it is not always clear that the manner in which they did so provided sound investment signals for the energy system. Moreover, stranded

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[10] William J. Baumol & J. Gregory Sidak, *Stranded Costs*, 18 HARV. J.L. & PUB. POL'Y 835, 835 (1995).

[11] *See* Jersey Cent. Power & Light Co. v. Fed. Energy Regulatory Comm'n, 810 F.2d 1168, 1189 (D.C. Cir. 1987) (Starr, J., concurring) (referencing the term).

[12] Particularly salient examples include the numerous canceled nuclear and coal-fired power plants in the 1980s and the major shifts associated with moving to competitive electricity markets. *See, e.g.*, John Burritt McArthur, *Cost Responsibility or Regulatory Indulgence for Electricity's Stranded Costs?*, 47 AM. U. L. REV. 775, 779–80 (1998) (electricity restructuring); Richard J. Pierce, Jr., *The Regulatory Treatment of Mistakes in Retrospect: Canceled Plants and Excess Capacity*, 132 U. PA. L. REV. 497, 497 (1984) (coal and nuclear). See *infra* Section I.A for further discussion.

cost recovery has often stood in the way of change, failing to sufficiently address the "stranded benefits" of new transitions[13] or the broader social values advanced by industry transitions. In large part, this has happened because stranded cost recovery has been addressed only ex post, when a fixation on losses to a firm's existing investments drives the discussion. This article maintains that this stranded cost myopia has distorted some necessary investment signals, magnified an excess capacity problem with some baseload power generators, thwarted new entrants, and prolonged the energy sector's dependency on existing energy infrastructure, including many fossil fuel plants.

Part II turns to the energy sector's transition to decarbonization. This transition to a new, low-carbon normal challenges every part of this sector, including resource extraction, power generation, transmission, and distribution. Given regulators' past appetite for stranded cost compensation, one can expect incumbent firms to raise new calls for stranded cost compensation each time a new change is proposed.[14] Even now, several coal companies have already filed for bankruptcy, some nuclear power plants are at risk for early closure, and local utilities are fighting rooftop solar incentives such as net metering.[15] At the same time, policymakers and industry representatives often speak of natural gas, and, increasingly, nuclear power, as bridge fuels that will facilitate the transition to a low-carbon future.[16] The simple reality is that energy regulation is not particularly adept at "temporary"—and once approved, incumbent firms expect their assets to stay in operation and produce revenue as long as they can convince regulators to allow

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[13] "Stranded benefits" are those off-setting benefits that transitions can create for firms in an industry or their investors. *See infra* Section I.B.2.

[14] *See, e.g.*, William J. Baumol & J. Gregory Sidak, *The Pig in the Python: Is Lumpy Capacity Investment Used and Useful?*, 23 ENERGY L.J. 383, 395–98 (2002); Jim Chen, *The Nature of the Public Utility: Infrastructure, the Market, and the Law*, 98 NW. U. L. REV. 1617, 1699–70 (2004) (reviewing GOSE A. GÓMEZ-IBÁÑEZ, REGULATING INFRASTRUCTURE: MONOPOLY, CONTRACTS, AND DISCRETION (2003)).

[15] *See* Richard Martin, *Battles over Net Metering Cloud the Future of Rooftop Solar*, MIT TECH. REV. (Jan. 5, 2016), https://www.technologyreview.com/s/545146/battles-over-net-metering-cloud-the-future-of-rooftop-solar/ [https://perma.cc/6WG7-JPMN] (describing several such challenges).

[16] WEISSMAN, *supra* note 3, at 1; *see also* Order Adopting a Clean Energy Standard at 1, Nos. 15-E-0302, 16-E-0270 (N.Y. P.U.C. Aug. 1, 2016) (listing among the purposes of the new clean energy standard "to preserve existing zero-emissions nuclear generation resources as a bridge to the clean energy future"). New York has approved a Clean Energy Standard that, among other things, seeks to maintain its nuclear fleet as the state transitions to 50% non-emitting electricity by the year 2030. *See* Denise Grab & Burcin Unel, *New York's Clean Energy Standard Is a Key Step Toward Pricing Carbon Pollution Fairly*, UTIL. DIVE (Aug. 18, 2016), http://www.utilitydive.com/news/new-yorks-clean-energy-standard-is-a-key-step-toward-pricing-carbon-pollut/424741/ [https://perma.cc/CAN6-UE6A].

it. At the very minimum, if left unaddressed, these stranded cost issues threaten to delay the transition to decarbonization.

As Part III discusses, the transition to decarbonization requires regulators to address stranded costs, though to avoid carbon lock-in they must apply similar principles to both new and old energy infrastructure. Even so, as Part III also discusses, treating old and new assets neutrally does not necessarily mean the end of stranded cost recovery with a transition toward decarbonization. Instead, stranded cost issues will remain as important as ever, albeit with a new focus. Investors will continue to seek some commitment from the regulatory process before moving forward,[17] and each successive capital investment decision in new energy infrastructure will represent an irreversible choice for decades into the future. But these concerns need not necessitate a wholesale reconstruction of energy law. Rather, we think that the transition to a post-carbon energy sector presents regulators with an opportunity to draw from some of energy law's traditional tools to better approach risk compensation—encouraging a more adaptive and flexible grid than in the past, while also attracting new investment by addressing stranded costs proactively in ways that recognize both market and nonmarket values.

Moving forward, a presumption or expectation in favor of stranded cost compensation based on past experience could be counterproductive, delaying and frustrating to the transition toward decarbonization. But realistically, some stranded cost compensation will be essential to the decarbonization transition. If approached in a careful manner, stranded cost recovery can facilitate the transition toward decarbonization by encouraging investors and firms to better price the core market and nonmarket attributes of energy resources. To do so, regulators need to pay attention to the timing of cost allocation, avoiding the temptation to address stranded costs only at the back end of the carbon transition. For example, as discussed in more detail below, regulators making decisions regarding major new infrastructure projects like pipelines and transmission lines should be attentive to stranded cost issues before approving projects, instead of waiting to address stranded costs only after change has occurred.[18]

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[17] Eliminating such commitments altogether would likely drive up the overall cost of capital for regulated utilities. *See* Emily Hammond & Richard J. Pierce, Jr., *The Clean Power Plan: Testing the Limits of Administrative Law and the Electric Grid*, 7 GEO. WASH. J. ENERGY & ENVTL. L. 1, 6 (2016).

[18] *See infra* Section III.B.1.

Regulators providing for stranded cost recovery must also be attentive to social values that are not currently priced in energy markets. Changes associated with decarbonization present a particularly propitious opportunity for regulators to address important values such as reliability and carbon impacts of various energy resources in stranded cost compensation, especially where the competitive energy markets fail to price these features of energy resources.[19] This article proposes some ways for stranded cost recovery to better recognize these positive benefits associated with regulatory transitions for new energy resources, without conflicting with federal energy market policy.

Reforms that address regulatory risk through early stranded cost recovery will inevitably come at some cost to consumers in the near term, yet a return on investment is imperative to attracting capital for new infrastructure that will facilitate a balanced portfolio of energy resources for a decarbonized grid.[20] If stranded costs for both new and old resources are addressed with similar principles in mind, the net effect should be to reduce the overall cost of capital investments necessary for a decarbonized energy system.

I. ENERGY LAW'S STRANDED COST HISTORY

Over the past half century, the energy sector has undergone some remarkable transformations. The regulatory contract that has predominated energy law's history envisions a utility taking on customer service obligations in exchange for a guarantee that its investors will be compensated for risk.[21] Even with traditional rate regulation, changing economic conditions, technological obsolescence, and unexpected shifts in regulatory approach have presented a threat to investors in energy firms.[22] Specifically, investors have faced the risk that an energy utility's investments would be rendered stranded as a result of transitions. If energy law cannot find ways to compensate investors for stranded costs, this will adversely affect the overall

[19] For discussion of the general issue, see Emily Hammond & David B. Spence, *The Regulatory Contract in the Marketplace*, 69 VAND. L. REV. 141, 192–214 (2016).

[20] Low returns available to investors are often seen as a barrier to attracting the investment necessary to decarbonize the electric power sector. *See, e.g.*, WORLD ECON. FORUM, THE FUTURE OF ELECTRICITY: ATTRACTING INVESTMENT TO BUILD TOMORROW'S ELECTRICITY SECTOR 7 (2015), http://www3.weforum.org/docs/WEFUSA_FutureOfElectricity_Report2015.pdf [https://perma.cc/SL87-7LJN].

[21] *See* Hammond & Spence, *supra* note 19, at 149–51 (describing traditional regulation).

[22] *E.g.*, Pierce, *supra* note 12, at 500.

cost of capital for new infrastructure, requiring firms to incur higher interest rates to attract debt and equity investors.

Over the past half century, the energy industry has undergone three significant stranded cost experiments: disallowance of construction costs for canceled nuclear power plants in the 1980s;[23] "take-or-pay" natural gas supply contracts associated with gas pipeline open access;[24] and stranded power generation assets associated with the transition to competitive electric power markets.[25] As described in more detail below, in each of these scenarios, significant amounts of economic capital were threatened by transition. As each transition took place, energy investors (and utilities) made forecasts of major economic loss and, at the extreme, financial catastrophe. In most instances, regulators drew on tools (often with controversy) to mitigate adverse financial impacts associated with the impending transition. By deferring any focus on compensating investors for the risks of change to the future, regulators in the past were able to keep the cost of new capital for energy firms low—although once change was imminent, the focus shifted to stranded cost compensation as a way to address these risks ex post.

Despite some industry prognostications, the sky never did fall with past energy industry transitions. But that also does not mean that stranded cost compensation always produced good results. In the past, regulators consistently favored stranded cost compensation ex post—that is, after projects (and their expected investments costs) had been approved, and sometimes decades after assets had been constructed and used to produce and deliver energy. By only really addressing the issue of stranded costs *after* initial investment decisions have been made, many regulators based stranded cost calculations on perceived investor losses related to a large-scale, already-approved capital asset. This ex post environment for determining stranded costs invited industry stakeholders to present regulators with grossly exaggerated claims of the adverse impact of a transition on the firm's investors and to present little or no evidence of how a change would produce benefits for the firm or others. This approach to stranded cost compensation may have assuaged regulators, firms, and their

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[23] Though less frequently mentioned, this issue extended to coal-fired plants as well. *See id.* at 498–99 (documenting both nuclear and coal-fired plant cancellations).

[24] *E.g.*, Hollye C. Doane, *Take-Or-Pay: FERC's Regulatory Dilemma*, 2 SPRING NAT. RES. & ENV'T 18, 18 (1987) ("No other issue in the history of the Federal Energy Regulatory Commission (FERC) has caused such paralysis . . . .").

[25] *See* Jim Rossi, *The Electric Deregulation Fiasco: Looking to Regulatory Federalism to Promote a Balance Between Markets and the Provision of Public Goods*, 100 MICH. L. REV. 1768, 1778–79 & n.25 (2002) (describing stranded cost recovery associated with California deregulation and collecting criticisms).

investors, but it resulted in myopia that exaggerated stranded costs losses to investors, delayed regulatory change, and ignored any broader assessment of the social costs and benefits associated with transitioning. Regulators determining stranded costs in this manner did a poor job of separating the common economic and technological risks that any business investor would expect, from regulatory risks over which firms have little or no control.

A. Past Stranded Cost Experiments

As should be evident, discussions of stranded costs in the energy industry are hardly new. Threats to investor expectations due to new technologies or changing economic conditions have a long legacy in regulated industries. For example, the impact of new technologies and new market entrants was at the core of the dispute of the landmark Charles River Bridge case, which clarified principles surrounding monopoly and innovation prior to industrial development.[26] In deciding that important case 180 years ago, the Supreme Court endorsed the principle that a monopoly's charter should be interpreted narrowly to favor new entrants.[27] Yet stranded cost compensation experiments over the past fifty years in the energy industry seem to run against the grain of this longstanding principle, with regulators consistently finding ways to ensure that investor-backed expectations are not upset by industry changes.[28] As these experiments show, instead of being wary of stranded costs, regulators have shown a considerable appetite for compensating investors post hoc, routinely approving customer charges designed to guarantee an incumbent energy utility one hundred percent compensation for stranded costs during regulatory, economic, and technological transitions in the energy sector.[29]

1. Excess Capacity and Canceled Nuclear Power Plants

One high-profile stranded cost issue was associated with new nuclear power plants—many of which were canceled mid-construction—and the subsequent disallowance of cost recovery

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[26] Proprietors of the Charles River Bridge v. Proprietors of the Warren Bridge, 36 U.S. 420 (1837).

[27] *Id.* For a general discussion of the history of the case, see STANLEY I. KUTLER, PRIVILEGE AND CREATIVE DESTRUCTION: THE CHARLES RIVER BRIDGE CASE (1971).

[28] *See infra* Sections I.A.1–3.

[29] *See infra* Sections I.A.1–3.

by regulatory commissions in the 1970s and '80s.[30] In the late 1960s and early 1970s, nuclear power looked like a prudent investment: electricity demand was projected to sharply increase, and nuclear power (and coal) appeared to be a far better investment than oil- and gas-fired plants.[31] Not only was nuclear power projected to be less costly to operate, but natural gas was in very short supply, and the United States had national security concerns about relying on foreign oil.[32] But by the late 1970s and into the 1980s, things changed. Demand did not increase as expected, Three Mile Island prompted concerns about the safety of nuclear power, and both world oil and the domestic natural gas markets underwent substantial price reductions.[33] Utilities were left holding excess generating capacity, and it became clear that newer power generation technologies could produce power more cheaply than nuclear plants.[34] Over 120 partially constructed plants were canceled, and the question of how to address the resulting stranded costs loomed large.[35]

In the end, many of these plants received full or at least partial cost recovery. As Richard Pierce describes it, the policy effect of the regulatory response was to provide many private utilities compensation for what, in retrospect, were considered mistakes—perhaps in part because the regulatory process encouraged investment in large baseload power generation plants.[36] Forcing the utilities to bear the full costs of cancellations would have ignored this regulatory relationship and, moreover, would have served to increase the overall cost of capital associated with these investments, perhaps putting the utility out of business.[37] On the other hand, allowing full cost recovery for every loss a firm incurred due to investment decisions that were mistakes in retrospect would have unfairly burdened customers. Thus, it would have been politically untenable and would have significantly diverged from how a competitive market would approach investment risks.[38]

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[30] *See* EISEN ET AL., ENERGY, ECONOMICS AND THE ENVIRONMENT: CASES AND MATERIAL 400–02 (4th ed. 2015) (describing changes in the nuclear energy sector over time).

[31] Pierce, *supra* note 12, at 500–01.

[32] *Id.*

[33] EISEN ET AL., *supra* note 30, at 400–02.

[34] *Id.*

[35] *Id.* at 401.

[36] *See* Pierce, *supra* note 12, at 499.

[37] *See* Legislative Util. Consumers' Council v. Pub. Serv. Co., 402 A.2d 626, 629 (N.H. 1979) (describing financial struggles of utility undertaking nuclear power plant construction).

[38] Pierce, *supra* note 12, at 506.

Some jurisdictions famously did not allow for stranded cost recovery at all. In the landmark decision *Duquesne Light Co. v. Barasch*,[39] for example, the Supreme Court rejected a Takings Clause challenge brought by the owners of canceled nuclear power plants that had been denied cost recovery for investments that had been deemed prudent when they were initially made.[40] More often, however, state commissions allowed nuclear power companies to recover from customers at least some of their stranded costs, whether these were attributed to excess capacity or for canceled plants.[41] And a few plants under construction during this time were permitted to recover from customers for construction works in progress (CWIP), representing regulators' recognition of the uncertain economic and regulatory environment for new nuclear plants and the need for substantial lines of credit early in the construction phase.[42]

Significantly, canceled nuclear plants were not a transition cost that regulators or investors had accurately predicted at the time they approved the plants in the first place. Rather, these stranded cost recovery decisions were routinely made *after* plants had undergone "prudence" review (the reasonableness review rate regulators apply to new investments) and were approved for construction. Still, routine ex post stranded cost recovery, independent of the initial decision of the firm (and its investors) to incur the costs of nuclear power generation facilities, could have an undeniable impact on the cost of capital and investment decisions. If at the time of making investment decisions, investors routinely expected this kind of ex post compensation (perhaps the regulatory contract encouraged them to do so), the initial cost

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[39] 488 U.S. 299 (1989).

[40] *Id.* at 302–03. Though the Court was not receptive to the utilities' claim that the Constitution requires stranded cost recovery for canceled nuclear plants, it also did not dismiss the idea that the Constitution provides a floor to protect investor-based expectations. *Id.* at 310. At the extreme, the Court noted, a rate still could be so low that it is confiscatory, especially if a firm is not allowed to compensate its investors at all for the financial risks that they incur. *Id.* at 314–15 ("[R]eturn to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks." (alteration in original) (quoting Fed. Power Comm'n v. Hope Nat. Gas Co., 320 U.S. 591, 603 (1944))). In addition, a regulator cannot "arbitrarily switch back and forth between methodologies in a way which required investors to bear the risk of bad investments at some times while denying them the benefit of good investments at others." *Id.* at 315.

[41] *See generally* Pierce, *supra* note 12 (detailing examples of such cases).

[42] *E.g.*, Legislative Util. Consumers' Council v. Pub. Serv. Co., 402 A.2d 626, 629, 641 (N.H. 1979) (upholding state commission's authority to allow construction funds for Seabrook nuclear plant to be recovered in CWIP); *cf.* Jersey Cent. Power & Light Co. v. Fed. Energy Regulatory Comm'n, 810 F.2d 1168, 1185–86 (D.C. Cir. 1987) (noting that FERC might permissibly allow utilities to include some unamortized costs of canceled plants in rate base).

of capital for a regulated utility would be lower than that of a competitive firm. To the extent this was the case, utility regulators (and the regulatory contract) effectively insured the risk of change for private investors. Against the backdrop of rate regulation, this artificially low cost of capital could have encouraged overinvestment in large baseload plants, contributing even further to excess capacity. On the other hand, if no compensation for harms caused by the regulatory change were expected by investors ex ante (i.e., at the time of the initial investment in the firm), investors would demand a risk premium (and a higher return on investment) to insure themselves against the possibility of change. So without stranded cost recovery, the firm's cost of capital would need to be priced higher to reflect this risk. A higher cost of capital would have discouraged new investments in these assets, given that regulators were attentive to the cost of capital in approving new investments and setting utility rates. So allowing for stranded cost recovery provided regulators a delicate way of balancing a need for investor certainty to attract capital with their need to keep the cost of capital for new infrastructure as low as possible, minimizing immediate impacts of new infrastructure on customer rates.

2. Natural Gas Pipelines and Take-Or-Pay Contracts

A second stranded cost recovery experiment from the past half century is associated with the Federal Energy Regulatory Commission's (FERC) implementation of open access in natural gas pipelines to encourage competition in interstate gas supply markets. Congress began restructuring the natural gas industry in the late 1980s by unbundling gas sales from pipeline transportation services and providing equal access to the latter.[43] This approach recognized that traditional gas regulation's approach to setting a single rate for pipeline gas had failed to see that there are two or more distinct markets bundled together, only one of which is a natural monopoly (i.e., the "pipes"). FERC set out to "unbundle" these distinct markets, implementing an "open access" regulatory scheme that applies only to the natural monopoly market so that all producers have access to the pipelines on similar terms to ship their gas to the buyer who offers them the best deal.[44]

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[43] *See generally* Richard J. Pierce, Jr., *Reconstituting the Natural Gas Industry from Wellhead to Burnertip*, 9 ENERGY L.J. 1 (1988) (discussing natural gas industry restructuring).

[44] *Id.* at 24–27.

However, pipelines' stranded costs presented a barrier to the transition to this new competitive market.[45] To support pipeline construction and operation, many pipelines had committed billions of dollars in long-term "take-or-pay" contracts at very high prices. These contracts obligated pipelines to pay their suppliers, even when pipelines could not take the gas.[46] In initially addressing the transition to pipeline deregulation, FERC refused to grant pipeline requests for take-or-pay relief.[47] FERC's Order 436,[48] described by the D.C. Circuit as a "complete restructuring" of the industry,[49] did not provide for any take-or-pay compensation because pipelines were successfully negotiating themselves out of these obligations without FERC's assistance.[50] But the D.C. Circuit vacated that aspect of Order 436, accusing FERC of "blindness" to the impacts of open access on pipelines, as well as a "tendency to elevate into affirmative benefits what are at best palliatives."[51] Without meaningful take-or-pay contract relief, the D.C. Circuit likened the voluntary open access option FERC had provided pipelines to "the choice between the noose and the firing squad."[52] When FERC continued to refuse any compensation for take-or-pay contracts on remand, the D.C. Circuit again rejected the agency's approach, charging FERC with attempting to delay indefinitely until the issue went away.[53]

FERC addressed the issue in Order 500, which adopted an equitable splitting of take-or-pay costs.[54] As FERC stated there:

> The Commission recognizes that it is difficult to assign blame for the pipeline industry's take-or-pay problems. In brief, no one segment of the natural gas industry or particular circumstance appears wholly responsible for the pipelines' excess inventories of gas. As a result, all segments should shoulder some of the burden of resolving the problem.[55]

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[45] For discussion, see Donald F. Santa, Jr. & Clifford S. Sikora, *Open Access and Transition Costs: Will the Electric Industry Transition Track the Natural Gas Industry Restructuring?*, 25 ENERGY L.J. 113, 139–43 (2004).

[46] For an overview, see EISEN ET AL., *supra* note 30, at 551–54.

[47] Order 380, 49 Fed. Reg. 22,778, 22,787 (1984).

[48] Order 436, 50 Fed. Reg. 42,408 (1985).

[49] Associated Gas Distribs. v. Fed. Energy Regulatory Comm'n, 824 F.2d 981, 993 (D.C. Cir. 1987).

[50] *Id.* at 1023.

[51] *Id.* at 1025.

[52] *Id.* at 1024.

[53] Am. Gas Ass'n v. Fed. Energy Regulatory Comm'n, 888 F.2d 136, 148 (D.C. Cir. 1989).

[54] Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol (Order 500), 52 Fed. Reg. 30,334 (Aug. 7, 1987).

[55] *Id.* at 30,337.

In Order 500, FERC still failed to endorse full recovery of pipeline stranded costs, perhaps because the very existence of these take-or-pay contracts indicated that pipelines were aware of some risks of changing economic conditions. In Order 636, which completed FERC's gas pipeline restructuring, FERC finally allowed pipelines to bill customers for one hundred percent of their remaining stranded costs,[56] though the agency was also careful to note that the equitable sharing approach of the past (as endorsed by Order 500) had been necessary to "encourage pipelines to share some of the cost of the extraordinary take-or-pay liabilities of the early and mid-1980's."[57] Although the D.C. Circuit had made it clear that FERC could not completely ignore the impact on investors of take-or-pay contracts during pipeline market restructuring, it bears emphasis that the agency was never legally obligated to provide one hundred percent recovery for stranded costs associated with transitioning from regulated to competitive gas markets—even though Order 636 ultimately took this policy position.

The nature of the stranded costs incurred by pipelines during this transition differed from nuclear stranded costs. Fuel costs are a relatively small component of the costs of operating a nuclear power plant, so nuclear stranded cost compensation debates were driven by the fixed costs of the assets.[58] By contrast, given how pipeline contracts were executed in the industry, pipelines' claims to stranded costs were driven almost entirely by the volatility in gas markets.[59] The use of stranded cost recovery to compensate firms for this risk made it even more difficult for regulators to assess which risks were appropriate for investors, on the one hand, and consumers, on the other. Still, as with nuclear power plants, stranded cost recovery for take-or-pay contracts was approved post hoc, after these contracts were executed, so this was not a risk that pipeline investors were presumably compensated for in their initial return on investment. Ex post stranded cost recovery helped to keep the cost of capital for approved pipeline projects low, while also providing investors compensation for risks of change as they materialized, rather than in a higher return on their initial investment.

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[56] Pipeline Service Obligations and Revisions to Regulations Governing Self-Implementing Transportation; and Regulation of Natural Gas Pipelines After Partial Wellhead Control (Order 636), 57 Fed. Reg. 13,267, 13,281, 13,307 (Apr. 8, 1992).

[57] *Id.* at 13,308.

[58] *See* Pierce, *supra* note 12, at 497–98 (detailing cost recovery claims).

[59] *See* EISEN ET AL., *supra* note 30, at 551–54 (detailing stranded cost issues for pipelines).

3. Competitive Restructuring of the Electric Power Industry

A third and more recent experiment with stranded cost recovery relates to the competitive restructuring of the electric power industry in the 1990s. For most of the twentieth century, the electric utility had been regulated as a natural monopoly, but a range of reforms in the 1970s and '80s led to efforts to restructure the industry toward competitive markets, much in the manner that FERC had reformed natural gas markets.[60]

This transition revived concern about constitutional takings of the sort that pepper the history of energy law,[61] repackaged for this particular set of events as "deregulatory takings."[62] These stranded cost claims included requests to allow regulatory compensation for some power plant assets that were no longer considered valuable in competitive power markets, in a similar manner to canceled nuclear plants.[63] However, many firms' claims to stranded costs from electric power restructuring also related to lost expected income given the change in regulatory rules. Just as with gas pipeline stranded cost compensation, this kind of focus on income streams stranded by regulatory transition challenged the ability of regulators to separate ordinary business risks over which the firm (and its investors) have some degree of control, from regulatory risks associated with the transition to competitive electric power markets.[64] Estimates of utilities' stranded costs in the transition to competitive electric power markets ranged from $10 billion to $500 billion, with most estimates falling in the $100 billion to $200 billion range.[65]

As with nuclear power plants' stranded cost recovery, courts were not receptive to legal claims that the Constitution required full compensation for all revenue lost during a

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[60] *See generally* Richard J. Pierce, Jr., *The State of the Transition to Competitive Markets in Natural Gas and Electricity*, 15 ENERGY L.J. 323 (1994) (comparing the transitions to competition in natural gas and electric power).

[61] *E.g.*, Duquesne Light Co. v. Barasch, 488 U.S. 299, 301–02 (1989) (takings challenge regarding cost recovery for canceled nuclear power plants); Fed. Power Comm'n v. Hope Nat. Gas Co., 320 U.S. 591 (1944) (takings challenge for method of computing cost recovery).

[62] J. GREGORY SIDAK & DANIEL F. SPULBER, DEREGULATORY TAKINGS AND THE REGULATORY CONTRACT, at xiii (1997).

[63] *See generally id.*

[64] *Cf.* Jim Rossi, *The Irony of Deregulatory Takings*, 77 TEX. L. REV. 297, 307 (1998) (reviewing J. GREGORY SIDAK & DANIEL F. SPULBER, DEREGULATORY TAKINGS AND THE REGULATORY CONTRACT: THE COMPETITIVE TRANSFORMATION OF NETWORK INDUSTRIES IN THE UNITED STATES (1997)).

[65] CONG. BUDGET OFF., ELECTRIC UTILITIES: DEREGULATION AND STRANDED COSTS 15 (1998).

transition to a competitive electricity market.[66] However, despite a lack of any judicial mandate to provide for full stranded cost compensation, regulators routinely found ways to help mitigate the stranded cost impacts on firms and investors of the regulatory transition to competitive markets. In Order 888, issued in 1996, FERC adopted an open access regime for wholesale electric power supply, similar to its competitive market approach for natural gas.[67] In contrast to FERC's initial shared cost allocation for take-or-pay contracts,[68] FERC allowed utility shareholders to recover one hundred percent of the stranded costs associated with transitioning to a competitive wholesale power supply industry.[69] In adopting retail competition plans, states such as California also allowed for full stranded cost recovery.[70] Importantly, however, some states transitioning to competitive retail power markets refused to allow for the full recovery of stranded costs or denied them altogether.[71]

B. Stranded Cost Myopia

These past experiments with stranded cost recovery and the tools used by regulators to address them share some common characteristics that contributed to a blinkered regulatory perspective, distorting the cost of capital to consistently favor old energy infrastructure over new entrants and new projects. Importantly, they were not driven by judicial mandate[72] so much as by political and regulatory processes that invited utilities (and their investors) to invest resources in lobbying for compensation for the stranded costs associated with industry changes, typically in the form of additional charges that customers would pay in their future bills. While this approach to stranded cost compensation was designed to ensure that the

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[66] John Burritt McArthur, *The Irreconcilable Differences Between FERC's Natural Gas and Electricity Stranded Cost Treatments*, 46 BUFF. L. REV. 71, 104–06 (1998); Susan Rose-Ackerman & Jim Rossi, *Disentangling Deregulatory Takings*, 86 VA. L. REV. 1435, 1457–68 (2000).

[67] Order 888, 61 Fed. Reg. 21,540 (Apr. 24, 1996).

[68] McArthur, *supra* note 66, at 73–76.

[69] *Id.* at 83, 93.

[70] *See infra* note 71.

[71] California allowed for one hundred percent stranded cost recovery in its retail market transition; other states, by contrast, provided for only partial stranded cost recovery or were outright hostile to stranded cost recovery claims, forcing firms to take the initiative in selling off uneconomic assets. *See* Elizabeth A. Nowicki, *Denial of Regulatory Assistance in Stranded Cost Recovery in a Deregulated Electricity Industry*, 32 LOY. L.A. L. REV. 431, 442–43 (1999).

[72] *See* Rossi, *supra* note 64, at 306–07 (noting that since *Market Street Railway v. Railroad Commission*, 324 U.S. 548 (1945), "courts have consistently imposed on regulated firms the risk of changing technological and economic circumstances").

firm would be able to continue to attract capital at a low cost to customers, it also served to lock in the status quo, resulting in delays in industry transitions, including slowing the onset of new technologies.[73] The narrowly focused nature of these past experiments involved both the timing of stranded cost recovery and a regulatory lack of appreciation for values beyond the immediate adverse financial impact of transitions on investors.

1. Ex Post Recovery Mechanisms

As described above, a common feature of these past experiments with stranded cost compensation is an appetite, on the part of both regulators and firms, for transition cost recovery at the back end of investment decisions. These past examples do not illustrate a regulatory process that makes a concerted effort to address stranded costs before investment decisions are made or at the time of their initial approval. Hindsight is always 20/20, so such ex post recovery of stranded costs serves to avert acknowledgment of any past mistakes on the part of regulators or firms. On the other hand, providing compensation for investment decisions gone wrong only ex post can look more like a form of industry bailout than traditional cost-based decision making, which would encourage actors to price any risk of change into their initial investment decisions.

These experiments show that stranded cost compensation helped to routinely ensure that investor risks were not ignored. As described above, however, this practice could contribute to an artificially low initial cost of capital for new investments. If regulators themselves were ensuring against regulatory change, investors (and the firm) had no incentive to demand a return on investment that prices the risks of regulatory change in present value as new infrastructure investment decisions were made. As Richard Pierce has chronicled, for example, with respect to the stranded cost problems associated with excess nuclear capacity, the regulatory tools used to address those problems exacerbated them, arguably encouraging rate-regulated utilities to overinvest in certain forms of power supply.[74]

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[73] This, of course, was one of the concerns famously raised by the Proprietors of the Charles River Bridge and rejected by Chief Justice Taney's majority, which reasoned that the loss of profit from the construction of a new bridge was simply irrelevant to determining the state's contractual obligations surrounding a monopoly charter, especially where the public stood to benefit from new technology. Proprietors of the Charles River Bridge v. Proprietors of the Warren Bridge, 36 U.S. 420, 544 (1837) (noting "any ambiguity in the terms of the [regulatory] contract, must operate against [the private company], and in favor of the public").

[74] Pierce, *supra* note 12, at 506.

At the same time, energy law's historic appetite for back-end cost recovery with changing circumstances systematically encouraged firms to lobby against regulatory change and, once changed seemed imminent, to make inflated claims for stranded cost recovery. To take one example, with the impending competitive restructuring of the electric power industry, the industry claimed that stranded costs would be in the hundreds of billions[75] and that restructuring would potentially force many utilities into bankruptcy. Not every firm made substantial profits in the transition to competitive markets, but today it is recognized that the actual stranded costs incurred by firms were far less—closer to $10 billion—even though early estimates and the regulatory and legislative process provided for transition recovery in excess of $100 billion.[76] Addressing stranded costs after an investment decision is more likely to lead to systematic overcompensation for regulatory risk because of loss aversion, or the exaggerated value a firm (especially a regulated firm with long-lived, capital-intensive assets) might place on losing revenue streams they have received in the past.[77] Out of fear of seeing their past investments lose existing revenue, many energy firms and their investors routinely overstated their stranded cost losses.[78] Regulators too feared criticism for past decisions they made, and therefore were often complicit in approving stranded cost recovery for energy infrastructure that they approved or encouraged. The expectation that regulators would provide a back-end bailout—as happened with excess nuclear capacity, take-or-pay contracts, and competitive restructuring—encouraged firms to aggressively use the regulatory process to prolong the revenue streams associated with their assets.[79]

These experiments with stranded cost recovery also show how energy regulators routinely confused different kinds of risk

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[75] *See* CONG. BUDGET OFF., *supra* note 65, at 15.

[76] *Compare* Lori A. Burkhart, *Moody's Frowns at Stranded Costs*, PUB. UTIL. FORT. (Oct. 1, 1995), https://www.fortnightly.com/fortnightly/1995/10/moodys-frowns-stranded-costs [https://perma.cc/2SXV-DRG4] (noting that Moody's Investors Services estimates that "[t]he most likely scenario [with electric power restructuring] would produce $135 billion in stranded costs" and threaten the creditworthiness of utilities, with a possibility of as much as $500 billion in stranded costs), *with* Ola Kinnander, *Public Power: New Moody's Study May Lead to More Muni Utility Downgrades*, BOND BUYER, Nov. 3, 1999 (noting that a new Moody's study adjusted stranded cost estimates downward to $10 billion, in part because of rising energy and capacity prices and legislative compensation that softened actual stranded costs over a period of fewer than five years).

[77] Eyal Zamir, *Law's Loss Aversion*, *in* THE OXFORD HANDBOOK OF BEHAVIORAL ECONOMICS AND THE LAW ch. 11 (Eyal Zamir & Doron Teichman eds., 2014).

[78] *See id.*

[79] *See* Rossi, *supra* note 64, at 316.

in compensating firms for stranded costs. Risks of economic and technological change were frequently lumped together in discussions of stranded cost recovery, perhaps because the expectation of recovery alleviated any need for fine-tuning. As stranded cost compensation shifted from focusing on a specific capital asset (as with nuclear power plants) to focusing on broader investor expectations about issues that were tied to things such as long-term contracts and fuel costs, regulatory risks (over which presumably firms and their investors had little or no control) became muddled with ordinary business risks, over which firms and their investors had some degree of control. The result may have been to encourage a moral hazard problem of sorts, leading to overinvestment in energy infrastructure and more excess capacity: Utility investors could expect some compensation at the back-end not only for risks of regulatory change, but also for routine business risks associated with changes in economic and technological conditions.[80]

2. Stranded Values of Past Stranded Cost Recovery

In addition to contributing to excess capacity and discouraging private pricing of risk, energy law's past experiments with stranded cost recovery did a poor job of recognizing the private and social gains associated with transitions. A fixation on the regulatory contract focused primarily on harms related to financial impacts to the firm and its investors. Regulators gave little consideration to "stranded benefits," that is, the offsetting advantages that a transition might also present to those firms or investors that were claiming harm.[81] For example, in the transition to competitive electric power markets, after restructuring, many utilities retained transmission lines that would become valuable new profit centers in their future operations.[82] Another such benefit is the value older baseload power plants might provide as a reliability and price hedge when competitive electric power markets presented new volatilities. Such benefits were often ignored or downplayed in stranded cost debates. Indeed, there is some evidence to suggest that firms held back on disclosing their

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[80] *See* Rose-Ackerman & Rossi, *supra* note 66, at 1486–89.

[81] *See* Reed W. Cearley & Daniel H. Cole, *Stranded Benefits Versus Stranded Costs in Utility Deregulation*, *in* 7 THE END OF A NATURAL MONOPOLY: DEREGULATION AND COMPETITION IN THE ELECTRIC POWER INDUSTRY (Peter Z. Grossman & Daniel H. Cole eds., 2003) (defining stranded benefits as a transfer from ratepayers to investors, as opposed to investors to ratepayers).

[82] *See* Rossi, *supra* note 64, at 313 (suggesting transmission and distribution assets as stranded benefits).

plans to exploit new opportunities with deregulation (and hence any stranded benefits) until regulators had resolved stranded cost compensation.[83]

Moreover, past stranded cost experiments made almost no mention of the broader social costs and benefits associated with a regulatory transition, or its impact on the energy system. Regulators' focus on compensating firm-specific investor value provided for little serious consideration of the social costs associated with industry transitions. An emphasis on the financial impact of stranded investments to investors left little room for regulators to address other values like energy reliability or the environmental attributes of energy resources. Little or no attention was given to the costs imposed on others, such as new entrants or workers. Given the lack of any pricing for environmental externalities, neither was serious attention given to the environmental impact of the utility's investment decisions. If an investor suffered a financial loss, a stranded cost was considered equally meritorious for compensation, whether it supported the operation of a polluting coal plant or a nuclear plant or pipeline, each of which imposes very different impacts on surrounding communities.[84] A decision to compensate stranded costs meant that a resource would continue to operate into the future, but by prolonging the life of obsolete infrastructure without considering broader social costs and benefits, it also left many noneconomic values stranded. In other words, looking at the financial impacts of each energy resource on investors and the firm in isolation for purposes of stranded cost compensation has blinded regulators from considering how cost recovery for particular sources of energy supply has broader system-wide effects on the grid or on the overall balance of energy resources in the nation's power supply portfolio.

II. DECARBONIZATION'S IMPENDING STRANDED INVESTMENT THREAT

Decarbonization of the grid will not come cheap.[85] It stands to be one of the most significant economic transformations

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[83] *See* Sanjeev Bhojraj et al., *Voluntary Disclosure in a Multi-Audience Setting: An Empirical Investigation*, 79 ACCT. REV. 921, 939 (2004).

[84] In part, this was because energy law was considered to be a separate paradigm, entirely separate and distinct from environmental law. *See* Todd S. Aagaard, *Energy-Environment Policy Alignments*, 90 WASH. L. REV. 1517 (2015) (discussing modern synergies between energy and environmental law).

[85] The costs of a failure to achieve decarbonization, however, may be far greater. *See* Zero Zone, Inc. v. U.S. Dep't of Energy, Nos. 14-2147, 14-2159, 14-2334, 2016

the economy has experienced in the last century.[86] To the extent that the stranded costs associated with the transition to decarbonization have never been addressed, this threatens to slow any change, contributing to carbon lock-in in the energy sector[87] and discouraging new investment dollars from flowing to new decarbonized energy infrastructure. As these transitions occur, it can be predicted that the industry (and its investors) will continue to show a reluctance to retire any assets that have remaining useful life, regardless of their environmental attributes or whether those investments are stranded because of regulatory change, market forces, or technological innovation. One can expect these firms to aggressively seek ex post compensation. One also can expect incumbent firms to couch the potential for financial losses with the transition in stranded investment terms, inviting the regulatory process to leave important other values stranded.

Changes to infrastructure are already beginning to happen, leading to these kinds of claims for stranded cost compensation. This observation is perhaps most salient for existing coal plants, many of which are expected to be phased out of operation with the regulation of carbon emissions, as well as existing nuclear plants.[88] No doubt, some existing infrastructure will no longer be considered valuable as new environmental regulations come into effect and energy markets begin to price carbon emissions into investment decisions. Many existing assets will need to be retired to make room for more efficient and less polluting sources of energy, leading to a major shift in investment in the industry. Equally important is that new investment must simultaneously be pursued to allow decarbonization to succeed—which might include a massive investment in new-generation nuclear plants, combined-cycle

WL 4177217, at *16 (7th Cir. Aug. 8, 2016) (refusing to hold arbitrary and capricious a Department of Energy cost-benefit analysis that included the social cost of carbon).

86 All of the deep decarbonization scenarios "see a decline in traditional fossil fuel plant investment" of $10 billion. PATHWAYS TO DEEP DECARBONIZATION, *supra* note 1, at 48. Taking the "mixed" scenario as a starting point, "increases in annual electricity generation investments would increase $15 billion per year from 2021–2030" and over $30 billion per year from 2031–2040. *Id.* at 47. "By 2050, the electricity sector would need more than $50 billion per year of incremental investment" in electricity generation. *Id.* A "high renewables" case would require more than $70 billion per year of new generation investments by 2050. *Id.*

87 For a description of carbon lock-in, see Unruh, *supra* note 7, at 817.

88 *See* Claire Cameron, *Coal Is Going, Going . . . Gone?*, UTIL. DIVE (Apr. 24, 2014), http://www.utilitydive.com/news/coal-is-going-going-gone/253641/ [https://perma.cc/2KF6-ZKAB] (discussing the U.S. Energy Information Administration's (EIA) predictions of the retirement of a significant number of coal-based power plants, along with a growth in natural gas power generation); Hammond & Spence, *supra* note 19, at 173–92 (discussing challenges for nuclear power plants).

natural gas plants, large-scale new solar and wind projects, and the transportation infrastructure such as pipelines and transmission lines that will interconnect these resources. The transition to decarbonization shows how stranded cost issues are not unique to old resources, but will be increasingly important for new investments. Here, the article highlights the stranded investment issues decarbonization presents for some of these resources, which are already giving rise to new pleas for stranded cost compensation by incumbent firms in the industry. This section focuses on fossil fuel power plants, nuclear power plants, and energy transportation infrastructure.

A. Fossil Fuel Power Plants

Coal and natural gas power plants account for more than 60% of the grid's energy supply portfolio.[89] Many of these plants have already been in operation for decades. Given the high fixed costs that have been paid to build and keep these plants in operation, firms face strong incentives to keep them in operation as long as they produce positive revenue streams from energy sales. The marginal costs to the firm of using these plants to produce energy can be very low, depending on the price of the fuel they use to produce the next unit of energy.[90] The impact of the carbon transition on these "legacy" fossil fuel plants presents one of the most significant stranded cost barriers to the decarbonization transition.

Coal-fired power is the obvious loser in the transition to a low-carbon future.[91] The Clean Power Plan (CPP), for example, expressly contemplated a phase-out of existing coal—to be replaced in the short term by increased utilization of natural gas combined cycle (NGCC), and ultimately by increased new renewables penetration.[92] Even without the CPP, this transition

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[89] *See Frequently Asked Questions: What Is U.S. Electricity Generation by Energy Source?*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3 [https://perma.cc/J28S-CNCH].

[90] For an overview, see Hammond & Spence, *supra* note 19, at 156–63 (providing comparative cost profiles of various electricity fuels).

[91] *See* Hammond & Pierce, *supra* note 17, at 2. Of course, if carbon capture and sequestration (CCS) becomes a viable technology, there may be a role for coal. EPA's carbon emission rule for new power plants requires at least some use of this technology. Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,509, 64,512–13 (Oct. 23, 2015).

[92] For an early look at the projected future electricity fuel mix under the CPP, see Laura Martin & Jeffrey Jones, *The Effects of the Clean Power Plan*, CLEAN TECHNICA (June 24, 2016), https://cleantechnica.com/2016/06/24/effects-clean-power-plan/ [https://perma.cc/Z6MN-PJ5K] (providing an early look at the projected future electricity fuel mix under the CPP). While this article was in production, Donald Trump, who has called

is occurring: Existing Clean Air Act (CAA) mandates—including the Cross-State Air Pollution Rule[93] and the Utility MACT Rule[94]—have put pressure on coal-fired power in recent years, increasing both the capital and operating costs associated with such plants.[95] These are regulatory changes, but they should not be a surprise. The 1990 Clean Air Act Amendments directed EPA to address both cross-state air quality issues for criteria pollutants and toxic emissions from the power sector.[96] And although greenhouse gas (GHG) regulation under the CAA may have come as a surprise to some,[97] the power sector's role in climate change has long been recognized.[98] At the very least, serious conversations about mitigation in the United States are nearing a decade old.

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climate change a Chinese hoax, became President. Louis Jacobsen, *Yes, Trump Did Call Climate Change a Chinese Hoax*, POLITIFACT (June 3, 2016), http://www.politifact.com/truth-o-meter/statements/2016/jun/03/hillary-clinton/yes-donald-trump-did-call-climate-change-chinese-h/ [https://perma.cc/J5KX-KZCN]. Scott Pruitt, the Trump appointee leading EPA, is a vocal climate denier, and overall, the CPP appears doomed. Coral Davenport, *E.P.A. Head Stacks Agency with Climate Change Skeptics*, N.Y. TIMES (Mar. 7, 2017), https://www.nytimes.com/2017/03/07/us/politics/scott-pruitt-environmental-protection-agency.html [https://perma.cc/VM5N-GWUU]; Keith Goldberg, *Trump Win Could Moot Cases over Obama Climate Regs*, LAW360 (Nov. 9, 2016), https://www.law360.com/articles/861201/trump-win-could-moot-cases-over-obama-climate-regs [https://perma.cc/8ZED-UZQK]. Regardless of the CPP's viability, the authors expect that the industry-wide trends will be to continue to support efforts to invest in a low-carbon energy future.

[93] Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208 (Aug. 8, 2011); *see* EPA v. EME Homer City Generation, L.P., 134 S. Ct. 1584, 1593 (2014) (upholding CSAPR).

[94] The MACT Rule was held unlawful in *Michigan v. EPA*, 135 S. Ct. 2699 (2015). The Rule, however, remained in effect and EPA has now issued a supplemental finding meant to address the deficiencies. 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 (Apr. 25, 2016). Some coal companies actually argued against a stay because they had already convinced their state PUCs to permit them to recover the costs for new pollution control equipment. Oral Argument at 36:12–36:58, White Stallion Energy Ctr. v. EPA, 748 F.3d 1222 (D.C. Cir. Dec. 4, 2015) (No. 12-1100).

[95] *See* U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2015 WITH PROJECTIONS TO 2040, at 24–26 (2015) (noting analyses include these regulations and depicting the reference case for coal remaining flat); *id.* at 27 (attributing most coal retirements to these two rules); NEIL COPELAND & DEBASHIS BOSE, BLACK & VEATCH, IMPACT OF COAL PLANT RETIREMENTS ON THE CAPACITY AND ENERGY MARKET IN PJM 1 (2012), http://bv.com/docs/reports-studies/impact-of-coal-plant-requirements-on-the-capacity-energy-market-in-pjm.pdf [https://perma.cc/6WDQ-WTDH] (describing 28 GW of coal-powered capacity slated to retire by 2020, partly due to CSAPR and MACT rules).

[96] *See* Michigan v. EPA, 135 S. Ct. at 2704–05 (describing 1990 amendments for hazardous air pollutants); *Clear Air Act Overview: 1990 Clean Air Act Amendment of Summary*, EPA, https://www.epa.gov/clean-air-act-overview/1990-clean-air-act-amendment-summary [https://perma.cc/VP2M-RANX].

[97] Massachusetts v. EPA, 549 U.S. 583, 556–58 (2007) (Scalia, J., dissenting) (disagreeing with majority's conclusion that the term "air pollutant" in the Clean Air Act encompasses greenhouse gases).

[98] *See* Stephen Ferrey, *International Power on "Power"*, 45 ENVTL. L. 1063, 1063 (2015) (describing history of efforts to use renewable electricity rather than fossil-fueled electricity for climate change mitigation purposes).

Market forces have also put pressure on coal. Natural gas has stepped in as a baseload competitor; its low prices have made it attractive to investors funding new power plants, and have also contributed to low short-run marginal costs, making it a hard competitor to beat on the competitive wholesale markets.[99] In fact, in its rule for new sources of carbon dioxide emissions in the electricity sector, EPA justified its strict approach for coal-fired power partly by explaining that very little new coal will be built anyway given these market forces.[100]

The result is that coal-fired power plants are closing, coal companies are going bankrupt,[101] and coal's share of power generation is expected to decrease from well over half of the power supply portfolio in the 1990s and early 2000s to about 18% by 2040.[102] Despite these negative results for coal companies and coal industry workers, there are significant carbon and other air-quality benefits to be gained by weaning ourselves from coal.[103] But it is also true that there are social costs associated with closing these plants. In parts of the country where natural gas pipeline capacity is lacking—for example, the northeast during winter's high demand—coal provides the security of reliability because the fuel itself is easily stored.[104] Furthermore, the economies of coal-producing states like West Virginia are heavily dependent on the resource. As just one metric, the coal industry has lost tens of thousands of jobs in recent years.[105]

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[99] *See* Hammond & Spence, *supra* note 19, at 158–63 (describing comparative cost data and considerations for various electricity fuels); *see also* U.S. ENERGY INFO. ADMIN., ELECTRIC POWER MONTHLY: WITH DATA FROM MARCH 2016 tbl.1.1 (2016), http://www.eia.gov/electricity/monthly/current_year/march2016.pdf [https://perma.cc/G9BQ-FB2H] (presenting power generation figures showing increasing contributions of natural gas to power generation, culminating with its generating approximately the same amount of power as coal in 2015).

[100] Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,509, 64,513–14 (Oct. 23, 2015).

[101] Charles Riley & Chris Isidore, *The Largest U.S. Coal Company Just Filed for Bankruptcy*, CNN MONEY (Apr. 13, 2016), http://money.cnn.com/2016/04/13/news/companies/peabody-coal-bankruptcy/ [https://perma.cc/PQ2C-UQNS] (describing bankruptcy filings of Peabody Energy and Arch Coal).

[102] U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2016 EARLY RELEASE: ANNOTATED SUMMARY OF TWO CASES 22 (2016), https://www.eia.gov/outlooks/aeo/er/pdf/0383er(2016).pdf [https://perma.cc/8K5L-6YQN].

[103] *See* Hammond & Spence, *supra* note 19, at 172–73 (describing these issues and collecting sources).

[104] *Id.* at 165.

[105] Drew Haerer & Lincoln Pratson, *Employment Trends in the U.S. Electricity Sector, 2008–2012*, 82 ENERGY POL'Y 85 (2015) (estimating loss of over 49,000 coal jobs during study period); *see* Kris Maher & Dan Frosch, *Coal Downturn Hammers Budgets in West Virginia and Wyoming*, WALL ST. J. (Dec. 22, 2015), http://www.wsj.com/articles/coal-downturn-hammers-budgets-in-west-virginia-and-wyoming-1450822015 [https://perma.cc/HMP7-BGZK].

As coal's share of the electricity supply wanes, natural gas's share is growing. In many states today, almost all of the new power plant capacity coming online is natural gas. The use of natural gas to produce electricity is expected to continue to increase in the near future, given its abundant supply, low costs relative to other fuel sources, and lower carbon impacts compared to other fossil fuels.[106] In contrast to older baseload coal plants, natural gas plants are usually built as peaking resources (i.e., those that are primarily deployed to meet peak customer loads) and offer many efficiencies as load following resources that can complement the integration of variable resources such as wind and solar into the grid.[107]

Yet one lurking concern is overinvestment in natural gas power plants for purposes of power supply, which could readily lead to overreliance on the fuel as a generation resource. For example, the Union of Concerned Scientists has warned that many states' heavy short-term reliance on natural gas plants presents a long-term risk of locking in investments in power plants that could peak in use by 2030, potentially creating massive new excess capacity problems.[108] Concerns with the grid's future overreliance on natural gas are heightened by the need for increased decarbonization over the coming decades, as natural gas is not carbon-free; as some scholars have argued, meeting our climate policy goals will require "eliminating virtually all [of our] natural gas use by 2050."[109] The prospect of future stranded costs for natural gas, akin to what is currently being claimed by the coal industry, seems highly likely a decade or two into the decarbonization transition.[110]

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[106] The U.S. Energy Information Administration (EIA) projects significant additions of natural gas capacity, whether or not the CPP remains in place. U.S. ENERGY INFO. ADMIN., *supra* note 102, at 22.

[107] *See Natural Gas-Fired Combustion Turbines Are Generally Used to Meet Peak Electricity Load*, U.S. ENERGY INFO. ADMIN. (Oct. 1, 2013), http://www.eia.gov/todayinenergy/detail.cfm?id=13191 [https://perma.cc/2N9S-D262]; J. Nicolas Puga, *The Importance of Combined Cycle Generating Plants in Integrating Large Levels of Wind Power Generation*, 23 ELEC. J. 33, 37 (2010) (arguing natural gas can complement other variable resources).

[108] *See* UNION OF CONCERNED SCIENTISTS, RATING THE STATES ON THEIR RISK OF NATURAL GAS OVERRELIANCE 1 (2015), http://www.ucsusa.org/sites/default/files/attach/2015/12/natural-gas-overreliance-analysis-document.pdf [https://perma.cc/RE5Q-WST8].

[109] WEISSMAN, *supra* note 3, at 8.

[110] *See also* Hammond & Pierce, *supra* note 17, at 14–15 (describing features of the CPP that would have made natural gas plants an increasingly high-risk investment).

B. Nuclear Power Plants

Nuclear power represents approximately 20% of the nation's power supply portfolio.[111] However, many existing plants are facing early retirement, largely as a result of the competitive electricity markets' failure to value carbon.[112] But decarbonization scenarios anticipate that nuclear power, which has no carbon emissions, will need to increase, and new plants will need to be built.[113] This makes nuclear plants a significant potential stranded cost issue for the decarbonization transition as well.

Like coal, nuclear power provides steady, reliable baseload electricity with a fueling schedule that insulates it from the pipeline capacity issues that can plague natural gas.[114] Unlike coal and natural gas, nuclear power does not emit criteria pollutants, toxics, or greenhouse gases.[115] Thus, it has not been subject to the same CAA regulatory pressures as coal in recent years—though it has always been a highly regulated industry.[116] Nevertheless, nuclear power is struggling on the competitive wholesale markets; several plants have begun the decommissioning process, and others are currently listed as marginal.[117] The reasons relate to the dynamics of imperfectly competitive markets. Because nuclear power must always run, it is a price-taker, meaning it will take whatever clearing price the wholesale markets provide regardless of its actual short-run marginal or long-run average costs.[118] Low natural gas prices and increasing renewables penetration have contributed to lower market clearing prices.[119] And without a price on carbon, the market is imperfect, making it harder for nuclear

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[111] *See* U.S. ENERGY INFO. ADMIN., *supra* note 102, at 22 (projecting significant added natural gas capacity).

[112] *See generally* Hammond & Spence, *supra* note 19 (providing detailed diagnosis).

[113] *See, e.g.*, PATHWAYS TO DEEP DECARBONIZATION, *supra* note 1, at 15 (noting that without substantial carbon capture and sequestration, reliance on nuclear power must remain an option).

[114] Hammond & Spence, *supra* note 19, at 165.

[115] Natural gas emits fewer of these pollutants than coal. *Id.* at 166–67. For a full discussion of the comparative environmental externalities of the various electricity fuel sources, see *id.* at 166–68.

[116] *See id.* at 173–90 (arguing this level of regulation has caused nuclear power to internalize costs that are externalities for competitor fuel sources, putting it at a comparative economic disadvantage).

[117] *See generally id.* (providing overview and diagnosis of nuclear power's struggles in wholesale markets).

[118] *Id.* at 189–90.

[119] *Id.*

power to compete given its significant continued operational and safety costs.[120]

Nuclear power plants operating outside of the competitive wholesale markets have not encountered these challenges. In fact, the most prominent new reactors under construction are in Georgia and South Carolina,[121] where the regulatory contract continues to provide cost recovery through rate-making and can further be used to hedge future uncertainties.[122] Thus, whether a nuclear reactor is at risk of becoming a stranded asset may well depend on the restructuring status of its jurisdiction.[123]

From the perspective of a post-carbon grid, the position of nuclear reactors raises important stranded cost issues—albeit issues that present different stakes than existing coal plants. Consider that existing reactors contribute over 60% of the nation's carbon-free electricity,[124] and when reactors are shut down, carbon emissions increase.[125] Achieving carbon emission reduction goals will require continued reliance on existing nuclear plants, as well as substantial new investment in them.[126] The CPP[127] did not afford credit to states that retained existing

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[120] *See, e.g.*, JOHN M. DEUTCH ET AL., MIT ENERGY INITIATIVE, UPDATE OF THE MIT 2003 FUTURE OF NUCLEAR POWER 5–6 (2009), http://web.mit.edu/nuclearpower/pdf/nuclearpower-update2009.pdf [https://perma.cc/2CMM-4VAK] (illustrating cost competitiveness of nuclear power were carbon fully valued).

[121] *See* Hammond & Spence, *supra* note 19, at 188 (describing regulatory circumstances leading to new construction). As of this writing, the Tennessee Valley Authority (TVA) was conducting power ascension testing on the new Watts Bar Unit 2 reactor, which was licensed under an older procedural framework but was only recently completed. *See Watts Bar Unit 2 Complete and Commercial*, TENN. VALLEY AUTH. (Oct. 19, 2016), https://www.tva.gov/Newsroom/Watts-Bar-2-Project [https://perma.cc/64KK-NZ4R] (providing updates). It began commercial operation October 2016. Press Release, Nuclear Energy Inst., TVA's Watts Bar Unit 2 Begins Commercial Operation (Oct. 19, 2016).

[122] *See infra* Section III.B.2 (discussing these states' approaches to cost recovery for the carrying costs of construction).

[123] As is described *infra* Part III, the jurisdiction's restructuring status may also bear on a state's options for addressing stranded cost issues.

[124] THE HORINKO GRP., NUCLEAR POWER AND THE CLEAN ENERGY FUTURE 6 (2016).

[125] *Id.* at 7. Regarding the closure of the Vermont Yankee power plant in Vermont, see William Opalka, *C02 Emissions Increase in ISO-NE: Loss of Nuclear Plant Reverses Trend*, RTO INSIDER (Feb. 22, 2016), https://www.rtoinsider.com/co2-new-england-22278/ [https://perma.cc/QP7Y-MV4X]. For sources regarding the closure of the San Onofre power plant in California, see CAL. ENVTL. PROT. AGENCY AIR RES. BD., 2014 EDITION CALIFORNIA GREENHOUSE GAS EMISSION INVENTORY: 2000–2012, at 4 (2014), https://www.arb.ca.gov/cc/inventory/pubs/reports/ghg_inventory_00-12_report.pdf [https://perma.cc/3CVW-RJYQ]. For experience in Japan following the moratorium on nuclear power following Fukushima, see MINISTRY OF ECON., TRADE & INDUS., LONG-TERM ENERGY SUPPLY AND DEMAND OUTLOOK 4 (2015), http://www.meti.go.jp/english/press/2015/pdf/0716_01a.pdf [https://perma.cc/244G-VGLL].

[126] *See* PATHWAYS TO DEEP DECARBONIZATION, *supra* note 1, at 15.

[127] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,661 (Oct. 23, 2015) (to be codified at 40

nuclear power, but it did give credit for plant uprates and new reactors.[128] Further, the CPP contemplated credit trading as the easiest path to compliance.[129] Marginal plants thus face a temporal gap: with the CPP stalled, and while there is no real price on carbon, these plants could be considered stranded assets. But in the next decade, it is likely that their value from a carbon perspective will increase—whether from the CPP or some other climate change mitigation policies. New York, for example, has taken the policy view that nuclear power should help bridge today's carbon-heavy electric sector to the low-carbon grid of the future.[130] The stranded cost question is whether—and if so, how—to support these plants while awaiting regulatory and market dynamics that value their carbon contribution.

C. *Energy Transportation*

Energy transportation is also not exempt from stranded cost issues with impending decarbonization. As noted above, construction of natural gas-fired power plants is projected to increase over the next decade or so. Yet natural gas-fired electricity requires not just power plants, but a transportation infrastructure. This necessity presents even trickier future excess capacity problems that relate to gas production as well as power plants.

Currently, there are a number of mismatches between the electricity and natural gas markets. Among these issues is pipeline capacity: natural gas is sold on spot markets, and the prices in recent times are significantly below their historical averages.[131] Electric power suppliers buy natural gas on those spot markets, obtaining even lower prices by taking interruptible service.[132] Without long-term contracts, investors are reluctant to take on the significant financial commitment needed to construct

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C.F.R. pt. 60). The Supreme Court stayed the CPP during the pendency of litigation, the outcome of which is uncertain given the Trump administration's desire to rescind it. *See* North Dakota v. EPA, No. 15A793 (U.S. Feb. 9, 2016) (issuing stay); Robinson Meyer, *Trump's Climate Agenda: Do Less, With Less*, ATLANTIC (Mar. 13, 2017), https://www.theatlantic.com/science/archive/2017/03/trumps-war-on-the-climate-begins/519159/ [https://perma.cc/DZW7-R7ZZ] (describing expected executive order to dismantle CPP).

128 Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. at 64,735.

129 *See id.* at 64,823; Federal Plan Requirements for Greenhouse Gas Emissions from Electric Utility Generation Units Constructed on or Before January 8, 2014, 80 Fed. Reg. 64,966, 64,968 (Oct. 23, 2015).

130 *See* sources cited *supra* note 16.

131 *See* Jake Huneycutt, *Taking a Look at Historical Natural Gas Prices*, SEEKING ALPHA (Jan. 19, 2015), http://seekingalpha.com/article/2830226-taking-a-look-at-historical-natural-gas-prices [https://perma.cc/XQ5R-GHL6].

132 *See* Hammond & Spence, *supra* note 19, at 165 & n.115 (collecting sources).

new natural gas pipelines.[133] Paradoxically, natural gas is flared in some regions due to lack of pipeline infrastructure[134] even while there are shortages in other regions in the winter months when natural gas is in demand for both heating and electricity generation.[135] This lack of pipeline infrastructure has already created some stranded costs. In some areas of the country, for example, natural gas wells have been drilled but not completed due to the lack of transportation to get natural gas to market.[136]

Carbon emission reduction goals contemplate that NGCC utilization in the nation's power supply portfolio—currently somewhere around 40%—could increase to as high as 75% to replace coal-fired generation.[137] Regional transmission organization such as PJM and MISO both contemplate that achieving this increased utilization would require major new pipeline infrastructure,[138] and the North American Electric Reliability Corporation has warned that significant pipeline investment is needed to avoid reliability issues.[139] This presents another stranded cost issue: will investors want to build this new infrastructure, knowing that the ultimate goal of the electricity sector is to wean ourselves from natural gas as well as coal? Keep in mind as well that once that infrastructure is in place, there will be a new path dependency: stranded cost concerns could mean reliance on natural-gas fired power longer than would be optimal from a climate change mitigation perspective.[140] New electricity transmission infrastructure

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[133] For a full exploration of the contributing factors to a lack of pipeline capacity, see generally Alexandra B. Klass & Danielle Meinhardt, *Transporting Oil and Gas: U.S. Infrastructure Challenges*, 100 IOWA L. REV. 947 (2015).

[134] The most notorious example involves flaring in North Dakota's Bakken field. *Id.* at 1009–15.

[135] FED. ENERGY REGULATORY COMM'N, WINTER 2013–2014 OPERATIONS AND MARKET PERFORMANCE IN RTOS AND ISOS 8 (2014), http://www.ferc.gov/legal/staff-reports/2014/04-01-14.pdf [https://perma.cc/8LAJ-YYRK] (describing significant electricity generation outages during polar vortex due to gas curtailment, lack of fuel diversity, and frozen coal).

[136] *See, e.g.*, Klass & Meinhardt, *supra* note 133, at 1005.

[137] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,661, 64,802–03. (Oct. 23, 2015) (to be codified at 40 C.F.R. pt. 60).

[138] To nudge investors toward firm natural gas contracts, PJM has adopted new capacity market rules with significant penalties for generators that cannot dispatch when called. *See* PJM Interconnection, LLC, 152 FERC ¶ 61,064 (July 22, 2015); PJM Interconnection, LLC, 151 FERC ¶ 61,208 (June 9, 2015).

[139] N. AM. ELEC. RELIABILITY CORP., POTENTIAL RELIABILITY IMPACTS OF EPA'S PROPOSED CLEAN POWER PLAN 24–25 (2014), http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/Potential_Reliability_Impacts_of_EPA_Proposed_CPP_Final.pdf [https://perma.cc/YU39-474W].

[140] Of course, some argue that this is already true. This article focuses on the use of natural gas as a bridge fuel for electric power generation, as the CPP contemplated. *See*

presents similar stranded cost challenges. On one hand, regulatory certainty is necessary to attract capital investments to build transmission lines in new locations for the decarbonized grid. On the other hand, it is important that new transmission lines do not help to prolong the asset life of older fossil fuel generation power plants that would otherwise be retired, thus exasperating the carbon legacy plant problem highlighted above.[141]

III. STRANDED COST COMPENSATION FOR GRID DECARBONIZATION

These examples point to the almost intractable problem presented by irreversible energy infrastructure investment decisions and the path dependencies they create—an especially salient challenge given the transition to a significantly decarbonized energy grid. History shows how energy law is consistently inept at retiring energy infrastructure with any remaining life, though there are occasional counter-examples related to the decommissioning of specific hydroelectric and nuclear facilities.[142] With new stranded cost issues already occurring or predictable in the near future, this article now turns its attention to how such costs might best be handled as we transition to a decarbonized energy grid.

This part first discusses whether, given structural changes the energy industry has undergone in recent decades, regulators today might be more justified than ever in ignoring stranded cost issues, including those associated with decarbonization's transition. Although these structural changes provide great promise for future private management of many investor risks, stranded cost compensation during the transition to deep decarbonization may yet prove necessary. Still, regulators should not follow the model of past stranded cost experiments. Instead, in making decisions today about our future energy infrastructure, regulators have an opportunity to write a new stranded cost chapter for energy law, one that both facilitates

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Hammond & Pierce, *supra* note 17, at 14–15 (hypothesizing that expected future shifts away from natural gas may drive up prices in the near-term because of investor reluctance).

[141] *See, e.g.*, Jim Rossi, *The Trojan Horse of Electric Power Transmission Line Siting Authority*, 39 ENVTL. L. 1015 (2009) (arguing that without careful attention to pricing and cost allocation, the expansion of transmission lines can benefit legacy power plants rather than new power generators).

[142] With both of these examples, federal regulators played a significant regulatory role in decommissioning—a role that is not available for existing fossil fuel generation plants. *See, e.g.*, 10 C.F.R. § 20.1401 (2016) (NRC regulations governing nuclear power plant decommissioning); FPL Energy Maine Hydro, LLC, 107 FERC ¶ 61,120 (May 6, 2004) (ordering surrender of hydro license and partial dam removal, with licensee's agreement).

the transition to decarbonization and provides a better balance between certainty and flexibility than in the past. Front-end stranded cost recovery for incremental energy infrastructure investment decisions can attract new capital for decarbonization by reducing uncertainty, while also ensuring that values associated with energy reliability and carbon impacts are not left stranded during the impending transition. In order to avoid distorting returns on investment to favor carbon lock-in, regulators must address stranded costs associated with existing energy infrastructure under the same principles that they apply to incentives designed to reduce uncertainty in the investment in new resources.

A. The Promise of Private Management of Stranded Costs

William Baumol and J. Gregory Sidak once predicted that the "new mode of mixed competition and regulation" is one "in which no such problem [of stranded costs] need arise again."[143] Compared to fifty years ago, private investors today are much better equipped to address the risks of many energy transitions. The regulatory contract that once described the industry can no longer be understood as a deal between a few firms and the state.[144] Shifts toward competitive energy markets have created a regulatory environment that is much more multifaceted in nature, with a range of firms, interest groups, and stakeholders now serving as the main participants in any regulatory bargain.[145] Energy regulation today is not understood as a binding bilateral deal subject to renegotiation each time a major new infrastructure decision is made; it is much more fluid and ongoing in nature.[146]

If FERC's competitive restructuring of wholesale gas and electric power markets had been effective in making the energy sector perfectly competitive, then no firm or investor in the energy industry today would face fundamentally different risks than any other business. Order 888 made clear FERC's preference for a market competition policy based on open access, but one should be careful not to overstate either the scope or success of competitive energy markets.[147] FERC's

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143 Baumol & Sidak, *supra* note 10, at 839.

144 Hammond & Spence, *supra* note 19, at 192.

145 *Id.* at 192–93.

146 *See* JIM ROSSI, REGULATORY BARGAINING AND PUBLIC LAW (2005).

147 *See, e.g.*, Richard J. Pierce, Jr., *Completing the Process of Restructuring the Electricity Market*, 40 WAKE FOREST L. REV. 451 (2005) (contrasting promise and realities of restructuring the electricity markets).

competitive restructuring efforts addressed only the wholesale side of domestic energy markets, and even today, that restructuring process is incomplete.[148] State regulators retain significant control over infrastructure related to retail gas and electric power sales, with most states continuing to apply traditional cost-based regulation to infrastructure decisions regarding these transactions.[149]

Even though the rules of the game for energy markets continue to evolve, it is undeniable that some structural changes have created the potential for better private management of business risks by firms and their investors. Under the traditional regulatory contract, firms and their investors were much more homogenous, with most regulation aimed at the traditional, vertically integrated utility. Today, the energy industry is comprised of a much more diverse range of investors operating outside of the regulatory compact.[150] Most new power generation today, for example, is nonutility generation—plants built by firms with whom no traditional regulatory compact can be said to exist.[151]

In addition, with a greater range of firms operating in the industry, private investors are better equipped to diversify risks themselves. For example, with the decline of the traditional utility's dominance in the electric power industry, firms operating in national markets today are better equipped to diversify their investments across jurisdictions and regions of the country.[152] Also, in part due to technological innovations, the scale of new energy supply investments is far smaller than the kinds of large-scale baseload plants that were characteristic of new investments in the 1960s and 1970s.[153] This has allowed for multiple, smaller-scale investments by larger firms that are

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[148] *Id.* at 460–61.

[149] *Id.*

[150] *Cf.* Richard F. Hirsch & Benjamin K. Sovacool, *Technological Systems and Momentum Change: American Electric Utilities, Restructuring, and Distributed Generation Technologies*, 36 J. TECH. STUD. 72, 78 (2006) (describing a new diversity of stakeholders negotiating toward a new electric power industry consensus).

[151] *See* U.S. ENERGY INFO. ADMIN., *supra* note 99, at ch. 6 (showing planned near-term capacity additions).

[152] For terrific general overviews of these structural changes, see STEVE ISSER, ELECTRICITY RESTRUCTURING IN THE UNITED STATES: MARKETS AND POLICY FROM THE 1978 ENERGY ACT TO THE PRESENT (2015); RICHARD F. HIRSCH, POWER LOSS: THE ORIGINS OF DEREGULATION AND RESTRUCTURING IN THE AMERICAN ELECTRIC UTILITY SYSTEM (1999).

[153] U.S. ENERGY INFO. ADMIN., *supra* note 99, at tbl.6.5 (showing numerous planned generating unit capacity additions of less than ten megawatts summer capacity); Jeff Riles, Jr., Dir., Regulatory Affairs, Enel Green Power N. Am., Inc., Remarks at GW Law J.B. & Maurice C. Shapiro Environmental Law Symposium: The Electricity Mix of the Future: Environment, Economics, and Governance (Mar. 11, 2016) (describing renewable company Enel's approach).

better able to diversify the assets on their balance sheets than utilities in the past.[154] For instance, many firms with power plants that they consider to be uneconomic seek to securitize or sell these assets by selling them (or spinning them off),[155] instead of asking regulators for stranded cost recovery.

Moreover, in recent decades financial regulation has improved the quality of information about investments that is available to investors in energy firms. Corporate disclosure expectations today are much more cognizant of potential changes in business and technological conditions as well as regulatory regimes.[156] One example is the past popularity of many utility stocks as low-risk investment vehicles in worker pensions. Historically, pension managers may not have been required to disclose the full risks of these investments, but institutional disclosure requirements for investment managers have changed significantly.[157] Past utility accounting practices, which were premised on rate recovery of asset costs, may have understated risks associated with long-term capital investments against the backdrop of changing conditions—a risk that firms today must disclose. Increasingly too, regulators are moving toward the disclosure of future risks associated with climate change, and this should better enable investors to price these risks in making future investment decisions.[158] There is some evidence to suggest that disclosure may encourage firms to do little more than reassure investors,[159] but at the very minimum, investors today in the energy sectors are better informed about risks than investors half a century ago.

These changes in the nature of regulation, industry structure, and risk disclosure may not make concerns about

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[154] *See* INT'L ENERGY AGENCY, POWER GENERATION INVESTMENT IN ELECTRICITY MARKETS 14 (2003), https://www.hks.harvard.edu/hepg/Papers/Fraser.gen.invest.elec.mkts.1203.pdf [https://perma.cc/TJ97-H2X8].

[155] These were commonly used strategies for addressing the stranded costs associated with electric power industry restructuring. *See* ISSER, *supra* note 152, at 200–03.

[156] *See, e.g.*, David S. Ruder et al., *The Securities and Exchange Commission's Pre- and Post-Enron Responses to Corporate Financial Fraud: An Analysis and Evaluation*, 80 NOTRE DAME L. REV. 1103 (2005).

[157] *Id.* at 1112–55 (detailing numerous changes to disclosure requirements).

[158] *See* Rick E. Hansen, *Climate Change Disclosure by SEC Registrants: Revisiting the SEC's 2010 Interpretive Release*, 6 BROOK. J. CORP. FIN. & COM. L. 487, 487 (2012) (discussing SEC rules requiring disclosure of climate change risks); *see also* Sey-Hyo Lee & Marushka Bland, *Carbon Transparency: Public Companies Face Rising Pressure to Disclose Climate Change Risks*, FORTNIGHTLY (May 2008), https://www.fortnightly.com/fortnightly/2008/05/carbon-transparency?page=0%2C0 [https://perma.cc/H7AN-43NW].

[159] *See, e.g.*, James W. Coleman, *How Cheap Is Corporate Talk? Comparing Companies' Comments on Regulations with Their Securities Disclosures*, 40 HARV. ENVTL. L. REV. 47, 49 (2016) (describing how oil companies told federal regulators that a renewable fuel standard would harm them financially while simultaneously telling investors that they are well positioned to comply with any new requirements).

transition costs irrelevant. But one would expect private investors to be much better equipped to deal with transitions, especially where they involve business assumptions or technology decisions over which investors can assume risks themselves, or over which the firm has some degree of control. After all, the history of energy regulation shows that transition is the only certainty, so new investors should not be permitted to claim surprise for the kinds of business risks that they can control.[160]

Consider again the fuel costs that drove the stranded cost problem with pipelines' take-or-pay contracts. Today, a pipeline operating on a national scale would be well positioned to address the risks of changes on its own and to hedge its take-or-pay contracts with other instruments. Such developments point to new investors being much better equipped than in the past to address the stranded cost problem in making their risk decisions, particularly to the extent that stranded cost issues reflect nothing more than ordinary business risks. Of course, one can still expect that the sheer size of many energy infrastructure investments—along with long asset lives—will produce more significant transition cost problems down the road than are faced by most sectors of the economy. But that should not deter regulators from encouraging private investors to act on their own to price the risks of changes at the front end, where they can do so.

B. Complementary Stranded Cost Recovery Mechanisms

Given the many private mechanisms for managing the risk of stranded costs, one might argue that regulatory approaches for stranded cost recovery going forward are either unnecessary or poor public policy because they create disincentives to address the issue in the marketplace. No doubt, the regulatory process can do a better job of encouraging investors to price risks themselves, especially the business risks of future economic or technology changes. Encouraging investors to price these kinds of risks at the time they make a decision to invest in assets could help to shift such risk to investors. This would allow regulators to focus their attention on pricing the residual risk of unexpected regulatory change or other values that are not already priced as risks in the competitive market.

The regulatory bargain in energy markets remains much more of a moving target than in most other sectors of the economy. Existing energy infrastructure may be more capital-

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160 See, for example, the discussion of the *Charles River Bridge* case, *supra* Section I.A.

intensive and long-lived than assets in other sectors of the economy, but even in those other sectors, regulators must be attentive to the transition costs associated with regulatory change.[161] Changes in the energy industry in recent decades thus do not render stranded costs concerns irrelevant, but provide energy regulators an opportunity to give stranded cost recovery a new focus, better aligning investor signals with core public values. Stranded cost compensation with the decarbonization transition presents some unique opportunities for regulatory reform that can avoid stranded cost myopia, especially to the extent that prices and investment signals in competitive energy markets fail to value reliability and environmental attributes of energy resources.

To begin, consider the massive levels of infrastructure investment that will be required to meet the goals of decarbonization. Keeping warming under two degrees Celsius is estimated to require hundreds of billions of dollars of new capital investment over the coming decades.[162] Presumably, many of these new energy infrastructure investments will be pursued because of their carbon emissions advantage over existing energy supply resources. Unless the carbon attributes of energy supply are somehow priced in all market decisions concerning these resources, however, the returns that firms offer to investors may be too low to attract new investments, leading to underinvestment in new resources and overdependence on old ones. In addition, uncertainties and high costs surrounding new resources such as next-generation nuclear plants, offshore wind, and electric power transmission have frightened investors away from sinking capital into such projects. To make new technological investments attractive, and to achieve the right balance of energy resources for decarbonization, the returns offered to investors must provide some premium for uncertainty while also pricing the carbon attributes and other values that are important to the energy system. As is discussed above, traditional stranded cost compensation included little or no consideration of these forms of stranded benefits in the calculation of stranded costs.

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[161] *See* Richard L. Revesz & Allison L. Westfahl Kong, *Regulatory Change and Optimal Transition Relief*, 105 NW. U. L. REV. 1581, 1582 & n.1 (2011) (discussing transition problems with grandfathering pollution from old power plants); *see also* Louis Kaplow, *An Economic Analysis of Legal Transitions*, 99 HARV. L. REV. 509, 511 (1986); Steven Shavell, *On Optimal Legal Change, Past Behavior, and Grandfathering*, 37 J. LEGAL STUD. 37, 56 (2008).

[162] *See* PATHWAYS TO DEEP DECARBONIZATION, *supra* note 1, at 47 (noting the need for an increase in new investments in the range of $15–$70 billion annually between today and 2050).

Regulators paying attention to stranded cost recovery as a mechanism for reducing uncertainty and addressing these values ex ante (i.e., before each energy resource investment decision is made) may better facilitate a transition to decarbonization that is attentive to the balance of resources in the energy system as a whole. By avoiding wasteful ex post lobbying to address stranded costs decades from now, it also could help to reduce the overall cost of capital for a decarbonized energy system.

But approaching stranded costs only as a way of incentivizing investors to steer capital to new decarbonized energy resources could also be counterproductive. The transition to decarbonization is plagued by an old resource problem too, which if left unaddressed can readily reinforce carbon lock-in.[163] It is thus imperative to recognize the challenge of addressing both new and old capital investment with the transition to decarbonized energy infrastructure. Subjecting old energy infrastructure to a different stranded cost recovery than the principles used to incentivize investments in new infrastructure risks distorts investor returns to favor carbon-lock by delaying new investments.

With respect to existing investments, such as those discussed in Part II, stranded cost recovery will remain important to ensuring that the transition to decarbonization occurs in a timely manner, and is not delayed further by path dependency. While this article does not propose a bailout of all existing assets, a failure to address stranded costs concerning decarbonization of existing energy supply resources risks the possibility that some transitions may never occur. Experience has shown that some stranded cost recovery might be a worthwhile price to pay for industry cooperation or even stakeholder buy-in in the midst of a transition.[164] It is equally important that regulators addressing stranded costs for existing resources be attentive to issues that they have ignored in the past, such as the social costs of transitions. Specifically, as with new energy infrastructure, the transition issues presented by existing resources underscores the importance of recognizing attributes of different energy resources that competitive energy

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[163] Unruh, *supra* note 7, at 817.

[164] *See, e.g.*, Jim Rossi, *Can the FERC Overcome Special Interest Politics? With the "Carrot/Stick" Incentives, the FERC Has Learned That Utilities Will Volunteer to Make the Choice Regulators Want*, 133 PUB. UTIL. FORT. 31, 33 (1995) (describing FERC's carrot/stick approach to minimizing special interest resistance to electricity restructuring); *see also* Richard J. Pierce, Jr., *The Evolution of Natural Gas Regulatory Policy*, 10 NAT. RESOURCES & ENV'T 53, 55 (1995) (describing how transition from regulatory contract to regulated market creates stranded costs, incentivizing industry to stall).

markets today do not value in their pricing mechanisms when calculating stranded costs.

Before we proceed, we emphasize that our argument is pragmatic: We are not contending that any one kind of stranded cost recovery is the most economically efficient regulatory approach,[165] or that it is required as a matter of contract or the Constitution.[166] Instead, the regulatory approach we propose can provide forms of stranded cost recovery that are politically expedient, reasonably justifiable, and useful for easing the transition to a clean energy future.

1. Temporal Approaches and Considerations

As the historical examples show, energy law has traditionally dealt with stranded costs for investors and firms once they arise, often long after initial private investment decisions are made. This ex post form of stranded cost recovery contributes to some problematic behaviors in the regulatory process by encouraging firms and their investors to lobby against change, as well as discouraging firms and regulators from being attentive to stranded benefits and to the public values that need to be protected in transitioning to a new normal.[167] It should not come as a surprise that the past forms of stranded cost compensation produced by this kind of regulatory process have appeared to be little more than a bribe to buy industry acquiescence in energy sector changes or, worse yet, a bailout that comes at the cost of consumers. If the history of energy law teaches anything, however, it is that transitions and change ought to be expected in the energy sector. It follows that regulatory approaches that force both regulators and investors to consider stranded cost issues in making current investment decisions, rather than only leaving them for the future, are worth consideration. Here the article canvasses just a few examples to show that energy regulators are already considering this as a way of encouraging new investments associated with grid decarbonization.

One way to encourage such investments to build expensive new infrastructure projects, especially where there is

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[165] This article focuses on whether and how stranded cost recovery should be allowed by regulators, and what core values it should reflect. It does not address the actual financial calculation of stranded costs. For various discussions of methods of calculating actual stranded costs, see CONG. BUDGET OFF., *supra* note 65; SIDAK & SPULBER, *supra* note 62, at 394–96; Ajay Gupta, *Tracking Stranded Costs*, 21 ENERGY L.J. 113 (2000).

[166] *Cf.* Rossi, *supra* note 64, at 299–306.

[167] *See supra* Section I.B.1.

uncertainty about the future, is to accelerate recovery for construction costs to the front end—when construction is occurring—rather than requiring infrastructure to be built and operating before recovery is permitted.[168] Several jurisdictions permit this approach, which is being used most notably for the only new nuclear reactors under construction.[169] This approach incentivizes investors to move forward with significant capital undertakings even against the backdrop of uncertainty by lessening any concern that if regulatory treatment of a project changes midconstruction, they will not have to repeat history's nuclear cancelation episode.[170] On the other hand, this approach shifts some of the burdens of uncertainty to customers. Their interests are protected only minimally: they have the predictability of CWIP being spread over a set period, and (using Georgia as an example) they have at least some oversight through the regulatory process, which requires periodic reports by the utility.[171] But construction disputes, delays, and increased costs can still pose issues.[172]

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[168] This is typically referred to as the "used and useful" requirement and is found in a number of jurisdictions' statutes. For example, Pennsylvania law requires that rates for electricity be fixed without consideration of a utility's expenditures for nuclear power generation plants that were planned but never built because they were not "used and useful in service to the public." 66 PA. STAT. AND CONS. STAT. ANN. § 1315 (West 2016). Utilities incurring millions of dollars in preliminary construction expenses to recover these costs from customers sued Pennsylvania regulators, alleging that this was an unconstitutional taking of their property without just compensation in violation of the Fifth Amendment of the U.S. Constitution. Duquesne Light Co. v. Barasch, 488 U.S. 299, 301 (1989). Ultimately, the U.S. Supreme Court upheld the Pennsylvania law, reasoning that the "end result" was just and reasonable and the Takings Clause did not dictate a specific method for cost recovery. *Id.* at 314. ("The economic judgments required in rate proceedings are often hopelessly complex and do not admit of a single correct result. The Constitution is not designed to arbitrate these economic niceties.").

[169] *See* Mid-Tex Elec. Coop., Inc. v. Fed. Energy Regulatory Comm'n, 773 F.2d 327, 330–36 (D.C. Cir. 1985) (discussing FERC's methods of cost recovery during construction, including allowance for funds used during construction (AFUDC) and construction work in progress (CWIP)); GA. CODE ANN. § 46-2-25(c)(3) (2016) (note that Georgia's statute applies only to nuclear reactors approved within a limited time window, making Southern Company the only eligible company); Georgia Power's Application for the Certification of Units 3 and 4 at Plant Vogtle and Updated Integrated Resource Plan, No. 27,800, 2010 WL 2647607, at *10–11 (Ga. Pub. Serv. Comm'n June 17, 2010) [hereinafter *Georgia Power's Application*] (finding Georgia Power's inclusion of CWIP in rate base would benefit ratepayers). *Compare* S.C. CODE ANN. § 58-33-220(2) (2011) (extending CWIP recovery to both nuclear and coal, provided that coal plants must comply with Best Available Control Technology for air emissions as defined by EPA); FLA. ADMIN. CODE ANN. r. 25-6.0423(6) (2007) (permitting a utility to petition the Florida Public Service Commission to recover carrying costs).

[170] *See supra* Section I.A.1.

[171] *See, e.g.*, GA. CODE ANN. § 46-3A-7(b) (2016) (requiring monitoring reports); *Georgia Power's Application*, 2010 WL 2647607, at *7 (additionally requiring monthly status reports on CWIP).

[172] *E.g.*, Thomas Overton, *Even More Delays and Cost Overruns for Vogtle Expansion*, POWER (Feb. 2, 2015), http://www.powermag.com/even-more-delays-and-cost-overruns-for-vogtle-expansion/ [https://perma.cc/PB3H-8RMH] (detailing new reports of cost overruns, delays, and construction litigation).

Cost recovery can also be apportioned to in-service assets as they come online, enabling investors to earn a return even for projects that are not yet fully complete. For example, Mississippi Power's Kemper County Energy Facility is an integrated gasification combined cycle plant that will be accompanied by carbon capture technology.[173] It is designed to use lignite coal and will be the first plant to employ these technologies at this scale (its capacity is 582 MW).[174] It is not yet fully online, but the state's public utilities commission (PUC) has approved cost recovery for the parts of the plant that are already in service and generating electricity.[175] The Kemper facility has also been plagued by construction delays and increased costs,[176] but these have been allocated somewhat between investors and customers. There is a cap on the costs to customers associated with the power plant portion of the project,[177] but uncapped costs are those associated with the lignite mine, CO_2 pipeline, and "improvements to design."[178] Mississippi Power's parent company reports it has taken a $2.5 billion write-down.[179]

At the federal level, the Modified Accelerated Cost Recovery System permits certain renewable energy projects to recover their investments through depreciation deductions.[180] To qualify for the 50% first-year bonus depreciation, these projects must be in service by January 1, 2018.[181] Some states are also allowing for an excise tax on energy sales to finance a trust fund to jump start renewable investments.[182] Others have considered guaranteed cost recovery for utilities' purchases of renewable

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173 *See Quick Facts*, MISS. POWER, http://www.mississippipower.com/about-energy/plants/kemper-county-energy-facility/facts [https://perma.cc/F3F6-55ZE].

174 *Id.*

175 *Id.*

176 Indeed, the plant lost its tax credit because it opened too late. *See* Jack Weatherly, *Mississippi Power: Tax Credit Likely to Be Repaid*, MISS. BUS. J. (Sept. 30, 2015), http://msbusiness.com/2015/09/mississippi-power-tax-credit-likely-to-be-repaid/ [https://perma.cc/D7M4-QNCF].

177 *See Kemper County Energy Facility Costs Through May 2016 (in Billions)*, MISS. POWER, http://www.mississippipower.com/pdf/kemper/Kemper-Cost-Breakdown.pdf [https://perma.cc/E9LD-ZEG7].

178 *Id.*

179 *Id.*

180 *Modified Accelerated Cost-Recovery System (MACRS)*, ENERGY.GOV, http://energy.gov/savings/modified-accelerated-cost-recovery-system-macrs [https://perma.cc/HCD4-GLS7].

181 *Id.*

182 *See, e.g.*, MASS. TECH. COLLABORATIVE (MTC), RENEWABLE ENERGY RESULTS FOR MASSACHUSETTS: A REPORT ON THE RENEWABLE ENERGY TRUST FUND 1998–2008 (2008), http://masstech.org/sites/mtc/files/documents/2008%20Renewable%20Energy%20Trust%20Report_0.pdf [https://perma.cc/J39Q-TL5W].

power as a strategy to avoid the uncertainty that plagued nuclear plant cost recovery.[183]

These examples show just a few ways that regulators can address uncertainty by providing investors some compensation for risk early on—whether during construction or early in an asset's life—so that the project's full lifetime need not pass before investors fully receive compensation for the risks they assume in their investments. For those capital-intensive projects involving first-mover technologies, or projects facing high levels of uncertainty, such arrangements can help alleviate investor reluctance. They come at some cost initially, but by reducing investor uncertainty, they have the promise of reducing the overall regulatory cost of capital for projects in comparison to only allowing for stranded cost recovery decades into the future. Either customers or taxpayers will bear these stranded costs, however, so it remains crucial for a regulatory process that carefully assesses the need for the project and the overall benefits and burdens to ensure that the investments are worthwhile. By placing all of these decisions at the front end of a regulatory examination of the value of energy infrastructure, such a temporal shift would better allow regulators to look at how the cost of capital for each energy resource fits into a more general assessment of the cost of capital for the firm and the benefits of new investments for the energy system.

One concern with these methods of temporal risk shifting is that, to the extent that they focus solely on the present value of the investor or firm's financial costs, they treat the noninvestor attributes of all energy resources the same. For example, basing early stranded cost recovery purely on compensating market risk treats the environmental and reliability attributes of every energy resource equally, even if these are not valued by investors because of the lack of any current pricing mechanism that produces a revenue stream. As an illustration, new natural gas plants are often touted as providing a "bridge" to the low-carbon energy system, while a new nuclear plant may provide a longer-term

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[183] A provision of Florida law requires full cost recovery by a public utility of all reasonable and prudent contracts incurred for renewable energy projects, without differentiation between customer classes. FLA. STAT. ANN. § 366.91(3) (West 2008). Florida has also considered allowing renewable projects similar early cost recovery to that available for nuclear plants, but these proposals have consistently been rejected. *See, e.g.*, Herman K. Trabish, *Florida Legislators Bring Bills to Boost Solar, Limits Utilities Billing Power*, UTIL. DIVE (Jan. 22, 2015), http://www.utilitydive.com/news/florida-legislators-bring-bills-to-boost-solar-limit-utilities-billing-po/355275/ [https://perma.cc/9EPH-H4WA].

resource for decarbonization.[184] Even if the financial risks associated with each project were otherwise similar, providing similar risk compensation to incentivize investments in both resources would lead to overinvestment in gas plants and contribute to carbon lock-in by delaying their retirement in the future, when lower carbon alternatives can be deployed. In other words, unless other public values are considered in setting these incentives, early stranded cost compensation based entirely on reducing financial risks to investors could readily suffer from the same narrow-mindedness as past stranded cost compensation, effectively leaving stranded public values that are central to the transition to decarbonization.

Regulators in the past have failed to address stranded benefits and broader values beyond investor protection, in part because an ex post stranded cost compensation regulatory process rewards firms that ignore or withhold disclosing them. In the past, firms seeking ex post compensation did not have incentives to claim future benefits that might offset these costs until the stranded cost compensation was resolved.[185] By contrast, addressing stranded costs at the front end would force all firms offering energy resources to be transparent about both the costs and benefits associated with those resources. To combat concerns about certain energy values or attributes not being priced in energy markets—for example, absent a carbon price, low-carbon energy resources may fail to attract investors in the first place—legislatures or regulators could address environmental attributes in approaching incentives designed to attract investors to new projects. Alternatively, regulators could condition early recovery and other approvals on a promise to retire an asset at some point in the future.[186] For example, a legislature concerned about the need to ultimately shift away from natural gas might set schedules tapering the

[184] One study, for example, sees the production of electricity from natural gas peaking in the year 2030, after which its deployment will begin to decline. *See* NELSON ET AL., *supra* note 8, at 25. On the stranded cost problem associated with natural gas infrastructure, see also Robert Walton, *Why Natural Gas Investments Could Spell Trouble for Electric Utilities: A Study Says There's a Place for Natural Gas in the US Power Mix, but How Big Is That Place?*, UTIL. DIVE (Feb. 8, 2016), http://www.utilitydive.com/news/why-natural-gas-investments-could-spell-trouble-for-electric-utilities/413368/ [https://perma.cc/AWS7-9WEU].

[185] *See* Bhojraj et al., *supra* note 83, at 924 (citing accounting article on this disclosure problem with ex post stranded cost recovery).

[186] One recent article refers to these kinds of proactive limited approvals as "sunrise" provisions. *See* Christopher Serkin & Michael Vandenbergh, *Prospective Grandfathering* (forthcoming __ MINN. L. REV. __) (on file with authors) (arguing for a sort of "sunrise" on the approval of new energy resources that have an adverse carbon-impact, based on a front incentive coupled with an enforceable promise not to lobby for keeping the resource in operation indefinitely).

availability of cost recovery over time.[187] Plants' licenses could also include definite expiration dates, creating a presumption of closure rather than renewal.[188]

Shifting compensation for these kinds of risks to the front-end of an asset may, of course, increase the firm's cost of capital for some new energy projects. Inevitably, this will come at some cost to consumers, but no one claims that the transition to decarbonization will be cheap. A higher return on investment will be essential to attracting new investors to low-carbon infrastructures such as next-generation nuclear power plants, large-scale renewable plants, and expensive new transmission lines to facilitate broader regional deployment of renewable energy. In addition, although the cost of capital for some investments may go up when initial investments are being considered, it is not clear that the firm's overall cost of capital (or what is known as the regulatory cost of capital) will follow suit. This is because regulators decades into the future will not face the same pressures of wasteful lobbying by incumbent firms to provide for back-end stranded cost recovery.[189] And even if the cost of capital for some firms were to increase, applying these kinds of principles to all investment compensation decisions would work to reduce the system-wide (trans-firm) cost of capital related to decarbonized energy infrastructure.

Equally important, providing incentives to attract investors to new decarbonized energy investments cannot, on its own, overcome lock-in where existing carbon-intensive energy resources remain in operation, and face lower marginal operational costs. Raising the return on investment to address uncertainty for new resources would attract new investment dollars, but this could backfire if, once new infrastructure goes online, the marginal costs of deploying low-carbon resources do not compare favorably to carbon-intensive resources built decades ago.[190]

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[187] *See also* WEISSMAN, *supra* note 3, at 2 (proposing that legislatures set final dates after which no new NG plants will be approved).

[188] Of course, whether this would be a state or federal option would depend on the type of plant.

[189] To the extent there is full recovery in present value for the risks associated with stranded costs at the front end, an enforceable regulatory mechanism to retire permits or plants in the future would help limit investors from having a second bite at apple and lobbying regulators for such recovery in the future. *See* Serkin & Vandenbergh, *supra* note 186. Absent such a provision, any ex post assessment of stranded cost would need to be considered nothing more than a true-up to past compensation.

[190] One of the authors has made this point, suggesting that once built, new transmission lines might be utilized to favor existing resources like coal plants with lower marginal costs. *See* Rossi, *supra* note 141, at 1042–44.

To avoid carbon lock-in, it is thus just as imperative for regulators to address stranded costs for existing energy resources, such as the examples involving older nuclear and coal plants highlighted in Part II, in a similar manner. For example, regulators providing stranded cost compensation for existing resources should not only be attentive to protecting a firm's investors to ensure that financial risks are sufficiently compensated, but they must also be attentive to the reliability and environmental attributes of energy resources. Attention to the energy attributes of various resources would lead regulators to approach stranded investments for some existing coal plants differently from some existing nuclear plants, or to treat existing gas pipelines differently across geographic areas based on the need for capacity to support decarbonized energy infrastructure in different regions. If incentives for new energy resources compensate investors for risks in a manner that contemplates values such as reliability and environmental attributes, so too should compensation for risks associated with older resources. A failure to treat risk compensation for new and existing resources in a similar manner regarding these values in stranded cost compensation could distort the cost of capital to favor existing resources, resulting in the same kind of wasteful delay that characterized the grandfathering of existing power plants under the Clean Air Act.[191]

2. Reconciling (Some) Stranded Cost Recovery with Competitive Markets

In most of the examples discussed above, cost recovery through ratemaking is the norm (as it remains in most states), and regulators can creatively permit investors to receive early compensation for risks to avoid future stranded cost issues. But, to raise an issue that has puzzled energy lawyers at least since FERC's Order 888, what regulatory approaches are available in competitive interstate energy markets? Overcoming stranded cost myopia with the transition toward decarbonized energy infrastructure will require energy law to resolve some of these issues, and here, this article offers a few thoughts on steps toward that goal.

Consider again the current issue of marginal merchant nuclear power plants, which are at risk of early closure notwithstanding their reliability and climate benefits. As suggested above, this particular stranded cost issue is driven by

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[191] *See, e.g.*, Revesz & Kong, *supra* note 161, at 1632.

an imperfect market,[192] and there are good reasons to treat these resources differently than fossil-fueled plants because of their comparative reliability and environmental benefits. The question that remains, however, is whether regulators can endorse compensating investor risks for certain forms of power generation against the backdrop of competitive interstate energy markets, or whether federal competition policy preempts regulators from taking such an approach.[193]

The Supreme Court's recent decision in *Hughes v. Talen Energy Marketing*[194] likely places some constraints on stranded cost recovery, at least for issues arising from flaws in the wholesale markets. In *Hughes*, the Court invalidated a Maryland scheme that provided incentives for constructing new natural gas plants.[195] Perceiving the wholesale capacity market to be insufficient to incentivize new construction within its borders, Maryland enacted a scheme whereby the power plant owners would be compensated with a fixed revenue stream for capacity that cleared the relevant market.[196] In other words, the compensation was designed to provide more revenue for the plants than what they would receive on the capacity market.[197] Maryland is one of thirteen states that have authorized their utilities to operate in PJM—a regional transmission organization that operates the largest organized wholesale power market in the United States. Under the Federal Power Act (FPA), "FERC has approved the PJM capacity auction as the sole ratesetting mechanism for sales of capacity to PJM, and has deemed the clearing price *per se* just and reasonable."[198] Because Maryland's auction for new in-state generation interfered with FERC's exclusive jurisdiction over interstate wholesale sales of energy under the FPA, the Court upheld a lower court determination that the Supremacy Clause of the U.S. Constitution preempts the Maryland scheme.[199]

The Court left observers questioning how far beyond its facts *Hughes* might extend.[200] Although it expressly emphasized

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[192] For such a discussion, see Hammond & Spence, *supra* note 19, at 173–90.

[193] For arguments suggesting that states' policy options are constrained depending on their restructuring status, see *id.* at 209; Hammond & Pierce, *supra* note 17, at 16–17.

[194] Hughes v. Talen Energy Mktg. LLC, 136 S. Ct. 1288 (2016).

[195] New Jersey attempted a similar approach, which the Third Circuit invalidated in *PPL Energyplus, LLC v. Solomon*, 766 F.3d 241 (3d Cir. 2014).

[196] *Hughes*, 136 S. Ct. at 1293.

[197] *Id.*

[198] *Id.* at 1297.

[199] *Id.* at 1299.

[200] *E.g.*, Emily Hammond, Hughes v. Talen Energy Marketing, LLC*: Energy Law's Jurisdictional Boundaries—Take Three*, GEO. WASH. L. REV. DOCKET (Oct. 2015), http://

the narrowness of its holding,[201] the Court suggested that states may not tether revenues to wholesale market participation or condition payments on capacity clearing the relevant auction.[202] At the same time, the Court left open "the permissibility of various other measures States might employ to encourage development of new or clean generation, including tax incentives, land grants, direct subsidies, construction of state-owned generation facilities, or re-regulation of the energy sector."[203] The concepts of "tethering," "conditioning," and "re-regulation" all suggest limits on the spectrum of state options in moving toward decarbonization, but the contours of those limits are unclear.

Hughes appears to constrain the ability of state regulators to adopt investment incentives to compensate investors for their risk (including stranded cost recovery) if these target federal wholesale power market prices. After all, these kinds of incentives or subsidies would seem to be fundamentally at odds with federal policies favoring competitive power markets, especially to the extent that they invite states to give incumbent firms favorable treatment over out-of-state sources of energy or otherwise distorting price signals in interstate markets. Indeed, FERC's initial response to the decision indicates some hostility toward stranded cost recovery for legacy coal or nuclear plants that are no longer competitive in regional wholesale power markets operating under similar rules as in Maryland.[204]

In traditionally regulated states like Georgia and South Carolina, however, forward-looking regulatory initiatives for new clean energy construction do not seem problematic. These states are not within competitive wholesale markets like PJM, nor have they restructured at the retail level.[205] Unlike Maryland, therefore, these states have retained their full authority to decide what values to compensate. Although wholesale costs must be carried forward into state rate-making proceedings,[206] states retain authority to set the utility's return on investment. Moreover, the wholesale costs in these states are not derived from

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www.gwlr.org/hughes-v-talen-energy-marketing-llc-energy-laws-jurisdictional-boundaries-take-three/ [https://perma.cc/ZG5J-HFHG].

201 *Hughes*, 136 S. Ct. at 1299 ("Our holding is limited: We reject Maryland's program only because it disregards an interstate wholesale rate required by FERC.").

202 *Id.*

203 *Id.*

204 *See* John Funk, *FERC Rejects PUCO-Approved FirstEnergy, AEP Power Deals*, CLEVELAND (Apr. 28, 2016), http://www.cleveland.com/business/index.ssf/2016/04/ferc_rejects_puco_approval_of.html [https://perma.cc/6AYW-6AYR] (describing FERC's rejection of monthly surcharges aimed at protecting existing coal and nuclear plants from competitive markets).

205 Hammond & Spence, *supra* note 19, at 209.

206 Nantahala Power & Light Co. v. Thornburg, 476 U.S. 953, 961 (1986).

competitive auctions, but rather from bilateral contracts.[207] Providing compensation for the carrying costs of construction, therefore, do not "second-guess" or "disregard[] [an] interstate wholesale rate[] FERC has deemed just and reasonable."[208] Thus, in contrast to the regional capacity market that FERC had approved for PJM, in many other parts of the country retail reliability (and the need for new power supply capacity) remains within the wheelhouse of state regulators and is not priced in the interstate wholesale market.[209]

Still, two-thirds of electricity use in the United States takes place within the organized competitive markets. And absent any effective market price on carbon (such as a national carbon tax), regional initiatives (including PJM's capacity market) fail entirely to price the carbon attributes of various sources of energy.[210] As Justice Ginsburg wrote for the *Hughes* majority, "We reject Maryland's program only because it disregards an interstate wholesale rate required by FERC."[211] Although somewhat unclear, the majority seems to leave open state flexibility to adopt power supply incentives and subsidies that advance other values, beyond what is reflected in FERC-approved market prices.[212] Regulatory measures that states are utilizing to promote clean power generation, especially those based on the carbon attributes of different energy resources, may, therefore, be able to coexist with FERC's regulation of wholesale power markets.

Hughes, therefore, leaves states considerable space to endorse important regulatory values in the transition to a decarbonized grid where these values are not priced in the wholesale competitive power market regulated by FERC. In addressing stranded cost compensation for the risks associated with energy infrastructure, state regulators should be encouraged

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207 *See* Hammond & Spence, *supra* note 19, at 154.

208 *Hughes*, 136 S. Ct. at 1298–99.

209 Even where, as in PJM, capacity markets provide some reliability pricing in the wholesale market, it is not clear that they provide a perfect market valuation of reliability values associated with different energy resources. The American Public Power Association, for example, has highlighted how long-term contracts provide a superior way of promoting reliability in comparison to capacity markets, and that capacity markets can result in different reliability pricing based on how a state chooses to address its retail market. *See* Randy Elliott, *Staying Power of a Bad Idea: Capacity Markets' Reliability Pricing Mechanism*, AM. PUB. POWER ASS'N (Sept. 8, 2015), http://blog.publicpower.org/sme/?p=761 [https://perma.cc/XM2L-E7LF].

210 Hammond & Spence, *supra* note 19, at 174, 212.

211 *Hughes*, 136 S. Ct. at 1299.

212 *Id.* Justice Sotomayor's concurrence also underscored "the importance of protecting the States' ability to contribute, within their regulatory domain, to the Federal Power Act's goal of ensuring a sustainable supply of efficient and price-effective energy." *Id.* at 1300 (Sotomayor, J., concurring).

to approach new infrastructure with the aim of advancing values such as low-carbon energy. Of course, as *Hughes* reminds us, such efforts cannot be motivated by or target a FERC-approved exclusive scheme for pricing wholesale power sales, such as the capacity market operated by PJM. However, to the extent that stranded cost recovery is aimed at social values that are not currently valued in competitive market prices as approved by FERC, such as retail reliability or carbon impacts of various energy resources, it is not inconsistent with *Hughes*'s preemption analysis for states to compensate these energy resources differently, even through subsidies.

In a new experiment that will test this assertion and the limits of *Hughes*, the N.Y. Public Service Commission (NYPSC) has adopted a Clean Energy Standard that will, among other things, compensate upstate merchant nuclear power plants for the social cost of carbon that their electricity generation avoids.[213] Under the Zero Emission Credit approach applicable to these plants, the nuclear energy companies operating the relevant plants will receive payments equivalent to the social cost of carbon, netting out revenues from the Regional Greenhouse Gas Initiative, for the first two-year period of the Credit.[214] This approach seems to fall on the "safe" side of *Hughes* because it makes no reference to the wholesale markets and prices, an attribute not considered in those markets. In later years, however, there will also be a price adjustment for wholesale energy and capacity market revenues.[215] Although the NYPSC was careful to note that it was not setting a price floor for nuclear power,[216] the fact that later compensation directly accounts for wholesale market revenues is at least worrisome under *Hughes*.[217]

Despite the uncertainties created by *Hughes*, the authors of this article are optimistic about the general viability of stranded cost approaches in furtherance of grid decarbonization. That decarbonization is directed at a value not incorporated into the wholesale markets means states ought to be able to craft a variety of approaches without running afoul of *Hughes*. To the extent that federal involvement is necessary to address some

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213 Order Adopting a Clean Energy Standard at 1, Nos. 15-E-0302, 16-E-0270 (N.Y. P.U.C. Aug. 1, 2016). In adopting this approach, New York regulators rejected earlier proposals that were much more closely tied to wholesale revenues. *See* Joel B. Eisen, *Dual Electricity Federalism Is Dead, but How Dead, and What Replaces It?*, 8 GEO. WASH. J. ENERGY & ENV'T. 1, 19 (2017).

214 Order Adopting a Clean Energy Standard at 51, Nos. 15-E-0302, 16-E-0270 (N.Y. P.U.C. Aug. 1, 2016).

215 *Id.*

216 *Id.* at 139.

217 For further analysis, see Eisen, *supra* note 213, at 19–20.

stranded cost issues, we are encouraged that FERC has experience with such policies just as the states do.

CONCLUSION

Stranded cost recovery for investor risk has played a central role in energy industry transitions, often helping to grease the wheels of change. However, as past experiments with cost recovery show, it also has suffered from myopia that has delayed some desirable industry transitions and left stranded important values that firms and energy markets fail to price. The impending transition to a decarbonized grid cannot ignore these timing and stranded value issues and thus presents a unique opportunity to improve energy law's approach to stranded cost compensation. As in the past, stranded cost compensation will prove important (and essential) to the next energy transition, but it can and should be approached in a manner that overcomes decarbonization's obstacles, reassures investors in new infrastructure without distorting price signals, and recognizes important energy resource attributes that markets fail to price.