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Public Utility and the Low-Carbon Future

William Boyd

ABSTRACT

Substantial reductions in global power sector emissions will be needed by midcentury to avoid significant disruption of the climate system. Achieving these reductions will require greatly increased levels of financing, technological innovation, and policy reform. In the United States, the scale and complexity of the overall challenge have raised important questions regarding prevailing regulatory and business models, with much scrutiny directed at the traditional practice of public utility regulation. Recognizing the many valid criticisms leveled against public utility regulation and the important questions raised about the viability of traditional utility business models, particularly in the face of substantial growth in distributed energy resources, this Article argues that a revitalized and expanded notion of public utility has a critical role to play in efforts to decarbonize the power sector in the United States.

In making this argument, the Article looks back to an earlier, more expansive concept of public utility as articulated by Progressives, legal realists, and institutional economists in the early twentieth century. This earlier concept of public utility contains valuable insights for dealing with the current challenges of decarbonization. The Article shows how this broader concept of public utility was substantially diminished by a confluence of external challenges and a sustained intellectual assault mounted by economists and lawyers starting in the 1960s. The narrowed understanding of public utility that resulted, it is argued, has distorted our views regarding the role of markets and disruptive technologies in the sector. In fact, basic public utility principles continue to govern a significant amount of activity across the power sector, including in both wholesale and retail electricity markets. And there are important unrealized possibilities embedded within the public utility concept that hold considerable promise for reforming current regulatory and business models in the face of rapid technological change and growing decarbonization imperatives.

Such principles and possibilities are particularly important in ongoing efforts to increase renewable energy and finance large low-carbon generation projects. They also hold great promise for ongoing efforts to plan for and optimize the integration of increasingly large amounts of distributed energy resources such as rooftop solar, demand response, and energy storage. Indeed, when one looks at the overall scale, complexity, and sequencing of investments needed to decarbonize the power sector over the coming decades (however it comes to be organized), it is clear that the broad concept of public utility offers essential tools for planning and coordinating such investments over the long time horizons contemplated and for managing a system of increasing complexity. In all of these areas, a more expansive notion of public utility that draws from earlier understandings of the concept provides a normative foundation for efforts to govern a power system that is increasingly complex, participatory, and intelligent, and

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for managing the sustained, collective effort to channel investment and behavior in a manner necessary to realize a low-carbon future.

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INTRODUCTION

Public utility. At one time, the concept was among the most powerful and evocative in American law—a legal innovation that married private business with public regulation to provide the means for building and managing a series of network industries (railroads, telephone, natural gas, electricity) that were the envy of the industrialized world. "No task more profoundly tests the capacity of our government, both in nation and state," wrote Felix Frankfurter, "than its share in securing for society those essential services which are furnished by public utilities."[1] A product of the Progressive era, public utility was a distinctively American approach to the "social control of business"—a third way between unregulated markets and outright public ownership that promised to harness the energy of private enterprise and direct it toward public ends.[2]

Today the concept all too often evokes derision, even scorn, from a range of critics who see it as an outdated relic of a bygone era that put too much faith in government control and the fuzzy notion of public interest.[3] To be sure, in some traditional public utility sectors, such as telecommunications, disruptive technologies and deregulation have dramatically reduced the importance of the basic public utility model.[4] But in others, notably electricity, the model still holds considerable sway. With a pedigree stretching back decades, the current critique sees the continued importance of public utility in the electric power sector as one of the last bastions of an early twentieth-century ap-

1. FELIX FRANKFURTER, THE PUBLIC AND ITS GOVERNMENT 81 (1930).
2. *See* CHARLES F. PHILLIPS, JR., THE REGULATION OF PUBLIC UTILITIES: THEORY AND PRACTICE 5 (3d ed. 1993) (discussing the "unique" approach of the United States to the provision of public utility services through regulated private companies); Marshall E. Dimock, *British and American Utilities: A Comparison*, 1 U. CHI. L. REV. 265, 265 (1933) ("Public utility regulation is preeminently American, although the public utility concept was derived from English rather than from American sources."). The phrase "social control of business" was a common one in early twentieth-century discussions of the proper role of government in managing the economy. *See, e.g.*, JOHN MAURICE CLARK, SOCIAL CONTROL OF BUSINESS (1926); *see also* William J. Novak, *Law and the Social Control of American Capitalism*, 60 EMORY L.J. 377, 392–99 (2010) (discussing early twentieth-century literature on the social control of business); Harry M. Trebing, *Realism and Relevance in Public Utility Regulation*, 8 J. ECON. ISSUES 209, 209 (1974) ("Public utility regulation was one of the pioneering areas of study in the social control of industry.").
3. *See* discussion *infra* Parts II.B, II.E.
4. *See generally* JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: TELECOMMUNICATIONS LAW AND POLICY IN THE INTERNET AGE (2d ed. 2013) (discussing impacts of changing regulatory frameworks and technological innovation on various aspects of the telecommunications industry).

proach to regulation that long ago metastasized into a pathological swamp of anti-innovation, rent-seeking behavior.

And yet, according to critics and industry observers, it appears that the forces of disruptive innovation are finally breaking down the barriers that have insulated electric utilities for so long.[5] New technologies and business models (smart grids, demand response, distributed generation, the services-oriented iUtility) are finally shaking up the electricity sector.[6] Predictions of imminent demise are common.[7] "Death spiral" is a favorite phrase.[8] Even the industry's own trade association, the Edison Electric Institute, is sounding alarms that the current conjuncture is different and that the electric utility business model is in need of serious revision.[9]

While it may well be the case that we are witnessing a historically unique set of challenges to the traditional electric utility business model, it is also clear that regulated utilities continue to play very important roles in the U.S. electric power sector and, more importantly, that the broader concept of public utility continues to inform a great deal of what is happening in the sector. A few quick facts illustrate this point. In the United States today, regulated investor-owned utilities (IOUs) serve about 70 percent of the population, with the remainder served by various retail providers, electric cooperatives,

5. *See, e.g.*, Fereidoon P. Sioshansi, *Why the Time Has Arrived to Rethink the Electric Business Model*, 25 ELECTRICITY J. 65, 73 (2012) (discussing the need to rethink the traditional utility business model).

6. *See, e.g.*, PETER FOX-PENNER, SMART POWER: CLIMATE CHANGE, THE SMART GRID, AND THE FUTURE OF ELECTRIC UTILITIES 34–40 (2010) (discussing impacts of technological change on utility business models); JOSEPH P. TOMAIN, ENDING DIRTY ENERGY POLICY: PRELUDE TO CLIMATE CHANGE 164–65 (2011) (advocating replacement of traditional utility business model with a new, "smarter," services-oriented "iUtility").

7. *See, e.g.*, Liam Denning, *Lights Flicker for Utilities*, WALL ST. J. (Dec. 22, 2013, 6:18 PM), http://online.wsj.com/news/articles/SB10001424052702304773104579270362739732266; Chris Martin et al., *Why the U.S. Power Grid's Days Are Numbered*, BLOOMBERG BUSINESSWEEK (Aug. 22, 2013), http://www.businessweek.com/articles/2013-08-22/homegrown-green-energy-is-making-power-utilities-irrelevant [hereinafter Martin et al., *Power Grid*]; Richard Martin, *Distributed Generation Poses Existential Threat to Utilities*, FORBES (Aug. 26, 2013, 1:46 PM), http://www.forbes.com/sites/pikeresearch/2013/08/26/distributed-generation-poses-existential-threat-to-utilities ("To the list of industries at risk of complete obsolescence—which at the moment includes daily newspapers, government postal services, and men-only barbershops, among others—you can add U.S. power utilities.").

8. *See, e.g.*, Martin et al., *Power Grid*, *supra* note 7; *see also* Diane Cardwell, *On Rooftops, a Rival for Utilities*, N.Y. TIMES, July 27, 2013, at B1 (discussing challenges to utility business models from rooftop solar and citing the "death spiral" characterization).

9. *See* EDISON ELEC. INST., DISRUPTIVE CHALLENGES: FINANCIAL IMPLICATIONS AND STRATEGIC RESPONSES TO A CHANGING RETAIL ELECTRIC BUSINESS 11, 13 (2013).

and publicly-owned utilities.[10] Many of these IOUs are vertically integrated; others, primarily in states that have restructured their retail electricity markets, provide retail, distribution, and default or "provider of last resort" services.[11] Most of the transmission and distribution systems across the country are also owned or operated by regulated utilities. In the organized wholesale power markets, the regional transmission organizations (RTOs) and independent system operators (ISOs) that manage the transmission systems for their member utilities are themselves regulated as public utilities by the Federal Energy Regulatory Commission (FERC), notwithstanding the fact that their business model is quite different from the traditional IOUs. The wholesale power markets that are administered by the RTOs and ISOs are also highly regulated—more so in some respects than traditional utilities operating under "rate-of-return" or "cost-of-service" frameworks.[12] In sum, public utility principles continue to inform and guide a significant amount of activity across the power sector.

When one considers the challenges involved in decarbonizing the electric power sector over the next half century, moreover, the concept of public utility takes on additional salience. The planning, sequencing, and financing of hundreds of billions of dollars in new investments needed to modernize the electric power grid and build new low carbon generation will require a level of certainty regarding cost recovery that markets alone will have difficulty providing. Similarly, the coordination and systems-operation challenges associated with increasing levels of intermittent renewable generation and integration of various distributed energy resources will require a degree of administration and oversight that exceeds current systems operation capabilities. Finally, the

10. *See* AM. PUB. POWER ASS'N, 2013–14 ANNUAL DIRECTORY & STATISTICAL REPORT 30 (2013) (reporting data showing that investor-owned utilities serve 68.2 percent of U.S. electricity customers, public owned utilities serve 14.6 percent, cooperatives serve 12.9 percent, and power marketers serve 4.3 percent).

11. Providers of last resort are typically incumbent utilities that have been designated by public utility commissions (PUCs) in states with retail competition to provide service to those customers who are not served by other retail electricity providers. It is an extension of the electric utility's duty to serve or universal service obligation. *See* Jim Rossi, *The Common Law "Duty to Serve" and Protection of Consumers in an Age of Competitive Retail Public Utility Restructuring*, 51 VAND. L. REV. 1233, 1288–1319 (1998) (discussing different models for extending duty to serve in competitive retail markets).

12. *See, e.g.*, Lester Lave et al., *Deregulation/Restructuring Part I: Reregulation Will Not Fix the Problems*, 20 ELECTRICITY J. 9, 10, 16 (2007) ("Rather than reduce regulation, restructuring has imposed two new levels of regulation. . . . If anything, there are more layers of regulation now. . . . The RTO regulation, especially by the market monitor, is more detailed and intrusive than any that the industry had under RORR [rate-of-return regulation]."); *see also* discussion *infra* Part II.D (discussing design and regulation of wholesale power markets).

pace and scale of policy innovation and the need for commercial-scale demonstration projects for new technologies (from carbon capture and storage to smart grid deployment and vehicle electrification) will call for sustained public-private cooperation that goes beyond what is feasible under current market structures. In all of these areas, a broad concept of public utility provides important organizing principles and tools for managing the transition to a low carbon future.

None of which is to say that there are not problems with the traditional electric utility business model, much less that the sector is not facing challenges from new technologies and business practices that are substantially different from those of the past. The concern here, and a premise of this Article, is that the enthusiasm for technological disruption, which permeates current policy discussions regarding the electric power sector and seems to be ubiquitous in contemporary culture, may be deflecting attention from other important pathways and possibilities. Given the uncertainty about future economic and technological change, it seems prudent to hedge a bit (in an institutional sense) and to consider some of the ways in which public utility, broadly understood, could be a vital part of a low-carbon future. In doing so, it is important to look not only at how the industry has changed and adapted in the wake of previous challenges, but also at how the concept of public utility itself has changed over time, and what lessons, if any, can be learned from these changes as we confront the challenge of decarbonization.

Such an undertaking requires that we distinguish between the current IOU business model and the broader concept of public utility. Although often conflated, they are not the same. As understood here, public utility is first and foremost a normative effort directed at ensuring that the governance of essential network industries, such as electric power, proceeds in a manner that protects the public from the abuses of market power by providing stable, reliable, and universal service at just and reasonable rates. Public utility, in this broader sense, is not a thing or a type of entity but an undertaking—a collective project aimed at harnessing the power of private enterprise and directing it toward public ends. The traditional IOU business model is thus a manifestation of public utility. But it hardly exhausts the category, and it would be a mistake to presume that there is only one right way to organize and regulate the power sector within the broad framework of public utility.

This Article investigates the changing understandings of public utility in the United States over the last century and the implications of these changes for efforts to decarbonize the power sector. It seeks to recover an earlier understanding of the concept as it was elaborated by Progressive lawyers, legal realists, and institutional economists during the first half of the twentieth century. Public utility, in their view, was an important and distinctive American innovation—an example of the "creative force of law" aimed at using government to guide certain private businesses toward public ends.[13] The Article shows how this broader concept of public utility gave way to a much thinner understanding in response to a confluence of external challenges (namely, technological stasis, the energy crisis of the 1970s, and the rise of environmental concerns) and a sustained intellectual assault mounted by economists and lawyers, many of them associated with the University of Chicago, starting in the 1960s. The diminished notion of public utility that resulted has distorted our views regarding the role of markets and disruptive technologies in the power sector, particularly in the context of efforts to promote low-carbon electricity.

Building on this, the Article's normative claim is that a revitalized notion of public utility—one that sees it less as an obstacle to markets and innovation and more as an "instrument of the commonwealth"—could play an important role in the effort to secure a low-carbon future.[14] Thus, rather than viewing the contemporary situation as a stark choice between the power of markets and disruptive innovation on the one side and ossification and rent seeking on the other, this Article argues that a broader notion of public utility offers a possible normative and conceptual frame for moving beyond the false separation of markets and regulation, beyond the current fascination with disruptive innovation, to guide the common, collective enterprise of building and elaborating the institutions, regulatory structures, and business models that will be necessary to realize a low-carbon future.

Part I discusses briefly the substantial contribution of the electric power sector to U.S. greenhouse gas (GHG) emissions, the distinctive challenges facing efforts to decarbonize the sector, and the diversity of institutional and regulatory forms that characterizes the current system. The central claim here is that when one looks at the overall scale, complexity, and sequencing of investments needed to decarbonize the electric power sector over the coming decades (however it comes to be organized), it is clear that the tools and practices of public utility regulation offer important resources for planning and coordinat-

13. *See* Novak, *supra* note 2, at 399; *infra* Part II.A.

14. Walton H. Hamilton, *Price—By Way of Litigation*, 38 COLUM. L. REV. 1008, 1034 (1938) [hereinafter Hamilton, *Price—By Way of Litigation*]; *see also* WALTON HAMILTON, THE POLITICS OF INDUSTRY 18 (1957) [hereinafter HAMILTON, POLITICS OF INDUSTRY] ("All industries are, in their several degrees, instruments of the general welfare; where there is failure in performance, the call is for statecraft.").

ing such investments over the long time horizons contemplated and for managing a system of increasing complexity.

Part II traces the major changes in the public utility concept over the last century. It first discusses the broad understanding of public utility advanced by Progressives, legal realists, and institutionalists during the early twentieth century, with particular attention to their views on rate regulation, competition, and experimentalism in public utility law. It then shows how this earlier understanding of the concept was narrowed and diminished by a sustained intellectual critique mounted by economists and lawyers starting in the 1960s—a critique that was further reinforced by the profound challenges facing electric utilities and public utility regulation in the 1970s and 1980s as a result of exhaustion of economies of scale in power generation, the energy crises of the 1970s, and rising environmental concerns. Part II then demonstrates how the subsequent move to deregulate various segments of the industry in the 1990s, which comported with broader trends toward deregulation that had been underway for more than a decade, drew directly on this narrowed understanding of public utility, reinforcing a sharp but problematic distinction between regulation and markets in thinking about the new modes of governance for the power sector.

Finally, Part II shows how the growing attention in the contemporary context to the potentially disruptive effects of technologies such as distributed generation and the corresponding threats to the traditional utility business model depend upon and reproduce a thin conception of public utility—even though these disruptive technologies have benefited greatly from traditional forms of public utility regulation and despite the considerable promise that a revitalized notion of public utility might play in the organization and governance of a system that includes more active and dynamic participation by consumers. The overall objective of Part II is to show how the thin conception of public utility that emerged from the economic critique of the 1960s and 1970s has shaped subsequent debates regarding the role of markets and disruptive technologies in the sector, reinforcing the view that public utility is an obstacle to be overcome rather than a possible source of new thinking and new approaches.

Part III draws directly on the historical discussion in Part II and argues for a more expansive and revitalized understanding of public utility as a key component of the effort to build a low-carbon future. It claims that a broad notion of public utility is essential to motivate and organize the planning and investment needed to decarbonize the power sector by midcentury, to coordinate and administer a grid capable of integrating substantial amounts of intermittent renewable generation and distributed energy resources, and to facilitate experimentation and innovation at scale. In making this claim, Part III emphasizes the importance of recovering a broad notion of the *public* in public utility, arguing that the transition to a low carbon electricity system over the coming decades can only be realized if it is seen as a collective, political choice that aligns technologies, business models, and regulatory frameworks in a manner that capitalizes upon the positive network effects of an increasingly integrated and participatory electric power grid.

I. ELECTRIC POWER AND THE CLIMATE CHANGE CHALLENGE

The U.S. electric power system is the largest in the world.[15] It has been described as the most complex machine ever built.[16] Organized into three major grids, or interconnects, (Eastern, Western, and Texas[17]) it joins a diverse array of generation assets with high-voltage transmission lines, local distribution systems, and, increasingly, active demand-side and distributed resources to deliver a highly reliable service to millions of households and businesses in a manner that must precisely balance generation (supply) and load (demand) in real-time. It is also the largest single source of greenhouse gas (GHG) emissions in the United States, accounting for a third of total U.S. GHG emissions in 2012.[18] It goes without saying that the power sector must be a vital part of any effort to build a low-carbon future in the United States—a fact that becomes

15. *See* MIT, THE FUTURE OF THE ELECTRIC GRID 1 (2011) ("Hailed as the 'supreme engineering achievement of the 20th century' by the National Academy of Engineering, the U.S. electric power grid serves more than 143 million residential, commercial, and industrial customers through more than 6 million miles of transmission and distribution lines owned by more than 3,000 highly diverse investor-owned, government-owned, and cooperative enterprises.") (citations omitted); S. Massoud Amin, *Securing the Electricity Grid*, 40 THE BRIDGE 1, 14 (2010) (describing the North American power system as the largest and most complex machine in the world).
16. PHILLIP F. SCHEWE, THE GRID: A JOURNEY THROUGH THE HEART OF OUR ELECTRIFIED WORLD 1 (2007) ("Taken in its entirety, the grid is a machine, the most complex machine ever made."); *see also* THOMAS P. HUGHES, NETWORKS OF POWER: ELECTRIFICATION IN WESTERN SOCIETY, 1880–1930, at 1 (1983) ("Of the great construction projects of the last century, none has been more impressive in its technical, economic, and scientific aspects, none has been more influential in its social effects, and none has engaged more thoroughly our constructive instincts and capabilities than the electric power system.").
17. *See* MIT, *supra* note 15, at 3 (describing the three major interconnects that make up the U.S. electric power system).
18. *See* U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2012, at ES-23 (2014) (noting that emissions from electricity generation accounted for the largest portion (32 percent) of US greenhouse gas emissions in 2012).

even more apparent as efforts to electrify the transportation sector (the second largest source of U.S. GHG emissions[19]) move forward.

Multiple scenarios have been developed to understand the possible future makeup of a decarbonized power sector in the United States. Several of these identify 80 percent reductions in GHG emissions by 2050 as a benchmark—a very ambitious target that would require substantial increases in investment across all aspects of the power sector over the next several decades, regardless of the ultimate mix of technologies and resources. Some of these studies focus on the possibility of a power sector composed primarily of renewable technologies,[20] while others look more broadly at a combination of renewables and other sources of low-carbon energy such as nuclear power and fossil fuel generation (coal or natural gas plants) with carbon capture and storage.[21] Under any scenario, however, certain distinctive features of the electric power system must be kept in mind. This Part discusses some of those key features and their implications for efforts to decarbonize the power sector over the next several decades. The central observation is that realizing a low-carbon future will require greatly enhanced levels of planning, investment, and coordination across multiple scales.

A. Energy System Momentum and Committed Emissions

Two concepts help to elucidate the challenge of decarbonizing the electric power sector: energy system momentum and committed emissions. Energy system momentum recognizes that the long-lived, relation-specific assets involved in electricity generation, transmission, and distribution, combined with the institutional and regulatory frameworks that govern the use of these assets,

19. *Id.* at ES-22 (reporting transportation as second largest source of US greenhouse gas emissions in 2012).

20. *See, e.g.*, NAT'L RENEWABLE ENERGY LAB., RENEWABLE ELECTRICITY FUTURES STUDY: EXECUTIVE SUMMARY iii (M.M. Hand et al. eds., 2012) [hereinafter RENEWABLE ELECTRICITY FUTURES STUDY: EXECUTIVE SUMMARY] (noting that the analysis presented in the four-volume renewable electricity futures study "assesses a variety of scenarios with prescribed levels of renewable electricity generation in 2050, from 30% to 90%, with a focus on 80% (with nearly 50% from variable wind and solar photovoltaic generation)"); s*ee* AMORY B. LOVINS & ROCKY MOUNTAIN INST., REINVENTING FIRE: BOLD BUSINESS SOLUTIONS FOR THE NEW ENERGY ERA 169 (2011) [hereinafter REINVENTING FIRE] (presenting multiple scenarios for the power sector including 80 percent renewables by 2050).

21. *See, e.g.*, WORLD BUSINESS COUNCIL FOR SUSTAINABLE DEVELOPMENT, PATHWAYS TO ENERGY AND CLIMATE CHANGE 2050, at 14–15 (2005) (presenting U.S. low-carbon power sector scenario with mix of nuclear, coal with carbon capture and storage, and renewables).

result in a system with a tremendous amount of inertia.[22] Put another way, the $1.1 trillion invested in the current electric power system in the United States, combined with the multi-decade lifetimes of many of these assets, and a constellation of deeply entrenched political and economic interests, makes the system very resistant to change.[23]

The corollary to energy system momentum—the idea of committed emissions—recognizes that these assets (and the system as a whole) have embedded within them a significant amount of future greenhouse gas emissions.[24] That is, if we assume that the current stock of fixed capital that constitutes our electric power system will live out its useful life (thirty to forty years in the case of most generation assets), we can derive an estimate of the emissions that are already baked into the current capital stock.[25] While it is possible that some of these assets will be retired early or retrofitted in a manner that changes their emissions profile (early retirements of coal plants as a result of cheap natural gas and new EPA regulations come to mind),[26] it is clear that there are

22. *See* HUGHES, *supra* note 16, at 15–16, 140, 465 (describing the sociotechnical momentum of developing electric power systems); John P. Holdren, *The Energy Innovation Imperative: Addressing Oil Dependence, Climate Change, and Other 21st Century Energy Challenges*, 1 INNOVATIONS 3, 6 (2006) (discussing the inertia of the current energy system that results from the combined effects of very large investments in fixed capital with long turnover times and entrenched political and economic interests).

23. The net asset value of the plant in service for all U.S. electric utilities in 2010 was approximately $1.1 trillion, which includes $765 billion for investor-owned utilities (IOUs), $200 billion for municipal utilities, and $112 billion for rural electric cooperatives. RON BINZ ET AL., CERES, PRACTICING RISK-AWARE ELECTRICITY REGULATION: WHAT EVERY STATE REGULATOR NEEDS TO KNOW 14 (2012).

24. *See* Steven J. Davis et al., *Future CO_2 Emissions and Climate Change From Existing Energy Infrastructure*, 329 SCIENCE 1330, 1330 (2010) (discussing "committed emissions" in the current stock of long-lived energy and transportation infrastructure and noting that "[b]arring widespread retrofitting of existing power plants with carbon capture and storage technologies or the early decommissioning of serviceable infrastructure, these 'committed emissions' represent infrastructural inertia, which may be the primary contributor to total future warming commitment").

25. R.T. Dahowski & J.J. Dooley, *Carbon Management Strategies for US Electricity Generation Capacity: A Vintage-Based Approach*, 29 ENERGY 1589, 1591–92 (2004) (estimating future CO_2 emissions from U.S. fossil fuel power plants built prior to 2000); Davis et al., *supra* note 24, at 1330 (discussing "committed emissions" in the current stock of long-lived energy and transportation infrastructure); Gregory C. Unruh, *Understanding Carbon Lock-in*, 28 ENERGY POL'Y 817, 817 (2000) (discussing carbon lock-in tendencies of current fossil fuel-dominated energy systems).

26. *See* U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2014, at IF-34–IF-38 (2014) [hereinafter ANNUAL ENERGY OUTLOOK 2014] (discussing accelerated coal plant retirements). In addition to early retirements, fuel switching, increased biomass co-firing, and a more general shift of fossil plants from providing energy to providing reserve capacity and balancing resources for renewables could also change the emissions profile of existing generation.

substantial committed emissions in the current system and, more importantly, that the investment decisions made today will strongly influence the industry's emissions profile for decades to come.

This is particularly important in the current environment, because the industry is in the midst of a major investment cycle. Over the last five years (2008–12), IOUs have invested an average of more than $80 billion per year in new generation, transmission, and distribution assets—a 50 percent increase over annual investment during the previous five years.[27] One estimate puts future investment needs in the power sector at roughly $2 trillion over the next twenty years (an average of $100 billion per year).[28] And because much of this capital investment will be in long-lived relation-specific assets—generating units, high voltage transmission lines, and local distribution systems—the current investment cycle will likely have a major influence on the shape of the power sector over the coming decades. In the absence of a substantial devaluation of existing utility assets, which is always a possibility, the current investment cycle is thus creating additional momentum for the future configuration of the electric power system.[29]

This leads to the conclusion that careful planning and sequencing of investments in various segments of the industry (and at multiple scales) will be necessary to create an electric power system that has a vastly reduced emissions profile compared to the current system. Even with a price on carbon, moreover, the wholesale power markets alone may not be able to deliver the proper incentives.[30] Waiting for disruptive technologies to emerge and deploy on a large scale is also problematic given the complexity of the system and the challenges of rapidly integrating large amounts of renewable energy, demand response, and distributed generation.

Indeed, despite the many comparisons made between telecommunications and electricity with respect to the potential for disruptive innovation, there are limits to how instructive the telecommunications experience is for electric power.[31] For starters, the power sector faces a set of growing carbon

27. *See* EDISON ELEC. INST., 2012 FINANCIAL REVIEW 18 (2012).
28. *See* BINZ ET AL., *supra* note 23, at 19.
29. *See* HUGHES, *supra* note 16, at 15–16, 465 (discussing concept of momentum in large socio-technological systems).
30. As discussed in Part III.A, *infra*, even a relatively high price on carbon may not be sufficient to incentivize the required investment in low-carbon technologies at the scale and pace necessary to significantly decarbonize the power sector by midcentury.
31. *See, e.g.*, Martin et al., *Power Grid, supra* note 7 (analogizing disruption of current electric power sector to telecommunications); EDISON ELEC. INST., *supra* note 9, at 14–17 (discussing history of disruption in telecommunications and its implications for the power sector). *But see* PAUL L. JOSKOW & RICHARD SCHMALENSEE, MARKETS FOR POWER:

and environmental constraints that the telecommunications sector has never faced. Moreover, in contrast to telecommunications, there are no obvious alternative networks that could take the place of the current electricity grid in the way that wireless and cable networks have rendered traditional landline telephone service redundant. It also seems unlikely that substantial numbers of people will soon exit the grid entirely, although the possibility of grid defection is growing.[32] More importantly, even though grid defection may become an increasingly attractive opportunity for some, it is not optimal from either an economic or an environmental perspective and it has potentially serious distributional consequences.[33] In short, as discussed in more detail below, modernizing the electric power grid and making it more responsive to decarbonization imperatives and more accommodating of various forms of distributed energy resources offers a more realistic pathway to reducing power sector emissions by 80 percent or more by midcentury.

B. Distinctive Features of Electric Power

Viewed as a whole, the electric power system is a complex, highly interdependent network that operates on multiple time scales, ranging from milliseconds to years.[34] Because electricity cannot be stored on any significant scale, cannot be directed (as in the case of classic switched networks), and because generation and load must be balanced in real time, sophisticated systems operation capabilities are necessary to ensure continuous delivery of reliable elec-

AN ANALYSIS OF ELECTRIC UTILITY DEREGULATION 43 (1983) (discussing differences between telecommunications and electricity in context of deregulation and noting that "casual reasoning by analogy produces sound policy only by chance").

32. *See* PETER BRONSKI ET AL., THE ECONOMICS OF GRID DEFECTION: WHEN AND WHERE DISTRIBUTED SOLAR GENERATION PLUS STORAGE COMPETES WITH TRADITIONAL UTILITY SERVICE 39 (2014) [hereinafter BRONSKI ET AL., ECONOMICS OF GRID DEFECTION] ("[S]olar-plus-battery systems will reach grid parity—for growing numbers of customers in certain geographies, especially those with high retail electricity prices—well within the 30-year period by which utilities capitalize major power assets. Millions of customers, commercial earlier than residential, representing billions of dollars in utility revenues will find themselves in a position to cost effectively defect from the grid if they so choose.").

33. *See id.* ("When solar-plus-battery systems are integrated into a network, new opportunities open up that generate even greater value for customers and the network (e.g., potentially better customer-side economics, additional sizing options, ability of distributed systems to share excess generation or storage).").

34. *See* ALEXANDRA VON MEIER, ELECTRIC POWER SYSTEMS: A CONCEPTUAL INTRODUCTION 260–68 (2006) (discussing balancing requirements at multiple scales necessary to coordinate generation and load in electric power systems).

tric service.[35] The electric power industry has been described, in this respect, as the ultimate just-in-time system.[36]

These facts make it difficult to design markets for electricity, which require carefully designed dispatch algorithms and auctions and are distinctly vulnerable to the exercise of market power.[37] They also pose challenges to the integration of large amounts of intermittent non-dispatchable renewable resources, demand response, and other distributed energy resources such as rooftop solar and storage. In all of these cases, balancing resources are needed to compensate for intermittency and to maintain frequency. One of the many promises of a more intelligent grid (one that encompasses transmission and distribution systems as well as advanced meters at the utility/customer interface) is to enable more careful and precise systems operation. Realizing that future will require more planning and coordination, not less. Simply put, as the complexity of the grid increases—with more actors buying and selling power, more renewables, more demand response, more storage, and more distributed generation—the importance of systems operation only grows.

In this respect, it is sometimes useful to think of electricity as less of a commodity and more of an infrastructure—a system of provisioning that allows energy services to be made available to those connected to the grid, thereby

35. Electricity is often mischaracterized as the flow of electrons. In fact, it is electric current that flows through the grid at roughly the speed of light. The electrons in the transmission and distribution wires simply oscillate in place (in Alternating Current (AC) systems), "shoved" back and forth in the direction of the electric field. The energy that is transmitted across the system occurs via the propagation of an electromagnetic wave. *See id.* at 8 ("Conceptually, it is important to recognize that what is traveling at this high speed is the *pulse* or *signal* of the current, not the individual electrons."). For a good overview of the distinctive features of electric power systems and their implications for the current grid, see Brief Amicus Curiae of Electrical Engineers, Energy Economists and Physicists in Support of Respondents at 2, 6–9, New York v. FERC, 535 U.S. 1 (2001) (No. 00-568).

36. *See* Paul L. Joskow, *Creating a Smarter U.S. Electricity Grid*, 26 J. ECON. PERSP. 29, 33 (2012) ("Electricity is the ultimate 'just-in-time' manufacturing process, where supply must be produced to meet demand in real time.").

37. *See* VON MEIER, *supra* note 34, at 295 ("The extreme inelasticity of demand and supply as the system nears its limits makes it vulnerable to the withholding of even small amounts of generation capacity."); Lave et al., *supra* note 12, at 17–18 (discussing the vulnerabilities of restructured markets to withholding and market manipulation); Frank A. Wolak, *Regulating Competition in Wholesale Electricity Supply*, *in* ECONOMIC REGULATION AND ITS REFORM: WHAT HAVE WE LEARNED? (Nancy L. Rose ed., forthcoming July 2014) (manuscript at 1), *available at* http://www.nber.org/chapters/c12567.pdf ("[T]he probability of a costly market failure in the electricity supply industry, often due to the exercise of unilateral market power, appears to be significantly higher than in other formerly regulated industries."); discussion *infra* Parts II.D, III.A.

providing a platform for other forms of economic activity.[38] The increase in distributed energy resources (distributed generation, demand response, storage) allows households and businesses to be more active participants in that infrastructure. This requires significant increases in system-wide flexibility that, if managed appropriately, could allow for high penetration of variable renewable sources. It also deepens rather than diminishes the collective nature of the system, as passive consumers become more active participants on the grid.

C. Institutional and Regulatory Diversity

The traditional electric power system in the United States was organized primarily into large, vertically integrated IOUs that owned the generation, transmission, and distribution assets necessary to provide a bundled retail service under a cost-of-service regulated franchise model.[39] These IOUs managed

38. *See* Harry M. Trebing, *On the Changing Nature of the Public Utility Concept: A Retrospective and Prospective Assessment*, *in* ECONOMICS BROADLY CONSIDERED: ESSAYS IN HONOR OF WARREN J. SAMUELS 258, 269 (Jeff E. Biddle et al. eds., 2001) [hereinafter Trebing, *Changing Nature*] ("Public utilities are network industries that are an integral part of society's infrastructure. This infrastructure, in turn, serves as a platform for promoting growth in productivity and gains in real income. It cannot be assumed that oligopolistic market structures will automatically culminate in the realization of an optimal infrastructure, the realization of all network and coordination economies, or the distribution of these gains to all sectors of the economy."). Trebing and others have also occasionally described the system as a commons. *See, e.g.*, Edythe S. Miller, *Implications for the Social Control of Business of Competing Economic Visions, in* THE INSTITUTIONALIST APPROACH TO PUBLIC UTILITIES REGULATION 437, 454 (Edythe S. Miller & Warren J. Samuels eds., 2002) (describing "public utilities and network infrastructure . . . as part of the social capital of the economy—that is, part of the commons—requiring oversight to ensure wide accessibility and to guard against use as a hostage to fortune"); Harry M. Trebing, *Market Failure in Public Utilities: An Institutionalist Crtique of Deregulation*, *in* INSTITUTIONAL ANALYSIS AND ECONOMIC POLICY 287, 305 (Marc R. Tool & Paul Dale Bush eds., 2003) ("[A] network should be envisioned as a commons, composed of a collection of services and activities that are provided under conditions where pervasive network and coordination economies combine to lower costs and improve functionality.").
39. *See* RICHARD F. HIRSH, POWER LOSS: THE ORIGINS OF DEREGULATION AND RESTRUCTURING IN THE AMERICAN ELECTRIC UTILITY SYSTEM 13–31 (1999) (describing development and early regulation of electric power system in the United States); Paul Joskow, *Regulatory Failure, Regulatory Reform, and Structural Change in the Electrical Power Industry*, BROOKINGS PAPERS ON ECON. ACTIVITY: MICROECONOMICS 125, 129 (1989) [hereinafter Joskow, *Regulatory Failure*] ("The typical utility has traditionally been vertically integrated, generating electricity and transmitting and distributing it to retail customers. As distributors, IOUs [investor owned utilities] typically have either a de jure or de facto exclusive franchise to provide service to the retail customers within their territories. In return, the rates they charge are subject to regulation by state regulatory commissions."); HUGHES, *supra* note 16, at 5–7 (discussing integration of electric power systems during the late nineteenth and early twentieth centuries).

their own systems, engaging in limited power transactions with neighboring utilities.[40] Rural cooperatives, municipal utilities, and other forms of public power operated in various parts of the country, often purchasing electricity from the large IOUs, but the IOU model dominated.[41]

Beginning in the early twentieth century, states established independent public utility commissions (PUCs) to regulate IOUs, creating an obvious and widening regulatory gap regarding interstate sales of electricity.[42] During this time, regional networks expanded to cover multiple states in order to take advantage of an increased ability to transmit electricity over large distances and to procure the benefits of load diversity.[43] Vast holding companies were created to organize, manage, and profit from the activities of local operating companies.[44] While these holding companies emerged in part to facilitate the building of regional systems, they also provided a means of escaping rate regulation by states and thus became an object of intense regulatory scrutiny and concern during the Great Depression as utilities went bankrupt across the country.[45]

40. *See* Joskow, *Regulatory Failure, supra* note 39, at 129 ("Historically, IOUs owned all the generation, transmission, and distribution capacity required to serve their retail customers."); *id*. at 130–31 (discussing wholesale transactions between utilities for coordination purposes).

41. In 1969, for example, IOUs provided electricity to 78 percent of all retail customers in the U.S. *See Competitive Aspects of the Energy Industry: Hearings on S. Res. 334, Pt.1 Before the Subcomm. on Antitrust and Monopoly of the S. Comm. on Judiciary*, 91st Cong. 263 (1970).

42. *See infra* Part II.A (discussing emergence and development of state public utility regulation during the early twentieth century). The names of these commissions varied across states and included Public Utility Commissions, Public Service Commissions, Corporation Commissions, and Railroad Commissions (among others). The term "Public Utility Commission" or PUC is used throughout this Article to refer to all of these state commissions charged with regulating public utilities. The regulatory gap regarding interstate transactions was known as the "Attleboro Gap," in reference to the 1927 Supreme Court case that prohibited states from regulating interstate sales of electricity under the dormant commerce clause. *See* Pub. Utils. Comm'n v. Attleboro Steam & Elec. Co., 273 U.S. 83, 90 (1927) (holding that interstate sale of electricity was "national in character" and thus could only be regulated "by the exercise of the power vested in Congress").

43. *See* HUGHES, *supra* note 16, at 363–403 (discussing the growth of regional systems); *id.* at 463 (noting the importance of "load factor" (or load diversity) and "economic mix" of supply-side resources as factors motivating the expansion of regional power systems).

44. *See* FED. TRADE COMM'N, UTILITY CORPORATIONS, S. DOC. NO. 70-92, pt. 72-A, at 882 (1935) (providing a comprehensive overview of the development of public utility holding companies in the United States, advantages and disadvantages of such holding companies, and the need for "thoroughgoing reform . . . in the intercorporate relations within the holding company groups, in corporate and financial structure, in accounting practice, and in the extent and methods of public regulation"). The FTC report led to the 1935 Public Utility Holding Company Act.

45. *See* JAMES C. BONBRIGHT & GARDINER C. MEANS, THE HOLDING COMPANY: ITS PUBLIC SIGNIFICANCE AND ITS REGULATION 221 (1932) (concluding that while "the public utility holding company has been a great factor in the development of efficient electrical systems throughout the country, . . . its almost complete freedom from regulation

In 1935, Congress enacted two statutes to deal with the increasingly interstate nature of the electricity industry and the abuses of the holding companies. Part II of the Federal Power Act[46] gave the Federal Power Commission (the predecessor to the Federal Energy Regulatory Commission) authority to regulate wholesale power sales and transmission in interstate commerce.[47] The Public Utility Holding Company Act[48] dismantled the holding company system, allowing only single-level holding companies operating in contiguous geographic areas.[49]

For the next several decades, the electric utility industry operated in a fairly stable economic and regulatory environment, enjoying increasing economies of scale, sustained growth in electricity demand, and declining real prices.[50] One historian has ascribed the stability that prevailed during the middle decades of the twentieth century to a "public utility consensus" forged among managers, regulators, and technical experts.[51] As discussed in the next Part, this consensus began to unravel in the 1970s for a variety of reasons, with a growing chorus of calls to deregulate various components of the sector.[52]

By the 1990s, Congress and the Federal Energy Regulatory Commission (FERC) adopted new laws and regulations to facilitate the rise of wholesale power markets, imposing an open-access regime on transmission owners and allowing

has become a major public menace"); *see also* HUGHES, *supra* note 16, at 393 (noting that, contrary to popular opinion at the time, the holding companies were not the creatures of bankers and stockbrokers but of engineers and managers responding to the problem of capital formation necessary to finance the increasingly capital-intensive nature of emerging regional power systems); *id.* at 394–403 (discussing the impacts of the Great Depression on several major holding companies).

46. Ch. 687, tit. 2, 49 Stat. 838 (1935) (codified as amended in scattered sections of 16 U.S.C.).

47. *Id.*

48. Ch. 687, tit. 1, 49 Stat. 803 (1935) (repealed 2005).

49. *Id.*; *see also* Paul G. Mahoney, *The Public Utility Pyramids*, 41 J. LEGAL STUD. 37, 38 (2012) (noting that the Public Utility Holding Company Act "limited holding companies to owning a single, geographically contiguous operating system and prohibited more than a single holding company tier atop any operating company").

50. *See* Joskow, *Regulatory Failure, supra* note 39, at 126 ("During the 1950s and most of the 1960s the electric power industry attracted little attention from public policy makers. It experienced high productivity growth, falling nominal and real prices, excellent financial performance, and little regulatory or political controversy. Utilities rarely had to file for rate increases, there were few formal hearings, and 'voluntary' rate decreases were the norm. The system worked smoothly.").

51. *See* HIRSH, *supra* note 39, at 11–54 (discussing creation and consolidation of the "utility consensus" in the electric power sector during early and middle decades of the twentieth century).

52. *Id.* at 55–70 (discussing multiples stresses on the utility consensus starting in the 1970s); Joskow, *Regulatory Failure, supra* note 39, at 149–63 (documenting significant economic and political challenges facing utilities in the 1970s as a result of economic shocks, higher fuel costs, and new environmental constraints).

independent generators and power marketers to participate in the sale of wholesale electricity.[53] During this time, a number of states also introduced retail choice for electricity consumers. At one point, roughly half of all states had initiated retail-restructuring efforts.[54] After the California electricity crisis in 2000–01 (discussed in Part II.D *infra*) and in the wake of several other problematic experiences with retail competition, however, many states suspended or abandoned their efforts. Today, fifteen states have some form of retail choice.[55]

The overall result, from an institutional and regulatory standpoint, is a pluralistic system that defies easy generalization. Roughly speaking, three major models compose the current system: (1) the fully restructured model (Texas and the Northeast), which combines wholesale power markets managed by independent system operators (ISOs) with retail electric competition in individual states; (2) the traditional cost-of-service model (the Southeast and much of the West), in which vertically integrated IOUs provide service to captive customers through regulated monopoly franchises; and (3) a hybrid model (the rest of the country), which combines wholesale power markets managed by ISOs with retail service provided by IOUs through regulated monopoly franchises.[56]

One advantage of this diversity is the opportunity for policy innovation. Contrary to the standard view of utility regulation as static, reactive, and un-

53. *See, e.g.*, Energy Policy Act of 1992, Pub L. No. 102-486, § 711, 106 Stat. 2776, 2905 (establishing an exemption under PUHCA for "exempt wholesale generators," defined as entities engaged exclusively in the sale of electricity at wholesale, in order to facilitate the growth of independent power producers); *id*. § 721, 106 Stat. 2776, 2915 (amending section 211 of the Federal Power Act to allow wholesale generators to apply to FERC for an order requiring that transmission owners provide transmission service to applicants); *id*. § 722, 106 Stat. 2776, 2916 (amending section 212 of the Federal Power Act to require that rates, charges, terms, and conditions for transmission service provided under section 211 are just and reasonable and not unduly discriminatory or preferential); FERC Order No. 888, Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 61 Fed. Reg. 21, 540, 21,541-21,543 (May 10, 1996) (codified at 18 C.F.R. pts. 35, 385) (summarizing final rules designed to require open access non-discriminatory transmission service in order to promote competitive wholesale power markets).

54. *See* Paul L. Joskow, *The Difficult Transition to Competitive Electricity Markets in the United States, in* ELECTRICITY DEREGULATION: CHOICES AND CHALLENGES 32 (Griffin & Puller eds., 2005) (noting that by 2000 about twelve states had begun to implement retail competition and another twelve states had announced plans to do so).

55. For a map of states that have adopted some form of retail choice, see *Status of Electricity Restructuring by State*, U.S. ENERGY INFO. ADMIN. (Sept. 2010), http://www.eia.gov/electricity/policies/restructuring/restructure_elect.html.

56. For a map of current regional transmission organizations (RTOs) and independent system operators (ISOs), see *Regional Transmission Organizations*, FED. ENERGY REG. COMMISSION, http://www.ferc.gov/industries/electric/indus-act/rto.asp (last updated Dec. 12, 2013).

imaginative, both FERC and a number of state PUCs have been quite active in developing new policies to facilitate various low-carbon technologies and practices and to modernize the grid in ways that can accommodate more variable- and distributed-energy resources. PUCs, for example, have used a range of tools to channel investments across a portfolio of generation resources, including low-carbon alternatives; have adjusted tariff structures to facilitate conservation, efficiency, demand response, and distributed generation; and have experimented with efforts to modernize local distribution systems.[57] At the same time, FERC, together with the regional transmission organizations (RTOs) and independent system operators (ISOs), has pursued a number of important and innovative initiatives in the organized wholesale markets, including efforts to integrate variable renewable resources, promote demand response, and facilitate long-term regional transmission planning and cost allocation.[58] Rather than seeing the diversity of institutional forms and regulatory structures that currently prevails in the United States as a liability, then, it seems more productive to view it as a source of new ideas and practices.

D. The Challenge of Decarbonization

Efforts to decarbonize the electric power sector are proceeding along multiple pathways, with many possible scenarios regarding the future organization of the system. Although there is no consensus on what such a system will or should look like, several recent studies have identified as a benchmark an 80 percent reduction of power-sector GHG emissions by 2050.[59] While some envision a large build-out of utility-scale renewables and other forms of low-carbon generation to replace the current fleet of centralized, fossil-generating

57. *See* discussion *infra* Part III.

58. *See, e.g.*, FERC Order No. 764, Integration of Variable Energy Resources, 77 Fed. Reg. 41,482 (July 13, 2012) (codified at 18 C.F.R. pt. 35) (amending scheduling and interconnection rules and transmission tariffs to remove barriers to integrating variable energy resources); FERC Order 719, Wholesale Competition in Regions with Organized Electric Markets, 73 Fed. Reg. 64,100 (Oct. 28, 2008) (codified at 18 C.F.R. pt. 35) (amending rules to promote integration of demand response into wholesale power markets); FERC Order 1000, Transmission Planning and Cost Allocation, 76 Fed. Reg. 49,842 (Aug. 11, 2011) (codified at 18 C.F.R. pt. 35) (amending rules to require regional transmission and cost allocation processes).

59. *See* REINVENTING FIRE, *supra* note 20, at 169 (presenting multiple scenarios for the power sector including 80 percent renewables by 2050); RENEWABLE ELECTRICITY FUTURES STUDY: EXECUTIVE SUMMARY, *supra* note 20, at 27 ("At 80% renewable electricity in 2050, annual generation from both coal-fired and natural gas-fired sources was reduced by about 80%, resulting in reductions in annual greenhouse gases of about 80% (on a direct combustion basis and on a full life cycle basis) . . . .").

plants,[60] others see a more distributed scenario with both residential and non-residential customers increasingly embracing rooftop solar and other forms of distributed generation integrated into the grid through a system of advanced meters and a more intelligent distribution system.[61] Virtually all scenarios focus on the significant potential of efficiency and demand response to reduce or flatten out load curves and thus avoid building new generation.[62] And all of them acknowledge the tremendous challenges of getting from here to there.[63]

Although speculation about the precise future organization of a low-carbon power sector is beyond the scope of this Article, it is probably safe to say that any such future will include a mix of utility-scale generation based on renewables, nuclear, and fossil fuels with carbon capture and storage, together with increasing penetration of distributed generation, demand response, and storage.[64] However it comes to be organized, it seems fairly obvious that the

60. *See, e.g.*, RENEWABLE ELECTRICITY FUTURES STUDY: EXECUTIVE SUMMARY, *supra* note 20, at iii ("The central conclusion of the analysis is that renewable electricity generation from technologies that are commercially available today, in combination with a more flexible electric system, is more than adequate to supply 80% of total U.S. electricity generation in 2050 while meeting electricity demand on an hourly basis in every region of the United States.").

61. *See* REINVENTING FIRE, *supra* note 20, at 202–11 (presenting 2050 power sector scenario based on extensive penetration of distributed energy resources).

62. *See, e.g.*, RENEWABLE ELECTRICITY FUTURES STUDY: EXECUTIVE SUMMARY, *supra* note 20, at 23 (reporting that in the core 80 percent renewable energy by 2050 scenarios, "28–48 GW of demand-side interruptible load were deployed in 2050, compared with just 15.6 GW deployed in 2009").

63. The National Renewable Energy Laboratory (NREL) Renewable Electricity Futures Study estimated average annual renewable capacity additions of nineteen to twenty-two gigawatts per year from 2011–20, rising to a maximum of thirty-two to forty-six gigawatts per year from 2041–50. This represents a substantial increase over recent renewable electricity capacity additions of eleven gigawatts in 2009 and seven gigawatts in 2010. *See id.* at 19.

64. For nuclear power and coal with carbon capture and storage (CCS), the basic economics are extremely challenging in a world of cheap natural gas. *See, e.g.*, Lucas W. Davis, *Prospects for Nuclear Power*, 26 J. ECON. PERSP. 49, 49–50 (2012) (discussing economic challenges facing nuclear power in current environment of cheap natural gas); Mathew Wald, *With Natural Gas Plentiful and Cheap, Carbon Capture Projects Stumble*, N.Y. TIMES, May 19, 2013, at B3 (discussing challenges posed by cheap natural gas to carbon capture and storage projects). According to several recent studies, CCS is still a decade or more away from commercial-scale deployment and such deployment will likely depend on a relatively high price of carbon. *See* Howard J. Herzog, *Scaling Up Carbon Dioxide Capture and Storage*, 33 ENERGY ECON. 597, 599–600 (2011) (reviewing recent studies finding that carbon prices of $60–65 per metric ton of CO2 will be needed to make coal fired power plants with carbon capture and storage economically viable). Both of these technologies, moreover, will likely only be viable in traditional cost-of-service states with generous rate-based incentives such as construction work in progress and automatic prudence determinations. *See, e.g.*, Mathew L. Wald, *Giant Holes in the Ground*, MIT TECH. REV. (Oct. 27, 2010), http://www.technologyreview.com/featuredstory/421399/giant-holes-in-the-ground ("It is not coincidental that what signs of life the

complexity associated with efforts to integrate an increasingly diverse, and in many cases variable, set of resources will only increase. This will reinforce rather than dispense with the need for careful coordination and planning.[65]

This is especially true in a scenario of high penetration of low- to medium-voltage distributed-energy resources, which will require advanced systems to manage bidirectional power flows across local distribution systems.[66] Indeed, contrary to our intuitions, a more decentralized power system in which consumers play a more active role on both the generation and the load side may actually require more planning and coordination than one built around large, centralized, utility-scale systems.[67]

Building a low-carbon electric power system will also require enormous investment. Any effective institutional framework for managing this transition will need to mobilize substantially increased amounts of capital. It also seems likely that the resulting system will have a higher capital intensity than the current system. On the generation side in particular, renewables, nuclear power, and fossil generation with carbon capture and storage are all more capital-intensive (that is, they have a higher fixed to variable cost ratio) than the current fleet of coal and gas plants, in which a substantial share of the cost of electricity is driven by fuel costs. This has significant implications for efforts to finance such investments. Specifically, it increases the relative importance of the cost of capital, which puts a premium on stability of future revenues in order to ensure cost recovery and thereby keep financing charges down. As discussed

industry shows in the United State are mostly in the South, where so-called "cost-of-service" regulation guarantees some profit.").

65. RENEWABLE ELECTRICITY FUTURES STUDY: EXECUTIVE SUMMARY, *supra* note 20, at 22–24 (noting the additional challenges to power system planning and operation that arise in a high renewable electricity future).

66. *See* ELECTRIC POWER RESEARCH INSTITUTE, THE INTEGRATED GRID: REALIZING THE FULL VALUE OF CENTRAL AND DISTRIBUTED ENERGY RESOURCES 28–29 (2014) (noting the additional systems operation challenges associated with increased penetration of distributed energy resources and need for more coordination and planning); NEW YORK DEPARTMENT OF PUBLIC SERVICE, REFORMING THE ENERGY VISION, Staff Report and Proposal, CASE 14-M-0101 (Apr. 24, 2014), at 22 [hereinafter NY DPS, REFORMING THE ENERGY VISION] ("The widespread integration of DER [distributed energy resources] will present new complexities and challenges to the continued reliable supply of electricity. Relatively predictable, one-way power flows within distribution systems required less sophisticated system monitoring and power flow management tools. In an enhanced grid, however, power flow will be bi-directional. Energy supplies will come from multiple new technologies, and various sources, of varying sizes and capabilities. Such changes will cause more complex challenges at the local level relating to network power flows, electrical constraints, voltage fluctuations, and reactive power characteristics.").

67. To be sure, one of the chief advantages of smart grid and related technologies is that they allow much of the coordination and systems operations needed to integrate more distributed resources into the grid to be automated. *See* REINVENTING FIRE, *supra* note 20, at 206–07.

in more detail below, this raises questions about the viability of current electricity market designs to incentivize the proper levels of investment.[68]

II. CHANGING CONCEPTIONS OF PUBLIC UTILITY

Investigating the relevance of the public utility concept for efforts to decarbonize the power sector requires an understanding of how the concept has changed over time. This Part begins with a discussion of earlier conceptions of public utility, as articulated most forcefully by Progressive lawyers and legal scholars, legal realists, and institutional economists in the early twentieth century. It pays particular attention to the broader normative agenda advanced by these early proponents of public utility and its potential to generate new ideas and approaches in the face of new challenges. Key elements of this earlier conception of public utility include the recognition that certain types of businesses should be subject to regulation in the public interest, that competition should be viewed as a tool rather than an end state, and that the entire undertaking of public utility regulation should be considered experimental and open to new pathways and possibilities. Most importantly, public utility was seen as a common, collective enterprise aimed at managing a series of vital network industries that were too important to be left exclusively to market forces.

That said, it is also true that the early proponents of public utility were well aware of the problems manifest in the actual practice of utility regulation. They recognized that rent seeking, regulatory capture, and overinvestment posed important challenges to the success of public utility regulation.[69] They bemoaned the lack of adequate resources, the dearth of qualified personnel, and the ongoing "judicialization" of the utility commissions.[70] They also recognized that competition could be an important tool to discipline certain aspects of the industry and to advance the public interest within a broader understanding

68. *See* discussion *infra* Part III.A.

69. *See, e.g.*, HAMILTON, POLITICS OF INDUSTRY, *supra* note 14, at 59–62 (discussing general problem of regulatory capture); Robert L. Hale, *The "Physical Value" Fallacy in Rate Cases*, 30 YALE L.J. 710, 720–21 (1921) [hereinafter Hale, *The "Physical Value" Fallacy*] (discussing problem of "extravagantly incurred costs" in rate regulation).

70. *See, e.g.*,William E. Mosher, *A Quarter-Century of Regulation by State Commissions*, 14 PROC. ACAD. POL. SCI. 35, 39–45 (1930) [hereinafter Mosher, *A Quarter-Century of Regulation*] (discussing problems of underfunding, lack of qualified personnel, and judicialization in state public utility commissions).

of public utility.[71] And they were skeptical of full government ownership of utilities, recognizing that important gains could come from harnessing the power of private enterprise toward public ends.[72]

Although their criticisms anticipated many of those advanced by a later generation of economists and lawyers writing in the 1960s and 1970s, they were never intended as a wholesale assault on the concept itself in the manner of these subsequent critiques. As this Part shows, that critique, along with the challenges to public utility regulation that stemmed from the exhaustion of economies of scale in generation, the prolonged energy crisis of the 1970s, and rising environmental concerns, resulted in a much narrower conception of public utility. This diminished understanding of public utility in turn provided much of the conceptual and normative framing for efforts to deregulate the sector in the 1990s as well as more recent arguments by the proponents of distributed generation and other potentially disruptive technologies that the time has come to abandon the traditional utility business model. As noted above, this narrowed understanding does not comport with the current makeup and trends in the electric power sector. Nor does it provide an adequate basis for planning and executing substantial decarbonization by midcentury.

A. Public Utility, Public Interest, and Social Control of Business

The modern usage of "public utility" dates from the late nineteenth century, but it was not until the early twentieth century that the term became embedded in American law.[73] The U.S. Supreme Court's famous decision in

71. *See* CLARK, *supra* note 2, at 168 ("As a weeder-out of inefficient concerns and methods, competition works wonders, rendering a service which we should be very slow to undertake to do without.").

72. *See* Hale, *The "Physical Value" Fallacy, supra* note 69, at 717 (characterizing rate regulation of public utilities as a "regulatory experiment" that deserved a "fair trial as a substitute for government ownership and operation"). *But see* RICHARD THEODORE ELY, STUDIES IN THE EVOLUTION OF INDUSTRIAL SOCIETY 225–42 (1903) (discussing advantages of municipal ownership of public utilities over public regulation of private corporations). Ely was a leading proponent of municipal ownership of public utilities in the early twentieth century and had an important influence on his student, John R. Commons, who drafted a "public ownership" provision into the Wisconsin Public Utilities Act of 1907. After evidence of widespread corruption in municipal governments came to light, however, Ely, along with other supporters of muncipalization, switched to support regulation by independent commission. *See* DANIEL T. RODGERS, ATLANTIC CROSSINGS: SOCIAL POLITICS IN A PROGRESSIVE AGE 148–59 (1998) (discussing Ely, Commons, and the early twentieth century muncipalization movement).

73. *See* Hamilton, *Price—By Way of Litigation*, *supra* note 14, at 1030 n.47 (discussing "etymological fortunes of the concept 'public utility'"). As Hamilton elaborated, "[t]he word 'utility,' of

Munn v. Illinois[74] is generally viewed as the progenitor of modern public utility law in the United States.[75] Reaching back to Lord Hale's sixteenth-century treatise on seaports, *Munn* held that when property is "affected with a public interest" it is subject to regulation "and must submit to be controlled by the public for the common good."[76] Applied to the facts of that case, in which a group of Chicago grain elevators had secured control over much of the Midwestern grain trade, the Court upheld a Granger-inspired Illinois statute that set the prices they could charge.[77] In doing so, the Court begged the question of when other types of property (other businesses) were affected with a "public interest" sufficient to support price regulation—a question that the Court struggled with for the next half century.[78]

From the beginning of this long quest, judges and commentators emphasized the ambiguous nature of the term "public interest" and the many challenges of trying to define a category of businesses so "affected with a public interest" that they should be subject to regulation.[79] In 1934, the Supreme

course, comes out of economics; the 'public' is the 'public' of the old police power, as in 'public morals,' 'public health,' 'public safety,' and 'public welfare.' As late as the [1870s] it was used as a correlative of 'the common good.' . . . The law on the subject was long in the making before it was garnered into the category of public utility. It seems high time for a restoration of the accent to the first word." *Id.; see also* MARTIN G. GLAESER, PUBLIC UTILITIES IN AMERICAN CAPITALISM 195–200 (1957 (discussing origins of public utility concept in the early church doctrine of a "just price" for certain kinds of goods and services and in the Medieval notion of "common callings," which referred to certain businesses that made their services available to all).

74. 94 U.S. 113 (1877).

75. *Id.*

76. *Id*. at 126.

77. *Id.* at 135–36.

78. The standard interpretation of *Munn* viewed it as a conservative opinion that limited regulation to only those businesses so "affected with a public interest,"thus inhibiting regulation of other businesses. *Id.* at 126. *But see* Novak, *supra* note 2, at 401–04 for a revisionist view of *Munn* as an expansive and innovative approach to regulation in the public interest.

79. In his dissenting opinion in a 1923 case involving the possible regulation of movie theatre ticket prices, Justice Holmes pointed out the futility of such efforts:

> [T]he notion that a business is clothed with a public interest and has been devoted to the public use is little more than a fiction intended to beautify what is disagreeable to the sufferers. The truth seems to me to be that, subject to compensation when compensation is due, the legislature may forbid or restrict any business when it has a sufficient force of public opinion behind it.

Tyson & Brother–United Theatre Ticket Offices, Inc. v. Banton, 273 U.S. 418, 446 (1927) (Holmes, J., dissenting); *see also id.* at 451 (Stone, J., dissenting) ("The phrase 'business affected with a public interest' seems to me to be too vague and illusory to carry us very far on the way to a solution."). Prominent legal realists such as Walton Hamilton and Robert Lee Hale agreed. *See, e.g.*, Robert L. Hale, *Rate Making and the Revision of the Property Concept*, 22 COLUM. L. REV. 209, 212 (1922) ("The advantages which various businesses possess

Court finally abandoned the effort, extending the possibility of price regulation to all businesses in *Nebbia v. New York*.[80] In dispensing with the need to define which businesses were "affected with a public interest" and thus amenable to rate regulation, *Nebbia* made clear that distinctions between public utilities and other businesses no longer served any purpose as a standard for determining when regulation was appropriate.[81] With the Court finally out of the business of trying to determine which businesses could be subjected to price regulation, legislatures were free to move forward in regulating any and all businesses as long as they could show some rational basis for the regulation.[82]

In the meantime, a robust body of law had developed around the concept of public utility and the role of public utility commissions (PUCs) in regulating rates charged by these businesses. Indeed, notwithstanding the doomed efforts of the Supreme Court to define a category of businesses "affected with a public interest," these public utilities had long been viewed as appropriate for price regulation because of their overall importance to the economy and their distinctive economic characteristics. As Felix Frankfurter put it in 1930, "[t]o think of contemporary America without the intricate and pervasive systems which furnish light, heat, power, water, transportation, and communication, is to conjure up another world. The needs thus met are today as truly public services as the traditional governmental functions of police and justice."[83]

What was distinctive in an economic sense about these industries were their high fixed-capital requirements (electric power has long been the most capital intensive sector of the U.S. economy), substantial economies of scale, and extensive reliance on a network infrastructure that was expensive to build

cannot be classified into those peculiar to utility companies on the one hand, and those common to everyone else on the other."); Walton H. Hamilton, *Affectation With Public Interest*, 39 YALE L.J. 1089, 1111 (1930) (arguing against a "categorical approach" to businesses affected with a public interest and concluding that the "control of price, like authority in other industrial affairs, becomes a question of general regulation"); *see also* BARBARA H. FRIED, THE PROGRESSIVE ASSAULT ON LAISSEZ FAIRE: ROBERT HALE AND THE FIRST LAW AND ECONOMICS MOVEMENT 165–75 (1998) (discussing criticisms mounted by Hale, Hamilton, and others of the notion that certain businesses were "affected with a public interest" and thus amenable to price regulation).

80. 291 U.S. 502 (1934).

81. *Id.* at 536 ("It is clear that there is no closed class or category of businesses affected with a public interest . . . . The phrase 'affected with a public interest' can, in the nature of things, mean no more than that an industry, for adequate reason, is subject to control for the public good.").

82. *See* FRIED, *supra* note 79, at 175 ("After *Nebbia*, the Court never again interfered with a legislature's decision about *which* enterprises were regulable.").

83. FRANKFURTER, *supra* note 1, at 81.

and maintain.[84] Together, these characteristics facilitated what economists since the late nineteenth century had referred to as "natural monopoly"—the basic idea being that because of declining average costs across the relevant demand curve, the industry was served most cost-effectively by a single firm.[85] As a result, the antitrust laws were not particularly effective in policing the exercise of market power and trying to impose remedies that would restore multifirm competition.[86] Rate regulation thus provided an alternative means of regulating those sectors of the economy that were seemingly beyond the full reach of the antitrust laws.[87]

As a species of common carriers, railroads provided the first major opportunity to experiment with rate regulation.[88] Over time, it became apparent that natural gas, electricity, and telephone service exhibited similar characteristics. During the late nineteenth- and early twentieth-centuries, local governments struggled with how to regulate these emerging network industries—with

84. *See* HUGHES, *supra* note 16, at 463–65 (summarizing key features of large regional electric power systems that emerged in the United States and other western countries during the half century between 1880 and 1930); JOHN MAURICE CLARK, STUDIES IN THE ECONOMICS OF OVERHEAD COSTS 318–22 (1923) (discussing distinctive economic characteristics of utilities, including large investments in highly specialized assets and substantial "economies of size").

85. *See* PAUL J. GARFIELD & WALLACE F. LOVEJOY, PUBLIC UTILITY ECONOMICS 15–19 (1964) (discussing historical understandings of the natural monopoly characteristics of public utilities); *see also* JOSKOW & SCHMALENSEE, *supra* note 31, at 33 ("Traditionally the production of electric power has been considered to have pervasive natural monopoly characteristics.").

86. *See, e.g.*, Bruce Wyman, *The Law of the Public Callings as a Solution of the Trust Problem*, 17 HARV. L. REV. 156, 163 (1904) (observing that with respect to the "troublesome problem of the public utilities, . . . experience has shown that . . . many of the public works can be conducted with advantage only upon the basis of exclusive franchise" and concluding that "it is necessary for the perpetuity of competitive conditions in general, that, in the particular instances of monopolistic conditions, the state should proceed to establish a legal monopoly and then apply to that situation such strict regulation as the exigency demands"); *see also* STEPHEN BREYER, REGULATION AND ITS REFORM 158 (1982) (describing the classical view of regulation as "an alternative to antitrust, necessary when antitrust cannot successfully maintain a workably competitive marketplace of when such a marketplace is inadequate due to some other serious defect").

87. Of course, the antitrust laws have long been held to apply to certain forms of anti competitive behavior engaged in by regulated public utilities. *See, e.g.*, Otter Tail Power Co. v. United States, 410 U.S. 366, 374–75 (1972) (concluding that the Federal Power Act did not immunize Otter Tail power from regulation under the antitrust laws for its refusal to deal with municipal utilities).

88. *See* John R. Commons, *The Wisconsin Public-Utilities Law*, 36 AM. REV. REVIEWS 221, 221 (1907) [hereinafter Commons, *Wisconsin Public-Utilities Law*] (discussing the importance of the Wisconsin Railroad Law of 1905 in establishing "the principle of regulation through a commission appointed by the Governor" that was subsequently applied in 1907 to "other public utilities"); Dimock, *supra* note 2, at 266 ("[T]he regulation of railways . . . furnished the real institutional foundation for both British and American public utility regulation.").

some opting for competition among firms for limited municipal franchises and others seeking outright public ownership.[89] State regulation emerged around the turn of the century as a third alternative, gaining momentum with the establishment of state railroad commissions in several states.[90]

Beginning with New York and Wisconsin in 1907, regulation by state commission spread rapidly across the country in a "veritable epidemic of laws."[91] Ten years later, twenty-four states had enacted public utility legislation.[92] By 1930, every state but Delaware had a public utility statute that charged some type of administrative entity with responsibility for regulating public utilities such as water, gas, and electricity.[93] These were quintessential Progressive-era laws, built on principles of scientific management and regulation by experts.[94] Statutory mandates were typically broad and open-ended, founded on the goal of ensuring that rates were just, reasonable, and nondiscriminatory in order to strike the appropriate balance between ratepayers and investors.[95] Given

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89. *See* Robert L. Bradley, Jr., *The Origins and Development of Electric Power Regulation, in* THE END OF A NATURAL MONOPOLY: DEREGULATION AND COMPETITION IN THE ELECTRIC POWER INDUSTRY 43, 46–61 (Peter Z. Grossman & Daniel H. Cole eds., 2003) (discussing the municipalization movement at the turn of the century and the move to regulation by state commissions); DANIEL T. RODGERS, ATLANTIC CROSSINGS: SOCIAL POLITICS IN A PROGRESSIVE AGE 130–59 (1998) (discussing the Progressive era movement for municipalization).

90. *See* Bradley, *supra* note 89, at 48–50; Forrest McDonald, *Samuel Insull and the Movement for State Utility Regulatory Commissions*, 32 BUS. HIST. REV. 241, 247–51 (1958).

91. Mosher, *A Quarter-Century of Regulation*, *supra* note 70, at 35, 36 (1930); Massachusetts established its own independent Gas and Electric Commission in 1885, more than twenty years before the Wisconsin and New York statutes. *See* MARTIN G. GLAESER, OUTLINES OF PUBLIC UTILITY ECONOMICS 235 (1927) (discussing Massachusetts Gas and Electric Commission established in 1885). *See also* RODGERS, *supra* note 89, at 155 (describing spread of public utilities laws during early twentieth century as a "legislative fad"). It is important to recognize, however, that there was considerable diversity regarding jurisdiction and substantive authority to regulate various types of public utilities across the different states. *See generally* William E. Mosher, *Defects of State Regulation of Public Utilities in the United States*, 201 ANNALS AM. ACAD. POL. & SOC. SCI. 105 (1939) [hereinafter Mosher, *Defects of State Regulation*] (discussing the differences among states regarding the regulation of public utilities).

92. *See* GARFIELD & LOVEJOY, *supra* note 85, at 33.

93. *See id.* at 32–33. *But see* Mosher, *Defects of State Regulation, supra* note 91 (discussing the wide variation among state public utility laws regarding scope and authority of the state commissions).

94. *See, e.g.*, FINLA G. CRAWFORD ET AL., ELECTRICAL UTILITIES: THE CRISIS IN PUBLIC CONTROL 35 (William E. Mosher ed., 1929) ("When it was inaugurated, commission regulation was hailed as the introduction of 'scientific' methods and as the beginning of an era of control which would be definite, precise and eventually almost automatic.").

95. *See, e.g.*, Eugene A. Gilmore, *The Wisconsin Public Utilities Act*, 19 THE GREEN BAG 517, 517–18 (1907) ("The object of the [Wisconsin Public Utilities Act] is to secure adequate service from all public utilities under conditions which are fair and reasonable, not only to the public, but also to the corporations concerned . . . .").

the existence of widespread corruption in many municipal governments and constant logrolling in the state legislatures, independent commissions staffed with experts were viewed as the most effective means of achieving this balance and securing the benefits of natural monopoly for consumers.[96]

Widely considered the strongest of the early public utility statutes, the Wisconsin law was drafted by John R. Commons, a student of Richard Ely and a leading scholar in the field of institutional economics.[97] Key features included mandatory universal service at reasonable rates, protected local franchises, delegated powers of eminent domain, a cost-based "used and useful" standard for valuing assets as part of rate base, a uniform system of accounting, and commission powers of investigation and adjudication.[98] Together with

96. *See* RODGERS, ATLANTIC CROSSINGS, *supra* note 89, at 155 ("It was the experience of democratized corruption that ultimately made the expert regulatory commission idea so attractive—beyond its handiness and familiarity, beyond the utility companies' sub-rosa promotion of it, beyond the dynamics of a legislative fad."); John R. Commons, *How Wisconsin Regulates Her Public Utilities*, 42 AM. REV. REVIEWS 215, 215 (1910) [hereinafter Commons, *How Wisconsin Regulates Her Public Utilities*] (noting the "elasticity" or "adjustability" of the Wisconsin law which "[i]nstead of laying down rigid rules, as has been customary, . . . creates a commission and staff of scientific investigators . . . [who] are commanded to 'investigate and ascertain' for each public utility what is the 'reasonable value' of the service which it renders to the public" (internal quotation marks omitted)).

97. Commons and others viewed public utility as one of the core concerns of institutional economics. *See, e.g.*, JOHN R. COMMONS, LEGAL FOUNDATIONS OF CAPITALISM 327–29 (1924) [hereinafter COMMONS, LEGAL FOUNDATIONS OF CAPITALISM] (discussing broad concept of public utility, its relation to "the public," and its application to particular types of businesses); John R. Commons, *Institutional Economics*, 26 AM. ECON. REV. 237, 242 (1936) ("[I]nstitutional economics is the field of the public interest in private ownership . . . ."). For an earlier statement on institutional economics and its attention to problems of social control in modern industrial society, see Walton H. Hamilton, *The Institutional Approach to Economic Theory*, 9 AM. ECON. REV. 309, 312–14 (1919). *See also* Malcolm Rutherford, *Understanding Institutional Economics: 1918–1929*, 22 J. HIST. ECON. THOUGHT 277, 299 (2000) ("Public utilities, including issues relating to the valuation of utility property and the proper basis for rate regulation, were major areas of institutionalist research.").

98. *See* Commons, *How Wisconsin Regulates Her Public Utilities*, *supra* note 96, at 216 (discussing Wisconsin approach to valuation of utility assets, described as "physical valuation," which he defines as "nothing more or less than the cost of construction or reconstruction of the physical property"); Commons, *Wisconsin Public-Utilities Law, supra* note 88, at 222–24 (discussing key features of the Wisconsin law); George B. Hudnall, *The Public Service Commission Law of Wisconsin*, 4 PROC. AM. POL. SCI. ASS'N. 316 (1907) (elaborating on key features of the Wisconsin law). In a 1923 decision, the Wisconsin Supreme Court, drawing on the work of Robert Lee Hale, interpreted the statute as requiring an approach to rate base valuation that gave controlling weight to the "prudent investment" standard. Waukesha Gas & Elec. Co. v. R.R. Comm'n of Wis., 194 N.W. 846, 854 (1923) ("In determining the present fair value of a public utility operating under our public utility law, it is our view that justice as well as sound economic practice requires that controlling weight should be given in the valuation of the plant of a public utility to the investment cost where the investment has been prudently made."). Hale wrote his dissertation on Wisconsin's approach to valuation and ratemaking. *See* MALCOLM RUTHERFORD, THE INSTITUTIONALIST MOVEMENT IN

California and New York, Wisconsin was seen as a leader in public utility regulatory practice and a model for other states. The commitment to a professional regulatory effort in other states, however, was not always taken as seriously as the Progressive architects of the Wisconsin and New York laws would have hoped.[99] All too often, "regulatory commissions served as dumping grounds for political hacks and cronies of the governor."[100]

For their part, industry executives and managers generally supported regulation by commission as a means to avoid municipal ownership, which was gaining momentum at the turn of the century, and to secure capital on favorable terms.[101] This last point is particularly important and has recently been elaborated by economic historians.[102] Because of the capital-intensive nature of the electricity industry, utilities were historically unable to finance new capital investment through the equity markets or their annual cash flow, forcing them

AMERICAN ECONOMICS, 1918–1947: SCIENCE AND SOCIAL CONTROL 234 (2011). On the importance of a uniform system of accounts as a basis for effective regulation in the Wisconsin law, see CHARLES MCCARTHY, THE WISCONSIN IDEA 192 (1912) ("We cannot attempt to regulate railroads or great public utilities unless our public service is in itself so organized that it has a thorough understanding of the intricate systems of cost accounting and efficiency used by these great economic units."); *see also* Jay H. Price, Jr. et al., *Accounting Uniformity in the Regulated Industries*, 30 LAW & CONTEMP. PROBS. 824, 830–36 (1965) (discussing the history of efforts to establish a uniform system of accounts as a basis for public utility regulation).

99. Many Commissions were plagued by lack of financial support, inadequate personnel, and an ongoing judicialization of basic tasks. *See* Mosher, *Defects of State Regulation*, *supra* note 91, at 107 (detailing problems with PUC regulation and concluding that "probably no commission in the United States is adequately financed to carry on the broad range of duties prescribed in the law").

100. THOMAS K. MCCRAW, PROPHETS OF REGULATION 243 (1984); *see also* Felix Frankfurter & Henry M. Hart, Jr., *Rate Regulation*, *in* THE CRISIS OF THE REGULATORY COMMISSIONS 1, 16 (Paul W. MacAvoy ed., 1970) ("But in the main the public interest has suffered from too many mediocre lawyers appointed for political considerations, looking to the Public Service Commission not as a means for solving difficult problems of government but as a step toward political advancement or more profitable future association with the utilities. As a result, there has been inequality in expertise, in will, and in imagination between the utilities and the regulatory bodies.").

101. *See* HIRSH, *supra* note 39, at 23–24 (discussing utility industry support for regulation by state commissions and its importance in lowering financing costs); FORREST MCDONALD, INSULL: THE RISE AND FALL OF A BILLIONAIRE TYCOON 113–32 (1962) (discussing Samuel Insull's leadership in mobilizing support among utility executives for regulation by state public utility commission).

102. *Cf.* William J. Hausman & John L. Neufeld, *The Market for Capital and the Origins of State Regulation of Electric Utilities in the United States*, 62 J. ECON. HIST. 1050, 1069 (2002) ("The historical record of the process that culminated in state regulation of electric utilities suggests that reduced borrowing costs was a primary reason utility companies, with prominent leaders such as Samuel Insull leading the way, came to embrace regulation."). *But see* Thomas P. Lyon & Nathan Wilson, *Capture of Contract? The Early Years of Electric Utility Regulation*, 42 J. REG. ECON. 225, 239 (2012) (finding no support for the conclusion that state regulation resulted in a stronger propensity to invest on the part of electric utilities).

to rely instead on long-term debt financing.[103] The threat of municipalization on the one hand and the lack of a protected franchise on the other made it difficult for utilities to access the capital markets on favorable terms. Rate regulation, with its promise of guaranteed rates and protected franchises, provided a new level of certainty that allowed them to do so.[104]

At its core, public utility regulation thus provided a means for utilities to secure capital at lower cost and to channel it into very large technological systems.[105] In short, it was a way to socialize the costs of building and operating a centralized electricity grid while protecting consumers from the potential abuses associated with natural monopoly. In return for an exclusive franchise, the right of eminent domain, and an ability to sell electricity at reasonable rates, electric utilities would provide reliable, universal service and forgo some of the profits that might be attainable in the absence of regulation.[106]

Regulation of these private enterprises was therefore seen, at least in part, as an antidote to the market failures that were associated with the natural monopoly characteristics of these industries. The objective of cost-based regulation was to mimic as closely as possible the outcomes (that is, the prices)

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103. *See* Hausman & Neufeld, *supra* note 102, at 1053 (noting that electric utilities could not fund investments out of retained earnings).

104. *Id.* at 1051 ("Regulation reduced the risk of investing in an electric utility, thus making utility bonds and stocks more attractive, increasing the availability of capital, and lowering its price.").

105. *Id.; see also* HUGHES, *supra* note 16, at 364–65 (discussing substantial demands for capital by the electric power industry in the 1910s and 1920s).

106. This was the basis for what has sometimes been referred to in more recent years as the "regulatory compact." *See, e.g.*, Jersey Cent. Power & Light Co. v. Fed. Energy Regulatory Comm'n, 810 F.2d 1168, 1189 (D.C. Cir. 1987) (Starr, J., concurring) ("The utility business represents a compact of sorts; a monopoly on service in a particular geographical area (coupled with state-conferred rights of eminent domain or condemnation) is granted to the utility in exchange for a regime of intensive regulation, including price regulation, quite alien to the free market. . . . Each party to the compact gets something in the bargain. As a general rule, utility investors are provided a level of stability in earnings and value less likely to be attained in the unregulated or moderately regulated sector; in turn, ratepayers are afforded universal, non-discriminatory service and protection from monopolistic profits through political control over an economic enterprise." (citation omitted)); *see also* J. GREGORY SIDAK & DANIEL F. SPULBER, DEREGULATORY TAKINGS AND THE REGULATORY CONTRACT: THE COMPETITIVE TRANSFORMATION OF NETWORK INDUSTRIES IN THE UNITED STATES 101 (1998) ("State public utility regulation of electric power generation, transmission, and distribution . . . represents a contract between the state and the regulated company. The economic functions of the regulatory contract, as well as the legal duties and remedies associated with it, are identical to those of a contract between private parties."). The concept became an important element of the restructuring debate, particularly with respect to the ability of utilities to recover stranded costs. *See, e.g.*, James Boyd, *The "Regulatory Compact" and Implicit Contracts: Should Stranded Costs Be Recoverable?*, 19 ENERGY J. 69, 72–73 (1998) (discussing different views of the "regulatory compact" in the context of stranded costs).

attainable in competitive markets in order to ensure that a vital public service was provided on reasonable terms.[107] For the supporters of free enterprise, this form of managed capitalism—public regulation of private business—was preferable to the model of outright government ownership that European governments were adopting and that had always operated on the margins in the United States with municipal utilities and other forms of public power.[108]

But the practice of rate regulation was easier said than done, and the Supreme Court had made it far more difficult than it needed to be with its 1898 decision in *Smyth v. Ames*.[109] By advancing a constitutional duty to determine the fair value of a utility's assets as a basis for setting rates, *Smyth v. Ames* put the courts, rather than legislatures and regulatory commissions, at the center of the effort to establish rates. For almost fifty years, despite withering criticism of the circularity of the fair value rule, courts struggled to police the

107. As Justice Brandeis put the matter: "The investor agrees, by embarking capital in a utility, that its charges to the public shall be reasonable. His company is the substitute for the State in the performance of the public service; thus becoming a public servant. The compensation which the Constitution guarantees an opportunity to earn is the reasonable cost of conducting the business." Missouri ex rel. Southwestern Bell Tel. Co. v. Pub. Serv. Comm'n, 262 U.S. 276, 290–91 (1923) (Brandeis, J., dissenting).

108. *See* Dimock, *supra* note 2, at 267 ("In most countries outside of the United States regulation is unimportant because the great majority of public service undertakings are owned in whole or in part by government subdivisions.").

109. 169 U.S. 466 (1898). The Court's tortured efforts to police ratemaking and to determine fair value plunged the judiciary, and the commissions that sought to demonstrate fidelity to the constitutional directives fashioned by the Court, into what Justice Frankfurter called a "maze of cobwebbery." FRANKFURTER, *supra* note 1, at 104. With the Great Depression and the dramatic decline in the value of utility assets, the futility of trying to articulate the proper course of determining fair value as a basis for rates began to give way to a focus on the end result rather than the method used. For, as Justice Brandeis and other prominent legal scholars pointed out, the notion of fair value was circular: How could one determine the fair value of the enterprise as a basis for setting rates when the value of the enterprise depended on the discounted present value of future revenues, which were themselves wholly dependent on the rates charged? *See, e.g.*, Missouri ex rel. Southwestern Bell Tel. Co. v. Pub. Serv. Comm'n, 262 U.S. 276, 292 (1923) (Brandeis, J., dissenting) ("The rule of *Smyth v. Ames* sets the laborious and baffling task of finding the present value of the utility. It is impossible to find an exchange value for a utility, since utilities, unlike merchandise or land, are not commonly bought and sold in the market. Nor can the present value of the utility be determined by capitalizing its net earnings, since the earnings are determined, in large measure, by the rate which the company will be permitted to charge, and thus, the vicious circle would be encountered."); Hale, *The "Physical Value" Fallacy*, *supra* note 69, at 716 ("[T]here are authorities who admit that the value depends upon the earnings, but insist that the vicious circle involved (in basing the earnings on the value) can be escaped merely by the simple expedient of measuring the value by replacement cost or some other 'evidence'! Like ostriches, they imagine that by blinking the fact they can escape its consequences."); Gerard Henderson, *Railway Valuation and the Courts* (pt. 3), 33 HARV. L. REV. 1031, 1051 (1920) ("[A]s a matter of economic and legal theory the doctrine of *Smyth v. Ames* is fallacious and fair value a juristic illusion . . . .").

methodology of ratemaking.[110] Writing in dissent in a 1935 case regarding telephone rates, Justice Stone described the effort as "the most speculative undertaking imposed upon [courts] in the entire history of English jurisprudence."[111]

In 1944, the Supreme Court extricated the judiciary from reviewing the methodology of ratemaking, relegating the courts to the more appropriate role of policing the constitutional boundaries of the end result.[112] In embracing a more pragmatic approach to ratemaking, the Court put the Federal Power Commission and state regulatory commissions back in control over the specifics of rate regulation. As Robert Lee Hale observed, the Court had finally "freed regulation from the obligation to perform the costly and meaningless rituals of *Smyth v. Ames*."[113]

But even with the fifty-year detour into the "gigantic illusion" that attended efforts to determine fair value finally at an end, it was still all too easy to get lost in the technical details of ratemaking and to lose sight of the broader importance of public utility regulation.[114] The lingering effects of *Smyth v. Ames*, manifest in the judicialization of Commission activity and attention to the adjudicatory function of PUCs, displaced the more affirmative functions of planning and creative policymaking.[115]

Viewed in broader terms, however, rate regulation represented an unprecedented experiment in the social control of business and nothing less than a revision

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110. The challenges of determining fair value were widely viewed during the 1920s and 1930s as one of the major obstacles to effective regulation by public utility commissions (PUCs). *See, e.g.*, Mosher, *Defects of State Regulation, supra* note 91, at 108 ("There is no gainsaying the fact that next to the need for professionalization of commissions and the inadequacy of funds, the major obstacle to regulation in the United States is the utter unworkability of methods of determining the fair value of properties for rate making purposes."); Henderson, *supra* note 109, at 1053 (arguing that utility regulation must be freed from "the vague constitutional fetters which the courts have woven about the subject").

111. West v. Chesapeake & Potomac Tel. Co. of Baltimore, 295 U.S. 662, 689 (1935) (Stone, J., dissenting). The Wisconsin Supreme Court offered a similar lament in a 1923 case on rate base valuation under the Wisconsin public utilities law. *See* Waukesha Gas & Elec. Co. v. R.R. Comm'n, 194 N.W. 846, 850 (1923) (describing the effort to determine "fair value" as "one of the most complex and involved subjects with which courts are called upon to deal").

112. Fed. Power. Comm'n v. Hope Natural Gas Co., 320 U.S. 591, 602 (1944) ("Under the statutory standard of 'just and reasonable' it is the result reached not the method employed which is controlling.").

113. Robert L. Hale, *Utility Regulation in the Light of the Hope Natural Gas Case*, 44 COLUM. L. REV. 488, 530 (1944).

114. *See* Henderson, *supra* note 109, at 1051 ("The whole doctrine of *Smyth v. Ames* rests upon a gigantic illusion. The fact which for twenty years the court has been vainly trying to find does not exist. 'Fair value' must be shelved among the great juristic myths of history, with the Law of Nature and the Social Contract. As a practical concept, from which practical conclusions can be drawn, it is valueless.").

115. *See* discussion *infra* Part III.A.

of received understandings of property. "We are experimenting with a legal curb on the power of property owners," Robert Lee Hale wrote.[116] "In applying that curb," he continued,

> we have to work out principles or working rules—in short a new body of law. Those principles will necessarily differ from the ones upon which the law acts in other fields—for in other fields it acts on the assumption that whatever income a property owner can get without fraud by virtue of his ownership is legitimately his. In the utility field, standards of what is proper for an owner to get out of his ownership have to be worked out *de novo*.[117]

Elsewhere, Hale characterized utility regulation as a "regulatory experiment" that deserved a "fair trial as a substitute for government ownership and operation."[118] John Commons described Wisconsin's public utility law of 1907 in similar terms; its approach to rates was designed to be "elastic enough to offer the opportunity for ingenuity and experiments that may combine the principle of State regulation with that of private enterprise."[119] Walton Hamilton likewise saw the determination of rates as part of a broader program "for the control of industry" that could hardly be "plucked from the air or conjured out of any system of accounts."[120] Rather, it could only emerge through

116. Hale, *supra* note 79, at 213.

117. *Id.* Hale went on to note that this experiment could be extended to other fields: "The revision of property rights worked out within the utility field may very well serve as a model, wherever applicable, for the revision of other property rights; but what the law still allows elsewhere is no proper guide in formulating this new code." *Id.*

118. Robert L. Hale, *The "Physical Value" Fallacy*, *supra* note 69, at 717.

119. Commons, *Wisconsin Public-Utilities Law*, *supra* note 88, at 223. Commons was referring specifically to provisions in the law that allowed for "'sliding scale,' profit-sharing, or other devices" to maintain incentives for "enterprise and initiative" on the part of the utility companies. *Id. See also* Gilmore, *supra* note 95, at 523–24 (identifying the provision of the Wisconsin Public Utilities Act that allowed for sliding scale rates and division of surplus proceeds between the utility and its customers as "[o]ne of the most important and characteristic features of the Act and one which has great possibilities in it for securing energetic and progressive management of public utilities"). This was an early example of what has more recently been characterized as incentive or performance-based regulation. Louis Brandeis was an important early proponent of the sliding scale approach to setting railroad rates. *See* GERALD BERK, LOUIS D. BRANDEIS AND THE MAKING OF REGULATED COMPETITION, 1900–1932, at 82–84 (2009) (discussing Brandeis's proposal for the sliding scale approach to rates).

120. Hamilton, *Price—By Way of Litigation*, *supra* note 14, at 1031. Hamilton was well aware of the challenges facing rate regulation and the need for innovations to ensure that public utilities would face the right incentives. *See id.* ("The invention of devices of protection and progress would, under the most favorable circumstances, tax the intellectual resources of regulatory bodies to the very limit. Their creation has been almost enjoined by the conventional stress upon the value of property.").

"experimentation."[121] "The way of its making," he continued, "is that of trial and error."[122] For Hamilton, utility regulation was part of "a developing program" in which the content of the approach would come not "by way of fact and logic" but instead from "what it is expected to do" as "an instrument of the commonwealth."[123]

Writing at roughly the same time, Felix Frankfurter reflected that public utility law had "made possible, within a selected field, a degree of experimentation in governmental direction of economic activity of vast import and beyond any historical parallel."[124] More recently, William Novak has argued that the "legal invention of the idea of the public utility" was "a perfect example of the creative force of law in the construction of the American regulatory state."[125] With this "new political machinery" combining legislative, executive, and judicial functions in an independent commission, the American experiment in social control of business entered new territory.[126]

The broad concept of public utility advanced by progressives and legal realists thus embodied a pragmatic approach to competition and markets in an era of rapid industrial change—something they shared with institutional economists such as Clark, Commons, and Veblen.[127] As Hamilton put it:

> The competitive system is no longer to be regarded as an automatic, self-regulating mechanism; like any other human institution it may work poorly, indifferently, or well: it produces very different results in different industries. In its wake may come disorder as well as order, waste as well as efficiency, unfair as well as reasonable prices.[128]

"A newer and more realistic conception of competition," he concluded, "suggests, not a new end for public policy, but another means for reaching a recognized end."[129]

121. *Id.*
122. *Id.*
123. *Id.* at 1034, 1036.
124. Novak, *supra* note 2, at 404 (quoting Felix Frankfurter & Henry M. Hart, Jr., *Rate Regulation*, *in* 13 ENCYCLOPAEDIA OF THE SOCIAL SCIENCES 104, 104 (1934)).
125. *Id.* at 399; *see also id.* at 399–400 ("[P]rogressives viewed the law of public utilities as a vibrant and expansive arena for experimenting with unprecedented governmental control over business, industry, and the market."); FRIED, *supra* note 79, at 160–204 (discussing the efforts of Hale and others in the area of rate regulation of public utilities).
126. *See* FRANKFURTER, *supra* note 1, at 88–89.
127. *See* Rutherford, *supra* note 97, at 297–99 (discussing the institutionalist approach to competitive markets and its close relationship to views of legal realists such as Hale and Hamilton).
128. Hamilton, *supra* note 79, at 1108–09.
129. *Id.* at 1109.

Ordered change in an economy that was under the "joint sovereignty of market and state" was the goal.[130] The idealized vision of competitive markets that would provide the motive force for the Chicago critique in coming decades was a myth according to the realists. Put simply, competition was not an end in itself. There was no *a priori* state of nature in which competitive markets flourished, no pre-political form of economic organization. Sometimes competition worked, but other times it did not. Like rate regulation, competition was a tool that could be deployed by regulators in appropriate contexts to achieve broader public policy goals.[131] This view comported with the more general idea that legal and economic institutions were all mixed up together, part of a larger "industrial system" (a favorite phrase of Hamilton's), which should be directed toward social welfare in the broadest sense. As Hamilton stated near the end of his career, "[a]ll industries are, in their several degrees, instruments of the general welfare; where there is failure in performance, the call is for statecraft."[132]

At the heart of the more expansive conception of public utility developed by the realists and institutionalists was a de-physicalized view of property that drew directly on the pioneering work of Wesley Hohfeld.[133] Conceived as a bundle of entitlements, public utility embodied a set of relationships that would structure a series of vitally important network industries in the context of a rapidly changing economy.[134] Such "complex [forms of] property" combined public and private in new ways, with no logical, predefined method for

130. *Id*. at 1110.
131. CLARK, *supra* note 2, at 131 ("Evidently the public cannot afford to rest upon a simple belief that all competition is good. The situation requires careful differentiation between types of competition, coupled with wise restraints temperately exercised."); HAMILTON, POLITICS OF INDUSTRY, *supra* note 14, at 167 ("As large an area of the industrial system as possible should be left to the competitive regime. Where it needs to be helped over the hard places or superseded by another method of control, the case needs to be clear.").
132. HAMILTON, POLITICS OF INDUSTRY, *supra* note 14, at 18.
133. *See generally* Wesley Newcomb Hohfeld, *Some Fundamental Legal Conceptions as Applied in Judicial Reasoning*, 23 YALE L.J. 16, 28–30 (1913) (developing analytical scheme of "fundamental jural relations" to be used in disaggregating forms of property and other complex legal interests).
134. *See* MORTON J. HORWITZ, THE TRANSFORMATION OF AMERICAN LAW, 1870–1960: THE CRISIS OF LEGAL ORTHODOXY 160–64 (1992) (discussing influence of debates over rate regulation and valuation on a new, de-physicalized view of property); John R. Commons, *Law and Economics*, 34 YALE L.J. 371, 375–76 (1924) (discussing Hohfeldian concept of property "as a complex set of acquired rights, of imposed duties, and of permitted liberties and exposures" and its central importance to, among other things, the regulation of public utilities); Hale, *supra* note 79, at 213–14 (discussing rate regulation in context of Hohfeld's conception of legal entitlements).

effecting that combination.[135] Pragmatic adjustment defined the overall approach. "The relation between the public utility and the community," wrote Gerard Henderson, "cannot be expressed in terms of a simple, quantitatively ascertainable fact, for the relation involves numerous and complex factors which depend on compromise and practical adjustment rather than on deductive logic."[136] As Walton Hamilton put it: "[t]he rate-structure of an [*sic*] utility is an aspect of public policy; it is an expression of what the community, acting through the legislature, commission, and court, expects it to do."[137] Public utility was, to use John Commons' terminology, a particular type of "going concern" subject to special duties precisely because of its distinctive relationship to the public.[138]

In practice, of course, the record of public utility regulation was mixed, and Progressives, realists, and institutional economists were as quick as anyone to criticize the poor performance of PUCs in carrying out their duties. Understaffing, inexperience, and a lack of adequate financial resources were endemic to many commissions.[139] The ongoing judicialization of public utility regulation, resulting in part from the multidecade struggle to make sense of fair value, detracted from the more creative and proactive responsibilities of the com-

135. West v. Chesapeake & Potomac Tel. Co., 295 U.S. 662, 689 (1935) (Stone, J., dissenting). *See also* Henderson, *supra* note 109, at 1056 ("Property engaged in an enterprise of which the earnings depend on state regulation is, however, in its nature different from property of the usual kind. It has voluntarily surrendered its value as ordinary private property.').

136. Henderson, *supra* note 109, at 1051.

137. Hamilton, *Price—By Way of Litigation*, supra note 14, at 1029.

138. COMMONS, LEGAL FOUNDATIONS OF CAPITALISM, *supra* note 97, at 327–29 (discussing complex of rights and duties inhering in public utility and its relationship to "the public"); GLAESER, *supra* note 91, at 102–25 (discussing public utilities as going concerns). Glaeser was a student of John R. Commons and, like Commons, a professor of economics at the University of Wisconsin. Although Commons's writings on the subject of going concerns are not always clear, Commons employed the concept to refer to various organized forms of collective action of which the businesses categorized as public utilities could be considered a particular type. The general aim was to move beyond a view of the economy founded on individual actors or organizations toward a broader, relational understanding of collective action as instantiated in particular types of enterprises or undertakings. According to Commons, "the true unit of economic theory is not an individual but a going concern composed of individuals in their many transactions as principal and agent, superior and inferior, employer and employee, seller and customer, creditor and debtor, bailor and bailee, patron and client, etc." *See* Commons, *Law and Economics, supra* note 134, at 375. Commons goes on to note in the same article that Hohfeld's analysis of jural relations "is of universal application to all going concerns." *Id.*

139. *See, e.g.,* Mosher, *Defects of State Regulation, supra* note 91, at 106–07 (discussing problems confronting state public utility commissions including inexperience of commissioners, insufficient funding, and lack of qualified personnel).

missions, forcing them to play the role of arbiter between ratepayers and utilities rather than acting as advocates for the public.[140]

Still, it is important to emphasize that the underlying concept of public utility as advanced by Progressives, legal realists, and institutional economists had certain features that transcended the problems of practical application, providing a basis for new pathways and possibilities. Specifically, these lawyers and economists saw public utility less as an object of regulation (a class of businesses to be regulated) than as a common, collective enterprise directed at the social control of business. Public utility in this sense was first and foremost a normative undertaking rather than a technical way of regulating a certain kind of activity.[141] In targeting new forms of economic power—new industries that provided much of the infrastructure for modern industrial capitalism—public utility regulation was of a piece with the broader effort aimed at devising working rules for the social control of business, an exercise viewed as much in social and political terms as in economic ones.

As part of a positive program of institutional development focused on devising tools to solve problems of social control, public utility regulation was thus intended to be open-ended, provisional, and experimental. The connection with John Dewey's pragmatism was manifest in all of this.[142] In fact,

140. *See, e.g.*, Mosher, *A Quarter-Century of Regulation*, *supra* note 70, at 43 (discussing major functions of commissions to protect the public interest and to adjudicate rate cases and noting that "[t]he judicial function has encroached upon, if it has not practically supplanted, that of public defender"); Franklin D. Roosevelt, *Government Regulation of Public Utilities*, 30 PROC. ACAD. POL. SCI. 44, 45 (1971) ("The Public Service Commission, therefore, was created in the days of Governor Hughes to act not as a court between the public on one side and the utility companies on the other, but to act definitely and directly for the public, as the representative of the public and of the Legislature, their sole function being to supervise the utilities themselves under definite rules."). *See also* ALFRED E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS, Vol. 2 at 86–92 (1988 [1971]) (discussing ways in which the increased adjudicatory role of regulatory commissions undermines broader legislative and executive functions).

141. *See* GLAESER, *supra* note 91, at 216 ("It is an institution not solely of economic significance but also one of large political importance; for while, on the one hand, it is concerned with the material needs of individual economic life, it serves, on the other hand, to strengthen and make possible socioeconomic life. Out of its institutional character arises the public interest in its maintenance and development. From this point of view, the term *public utility* does not refer to any specific industry but is used as a collective name for an entire group of industries. It becomes a highly abstract conception of certain relationships, embracing certain definable rights and duties.").

142. *See, e.g.*, JOHN DEWEY, THE PUBLIC AND ITS PROBLEMS 202–03 (1954) ("[P]olicies and proposals for social action should be treated as working hypotheses, not as programs to be rigidly adhered to and executed. They will be experimental in the sense that they will be entertained subject to constant and well-equipped observation of the consequences they entail when acted upon and subject to ready and flexible revision in the light of observed consequences."); *see also* William H. Simon, *The Institutional Configuration of Deweyan Democracy*, 9 CONTEMP.

Dewey himself made recourse to Hale's writings on rate regulation in working out his own understanding of judgment and experimental knowledge.[143] And it is in this sense as well that public utility represented a legal and policy innovation of the first order. There was no fixed set of understandings or received wisdoms regarding how it would or should evolve. It was, and always would be, a work in progress. By necessity, it would change and adapt over time in response to new circumstances.

B. Economic Critiques of Public Utility

Although the public utility concept had its critics from the beginning (on both the left and right),[144] professional economists and a few economically minded lawyers mounted a vigorous and sustained critique of public utility regulation in the 1960s and 1970s that transformed the concept. To these critics, many of whom were affiliated with the University of Chicago, rate regulation, or what was sometimes broadly construed as economic regulation, was considered anathema to the principles of market competition. The technical criticisms that stemmed from the rigorous application of marginalist economic principles and early conceptions of public choice complemented a broader ideological agenda that sought to stop a rapidly growing regulatory state from extinguishing economic liberty.[145]

Boiled down to its essentials, the critique consisted of several key points. First, these critics challenged the theory of natural monopoly as an ongoing

PRAGMATISM 5, 12 (2012) (discussing Dewey's commitment to a provisional, experimental approach to policy and governance).

143. *See* John Dewey, *Valuation and Experimental Knowledge*, 31 PHIL. REV. 325, 341–42 (1922) (discussing rate regulation as example of "experimental" judgment and citing Hale's article, *Rate Regulation and the Revision of the Property Concept*). Dewey and Hale were colleagues at Columbia University.

144. *See, e.g.*, Horace M. Gray, *The Passing of the Public Utility Concept*, 16 J. LAND & PUB. UTILITY ECON. 8, 12–13 (1940) (arguing public utility regulation had created an effective means for regulated electricity companies to block municipal ownership and rural cooperatives).

145. *See, e.g.*, MILTON FRIEDMAN, CAPITALISM AND FREEDOM 28 (1962) (concluding "reluctantly" that of the three alternatives available to deal with natural monopoly—private monopoly, public monopoly, or public regulation—"private monopoly may be the least of the evils"); ANGUS BURGIN, THE GREAT PERSUASION 152–85 (2012) (discussing the historical development of Friedman's views on regulation and their relationship to earlier views of Hayek and other members of the Mount Pelerin society); DANIEL T. RODGERS, AGE OF FRACTURE 60–62 (2011) [hereinafter RODGERS, AGE OF FRACTURE] (discussing the Chicago school critique of public utility regulation).

rationale for regulation.[146] Changing economic and technical conditions made the category itself inherently unstable, if not altogether useless. And even for those firms operating in industries with natural monopoly characteristics, it was not clear that they would be able to capture monopoly rents on a sustained basis.[147] Second, in contrast to the notion that utility regulation emerged in response to the public interest, economists such as George Stigler advanced a public choice, or capture, explanation, which held that regulated entities actively sought regulation and used it for their benefit.[148] Public utility regulation was thus a product of rent-seeking behavior on the part of regulated firms; the idea of a general public interest was tenuous at best.[149] Third, economic models and subsequent empirical research indicated that firms operating under regulatory constraints had an incentive to overinvest in their rate base, thus raising costs and destroying consumer welfare (the so-called Averch-Johnson effect).[150]

146. *See, e.g.*, Harold Demsetz, *Why Regulate Utilities?*, 11 J.L. & ECON. 55, 59 (1968) ("The natural monopoly theory provides no logical basis for monopoly prices. The theory is illogical. Moreover, for the general case of public utility industries, there seems no clear evidence that the cost of colluding is significantly lower than it is for industries for which unregulated market competition seems to work. To the extent that utility regulation is based on the fear of monopoly price, *merely because one firm will serve each market*, it is not based on any deducible economic theorem."); Richard A. Posner, *Natural Monopoly and its Regulation*, 21 STAN. L. REV. 548, 635 (1969) ("Our analysis of proposals for reforming public utility regulation confirms our preliminary conclusion that its contribution to social and economic welfare is very possibly negative. The benefits of regulation are dubious, not only because the evils of natural monopoly are exaggerated but also because the effectiveness of regulation in controlling them is highly questionable.").

147. *See* Posner, *supra* note 146, at 636 ("But natural monopoly conditions are quite likely to be transient. . . . To embrace regulation because an industry is today a natural monopoly and seems likely to remain so is to gamble dangerously with the future. To impose regulation on the basis of a prophecy that the industry will remain monopolistic forever may be to make the prophecy self-fulfilling."); *id.* at 643 ("In the long run, there may be few natural monopolies, perhaps none, such is the pace of change in consumer taste and in technology in a dynamic economy.").

148. *See* George J. Stigler, *The Theory of Economic Regulation*, 2 BELL J. ECON. & MGMT. SCI. 3, 3 (1971) ("[A]s a rule, regulation is acquired by the industry and is designed and operated primarily for its benefit."); *see also* Jim Rossi, *Public Choice, Energy Regulation and Deregulation*, *in* RESEARCH HANDBOOK ON PUBLIC CHOICE AND PUBLIC LAW 419, 421–22 (Daniel A. Farber & Anne Joseph O'Connell eds., 2010) (discussing the capture theory of regulation advanced by Stigler and others and its applicability to electricity regulation).

149. *See* Greg A. Jarrell, *The Demand for State Regulation of the Electric Utility Industry*, 21 J. LAW & ECON. 269, 271–72 (1978) (criticizing public interest theory of state public utility regulation and arguing instead that regulation emerged to serve the interests of utilities).

150. *See* Harvey Averch & Leland L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1052, 1068 (1962) (concluding that firms operating under rate-of-return constraint of price control have an incentive to substitute capital for other factors of production "in an uneconomic fashion that is difficult for the regulatory agency to detect"). Their thesis has since been memorialized as the Averch-Johnson effect.

The general conclusion that emerged from these critiques was straightforward and devastating: Regulation did more than harm than good.[151] Even in cases of natural monopoly, it was preferable to leave the market alone rather than try to correct for market failure or remedy the abuses of market power with regulation.[152] In fact, according to one study, there was no evidence that regulation actually had any demonstrable positive effect in reducing electricity prices when compared to the alternative.[153] Moreover, the pathologies of rate regulation—as manifest in the Averch-Johnson effect and the inevitably of capture—meant that even if the regulatory enterprise itself was born of noble intentions, it was sure to result in diminished social welfare.[154]

151. *See, e.g.*, Posner, *supra* note 146, at 625 ("[T]he social gain from public utility and common carrier regulation is quite possibly negative.").

152. Demsetz advocated subjecting monopoly franchises to competitive bidding, with the franchise awarded to the bidder offering to provide service at the lowest price. *See* Demsetz, *supra* note 146, at 56–62. But, as has been pointed out by Oliver Williamson and others, Demsetz's proposal ignores many crucial details regarding utility assets (physical and human), the contracting arrangements necessary to facilitate his scheme, and the asset valuation problems that inhere in any scheme to transfer utility property. As Williamson argues, because of the inefficiencies associated with building duplicate utility systems (one of the features of natural monopoly in the utility sector), the transfer of utility assets between successive franchisees would devolve into a process that resembles public utility regulation, specifically in the valuation of assets necessary to facilitate the transfer. *See* Oliver E. Williamson, *Franchise Bidding for Natural Monopolies-in General and With Respect to CATV*, 7 BELL J. ECON. 73, 78, 85 (1976) (taking Demsetz to task for dismissing as "irrelevant complications" the issues of equipment durability and uncertainty and noting that "franchise bidding for public utility services under uncertainty encounters many of the same problems that the critics of regulation associate with regulation"); *id.* at 85–87 (discussing the asset valuation problems with the franchise bidding scheme and concluding that "the valuation of physical assets is predictably more severe under franchise bidding than under regulation")*; see also* JOSKOW & SCHMALENSEE, *supra* note 31, at 31 (following Williamson and noting that "in most situations the administration of long-term contracts negotiated as a result of franchise bidding degenerates into a process that resembles public utility regulation. This is more likely to happen the more important are the supplier's long-lived investments that cannot easily be transferred to other uses. Such investments are important in the electric power industry."). Posner advocated for removal of restrictions on entry and lifting of rate controls combined with a tax on excess profits to mitigate against monopoly rents. *See* Posner, *supra* note 146, at 639–40. *But see* Harry M. Trebing, *Realism and Relevance in Public Utility Regulation*, 8 J. ECON. ISSUES 209, 219 (1974) (criticizing Posner's excess profits tax proposal on grounds that "[i]f the excess profits tax is set too high, it will produce all of the waste and inefficiency attributed to cost-plus regulation; if it is set too low, it will have only salutary effects. In practice, it is reasonable to assume that such a tax ultimately would be shifted forward to the consumer and that the rate would be either too low to be bothersome or high enough to be the subject of continuous adjudication and revision.").

153. *See* George J. Stigler & Claire Friedland, *What Can Regulators Regulate? The Case of Electricity*, 5 J.L. & ECON. 1, 8 (1962) (concluding that regulation of electric utilities had no detectable effect on the average level of electricity rates).

154. *See, e.g.*, Paul M. Hayashi & John M. Trapani, *Rate of Return Regulation and the Regulated Firm's Choice of Capital-Labor Ratio: Further Empirical Evidence on the Averch-Johnson Model*,

Little of this critique was especially new. Much of the early twentieth-century writing on public utilities discussed the problem of capture.[155] Institutional economists and legal realists such as Commons and Hamilton were well aware of the problem, but were nuanced enough in their appreciation for the complexity of the real economy and the role of government therein that they would never have proposed this as a single overarching explanation for the experiment of public utility law, much less as a reason to abandon the effort.[156] During the 1950s and 1960s, moreover, several left-leaning historians argued that Progressive era legislative reforms such as public utility regulation epitomized the corporate control of government.[157] To be sure, by the middle decades of the twentieth century, anecdotal evidence suggested that capture did in fact represent a semi-stable end state for all too many commissions.[158] Nonetheless, such evidence could hardly be considered the single explanation for why regulation emerged when it did and took the form that it did.[159] Nor

42 S. ECON. J. 384, 397 (1976) (using a cross-section sample of electric utility firms to provide empirical support for Averch-Johnson effect that firms operating under rate of return regulation will produce with a capital-labor ratio greater than the cost minimizing one); Robert M. Spann, *Rate of Return Regulation and Efficiency in Production: An Empirical Test of the Averch-Johnson Thesis*, 5 BELL J. ECON. & MGMT. SCI. 38, 50 (1974) (reporting results of empirical study of regulated electric utilities confirming Averch-Johnson thesis that firms subject to rate of return regulation will "overcapitalize"). *But see* Paul L. Joskow & Roger C. Noll, *Regulation in Theory and Practice: An Overview*, *in* STUDIES IN PUBLIC REGULATION 1, 10–14 (Gary Fromm ed., 1981) (criticizing assumptions of Averch-Johnson model and studies purporting to demonstrate empirical support for the model); JOSKOW & SCHMALENSEE, *supra* note 31, at 86 (noting lack of empirical support for the Averch-Johnson effect and observing that during late 1970s and early 1980s rate-of-return regulation was having the opposite effect with utilities "avoiding making socially desirable capital expenditures" because expected rates of return were below their costs of capital).

155. *See, e.g.*, Edwin C. Goddard, *The Evolution and Devolution of Public Utility Law*, 32 MICH. L. REV. 577, 619 (1934) (discussing the common charge "that commissions have gradually developed into utility-owned bodies").

156. *See, e.g.*, HAMILTON, POLITICS OF INDUSTRY, *supra* note 14, at 59–62 (discussing general problem of "regulation in captivity"); Commons, *Wisconsin Public-Utilities Law, supra* note 88, at 222 ("Nearly every State commission created in other States to regulate corporations has sooner or later fallen under the control of corporations supposed to be regulated.").

157. *See* GABRIEL KOLKO, THE TRIUMPH OF CONSERVATISM: A REINTERPRETATION OF AMERICAN HISTORY, 1900–1916, at 3 (1963) ("It is business control over politics (and by 'business' I mean the major economic interests) rather than political regulation of the economy that is the significant phenomenon of the Progressive Era."); *see also* William J. Novak, *A Revisionist History of Regulatory Capture, in* PREVENTING REGULATORY CAPTURE: SPECIAL INTEREST INFLUENCE AND HOW TO LIMIT IT 26–32 (Daniel Carpenter & David A. Moss eds., 2014) (discussing intellectual history of the "capture thesis").

158. *See, e.g.*, James W. Fesler, *The Independence of State Utility Commissions, II*, 3 J. POLITICS 42, 66 (1941) (reviewing state utility commission behavior and concluding that "[i]ndependence of utility commissions . . . is an illusory will-o'-the-wisp").

159. George Priest made this point in his critique of the Stigler/Posner thesis advancing a "capture" theory as the explanation for utility regulation. *See* George L. Priest, *The Origins of*

could it be taken as the inevitable result of any such effort to regulate these types of businesses.

Likewise, the perverse incentives that resulted from the actual practice of rate regulation were well known to the realists and others. Robert Lee Hale, for example, identified the problem of "extravagantly incurred" costs as part of a more general criticism of an "actual cost" approach to rate base valuation, arguing instead for a prudent investment standard that, however imperfect, provided a possible check on the utility incentive to overinvest in rate base.[160] John Commons, too, had long supported a cost-based approach to assessing rate base, a uniform system of accounting for utility assets, and full public disclosure of utility investments.[161] Many public utility statutes, including Wisconsin's, had also adopted a "used and useful" requirement for assets placed in rate base.[162] Thus, even if the tendency to overinvest was not modeled with the authority of Averch-Johnson, most people understood that rate-regulated utilities sometimes had an incentive to "gold plate" their rate base and thereby inflate the rates they could charge. Regulators, too, were hardly unaware of

Utility Regulation and the "Theories of Regulation" Debate, 36 J.L. & ECON. 289, 323 (1993) ("The search for a single theory of regulation . . . does not illuminate regulatory behavior. . . . [T]he assertion that an agency has been 'captured' by a utility or is serving that utility's economic interests necessarily is too crude a depiction of the regulatory relationship."). For a more recent critique of public choice theory, see STEVEN P. CROLEY, REGULATION AND PUBLIC INTERESTS: THE POSSIBILITY OF GOOD REGULATORY GOVERNMENT 3 (2008) (arguing that public choice theory "rests on a seriously incomplete and undertheorized understanding of regulatory government, and . . . that its empirical predictions are not supported by careful consideration of the evidence about how regulatory agencies operate or what they do").

160. *See* Hale, *The "Physical Value" Fallacy*, *supra* note 69, at 720–21; Hamilton, *Price—By Way of Litigation*, *supra* note 14, at 1035 ("The attention of management has been riveted upon the problem of the rate-base; its augmentation has become a conscious end of policy. The energy, thought, and initiative which in many another industry is directed to the elimination of waste, the advancement of technology, and the enlargement of markets is in the utilities spent in a continuous act of pecuniary creation.").

161. *See, e.g.*, Commons, *Wisconsin Public-Utilties Law*, *supra* note 88, at 222 (discussing the "physical valuation" basis for establishing rates under the Wisconsin statute that, when combined with a system of uniform accounting and full public disclosure, would allow "every person in the State [to] know at the end of each fiscal year exactly the rate of profit which each company has made on its actual property invested").

162. *See, e.g.*, Sec. 1797m-5, *Wisconsin Public Utilities Law*, 1907 LAWS OF WISCONSIN 448, 450 (1907) ("The commission shall value all the property of every public utility actually used and useful for the convenience of the public."); Gilmore, *supra* note 95, at 519 ("The expression 'actually used and useful for the public convenience' was selected after much consideration. . . . [T]he purpose of the clause is to require the Commission to ascertain the existing valuation of all property actually used for the public, and the requirement of 'useful' for the convenience of the public was designed to eliminate from the valuation losses due to economic inefficiency, extravagant or bad management, improvident construction or excessive original cost, superceded or antiquated equipment.").

this problem and endeavored (albeit unevenly and with varying degrees of success) to develop principles and practices to mitigate such tendencies.[163]

What was different about Averch-Johnson and the other criticisms mounted by the economists, however, was the normative force that lay behind them. By making the pathologies of rate regulation seem like the inevitable outcome of the regulatory model itself rather than the more mundane result of how well the regulators did their job, they reinforced a naturalized view of markets as superior to government regulation. In effect, the conceptual models developed to understand certain aspects of firm behavior under a set of highly stylized constraints came to be taken as accurate representations of what was actually going on with regulated utilities in the real world.[164]

This is not the place to rehearse every feature of these critiques. And even if some of the criticisms were exaggerated, it is clear that many of them had merit and comported with long-standing concerns. The point here is to emphasize the effects of the overall critique on the general understanding of public utility. More than anything else, what resulted from the sustained economic criticisms of public utility was a substantial thinning of the concept. By taking public utility out of the broad normative context that legal realists and early institutional economists investigated, and by and stripping it down to its bare-boned economic features, the post-1960 economic critique made it into something that could be modeled under the strict parameters of neoclassical economics and held up by lawyers and economists as an example of the endemic problems afflicting government regulation and the concomitant superiority of markets.

As part of a broader trend that elevated idealized conceptions of competitive markets by detaching them from their historical and institutional contexts, the economic critique worked to redefine public utility as a perverse and wasteful economic form that almost inevitably resulted in the destruction of

163. *See* Joskow & Noll, *supra* note 154, at 14 ("Recent efforts by state utility commissions to monitor utility supply decisions more closely recognize implicitly that rate-of-return regulation may produce incentives that lead a firm to depart from least-cost production in a variety of ways, especially in the current economic environment.").

164. *See* Paul L. Joskow, *Incentive Regulation and its Application to Electricity Networks*, 7 REV. NETWORK ECON. 547, 549 (2008) ("This theory [(the Averch-Johnson model)] ignores many attributes of real regulatory institutions and it has little if any empirical support, but for many years it was 'the' positive theory of regulation."); Paul L. Joskow, *Inflation and Environmental Concern: Structural Change in the Process of Public Utility Price Regulation*, 17 J.L. & ECON. 291, 293 (1974) [hereinafter Joskow, *Inflation and Environmental Concern*] ("[the Averch-Johnson model] does not capture the essence of the regulatory process and as a result may lead to incorrect predictions of static and dynamic efficiency. More importantly it is useless for predicting changes in regulatory techniques and their associated effects.").

consumer welfare.[165] Of course, comparing an ideal view of markets to real-world regulation was never going to go in regulation's favor and, as noted, there were plenty of problems with existing practices of utility regulation to provide fodder for these critics.[166] It is somewhat puzzling, nonetheless, that the reductionism and resulting separation of economics from history, institutions, and the exercise of social power that allowed the economic critique to stand up has been able to exert such influence for so long.[167] Gone was any appreciation for the challenge of engaging with the complexity of the real economy, with all of its legal and institutional nuances, that an earlier generation of economists and lawyers had taken as their starting point.[168] Lost, perhaps

165. *See* RODGERS, AGE OF FRACTURE, *supra* note 145, at 47 ("By the end of the 1970s, a new idea of the market, cut free from the institutional and sociological relationships constitutive of earlier economic analysis—from Ricardo's great economic 'classes,' from Marshall's tangibly imagined Manchester cotton exchange, from Samuelson's government macroeconomic stabilizers—was being called on to do unprecedented amounts of thinking. Under the skin of an old word, something quite new had indeed emerged."). Rodgers goes on to note that the "most dramatic instance of the new authority of market models came in public utility law" and elaborates on how the economists embrace of competitive markets led to a broad deregulatory movement. *Id.* at 60–63.

166. *Cf.* Joskow, *Inflation and Environmental Concern*, *supra* note 164, at 292 (discussing Averch-Johnson and other studies seeking "to compare the 'regulated' world with an ideal competitive world" and noting that such "work often suffers because of an incomplete development of the actual process of regulation that is being evaluated, comparisons with competitive ideals which are not actually feasible alternatives, and a failure to deal with the distributional consequences of regulation in a satisfactory fashion").

167. *See* RODGERS, AGE OF FRACTURE, *supra* note 145, at 43, 76.

168. *See* COMMONS, LEGAL FOUNDATIONS OF CAPITALISM, *supra* note 97 at 387 ("Economic theory, in avoiding ethical notions of purpose, has usually assumed that it is the business of those working rules which we name 'the law,' to eliminate the unethical attributes of transactions, such as fraud, violence, coercion, deception, and has then operated with the abstract notions of utility and exchange. . . . Yet in a science of human transactions there is no clear dividing line between utility, sympathy and duty, between economics, ethics and law."); Hamilton, *supra* note 97, at 311 ("'Institutional economics' alone meets the demand for a generalized description of the economic order. Its claim is to explain the nature and extent of order amid economic phenomena, or those concerned with industry in relation to human well-being. . . . Such an explanation cannot properly be answered in formulas explaining the processes through which prices emerge in a market. Its quest must go beyond sale and purchase to the peculiarities of the economic system which allow these things to take place upon particular terms and not upon others. It cannot stop short of the study of conventions, customs, habits of thinking, and modes of doing which make up the scheme of arrangements which we call the 'economic order.' It must set forth in their relations one to another the institutions which together comprise the organization of modern industrial society."). Although the theoretical project of institutional economics certainly did not have the elegance or simplicity of formal neoclassical theory, criticisms of the "institutional school" as hostile to theory seem a bit unfair. George Stigler, for example, was unsparing in his critique: "I would say the institutional school failed in America for a very simple reason. It had nothing in it except a stance of hostility to the standard theoretical tradition. There was no positive agenda of research, there was no new set of problems or new methods they wanted to

forever, was any sense of the creative force of law and the potential for innovative forms of public utility regulation as part of a broader agenda aimed at harnessing the power of private enterprise to public ends. Henceforth, competitive markets would be viewed by advocates of deregulation as the goal toward which reform of public utility regulation should aim.

C. Technical Limits, Energy Crises, and Environmental Concerns

At the same time that the Chicago School economists were mounting their critique of public utility regulation, the electric power sector was undergoing a fundamental technological shift and facing a series of external crises that raised very real questions about the viability of the investor-owned utility (IOU) business model. First, by the 1960s, economies of scale in power generation had been exhausted.[169] This meant that the industry would no longer be able to build ever-larger plants to capture these economies and deliver declining prices to consumers. Second, the oil embargos and associated energy crises of the 1970s translated into higher fuel costs, which meant higher electricity prices, a growing emphasis on conservation and efficiency, and slower growth in electricity demand.[170] Third, mounting concerns about the environmental impacts of power generation combined with the new environmental laws of the 1970s made it easier for opponents of large power generation facilities to slow or stop new projects and to impose expensive new pollution control requirements, creating additional, unanticipated costs for many utilities.[171]

Together, these three developments put enormous strain on electric utilities. For the first time in years, electricity rates started to rise and utilities

invoke." *See* Edmund W. Kitch, *The Fire of Truth: A Remembrance of Law and Economics at Chicago, 1932–1970*, 26 J. LAW ECON. 163, 170 (1983) (quoting Stigler). One is reminded of Ronald Coase's response to an earlier and somewhat similar criticism of "the baleful influence of American institutionalists" on the state of economic theory: "I would like to say that we have less to fear from institutionalists who are not theorists than from theorists who are not institutionalists." Ronald H. Coase, *Discussion: Regulated Industries*, 54 AM. ECON. REV. 192, 196 (1964).

169. *See* HIRSH, *supra* note 39, at 55–58 (discussing exhaustion of economies of scale in power generation in the 1960s); Joskow, *Regulatory Failure*, *supra* note 39, at 151 (noting that by 1970 "productivity growth resulting from fuller exploitation of economies of scale, better coordination, and technological innovation stagnated").

170. *See* HIRSH, *supra* note 39, at 58–63 (discussing impacts of the energy crisis on the electric power industry); Joskow, *Regulatory Failure*, *supra* note 39, at 149–50 (discussing economic shocks of the 1970s and their impact on fuel costs for the power industry).

171. *See* HIRSH, *supra* note 39, at 63–68 (discussing impacts of environmental movement on the electric power industry); Joskow, *Regulatory Failure*, *supra* note 39, at 149 (noting that "new environmental constraints on air and water emissions . . . increased the costs of building and operating fossil-fired plants").

found themselves in a defensive posture with respect to ratepayers and a larger environmental movement that was gaining momentum.[172] As a result of the energy crises of the 1970s, which translated into rising costs and an increased emphasis on conservation and efficiency, utilities could no longer count on the consistent demand growth that they took for granted during the long post-World War II economic boom.[173] The world had changed.

It soon became apparent that the declining costs of previous decades had worked to hide past sins.[174] In a world where prices kept going down, regulators and ratepayers did not need to worry as much about the details of utility investments and the specifics of rate cases. But as costs rose and prices began to increase, heightened regulatory scrutiny and increasing advocacy on the part of ratepayers uncovered problems of overbuilding, the perverse incentives of rate design, and the lack of sustained attention to smaller scale and even non-generation alternatives in evaluating utility investments. This was perhaps most apparent in the abandonment of several high-profile nuclear power plants and subsequent battles during the 1980s over the disallowance of billions of dollars of utility investments.[175]

Of the policy responses to these developments, none would prove to be more influential (though not without controversy) in the ensuing decades than the obscurely named Public Utility Regulatory Policy Act (PURPA).[176] As a central component of President Jimmy Carter's response to the energy crisis of the 1970s, PURPA did several important things. It directed state PUCs to consider replacing declining block rates, in which rates decline as electricity use increases above certain thresholds, with new rate designs that

172. *See* Joskow, *Regulatory Failure, supra* note 39, at 152–55 (discussing rising prices and increased regulatory scrutiny of utilities in 1970s).

173. *Id.*, at 150–51 (discussing significant reductions in the rate of growth in electricity demand during the 1970s, resulting in substantial excess generating capacity and adding to growing demands for regulatory reform).

174. *See, e.g.*, Lave et al., *supra* note 12, at 11 (noting that the defects of rate-of-return regulation "had been hidden by rapidly evolving generation technology that continually lowered generation costs").

175. *See* BINZ ET AL., *supra* note 23, at 26 ("Between 1981 and 1991, U.S. regulators disallowed about $19 billion of investment in power plants by regulated utilities. During this time, the industry invested approximately $288 billion, so that the disallowances equated to about 6.6 percent of total investment. The majority of the disallowances were related to nuclear plant construction, and most could be traced to a finding by regulators that utility management was to blame." (citation omitted)); *see also* Richard J. Pierce, Jr., *The Regulatory Treatment of Mistakes in Retrospect: Canceled Plants and Excess Capacity*, 132 U. PA. L. REV. 497, 497–98, 500–02 (1984) (discussing problems of overbuilding in the electric power industry in the 1970s).

176. Public Utility Regulatory Policies Act of 1978, Pub. L. 95-617, 92 Stat. 3117 (Nov. 9, 1978) [hereinafter PURPA].

would incentivize conservation and efficiency.[177] It established rules for the interconnection and wheeling of wholesale power over neighboring systems.[178] And, most significantly, it required utilities to purchase power at their "avoided cost" from certain qualifying facilities (QFs), namely small cogeneration and renewable energy facilities.[179]

One historian has argued that PURPA's QF requirements and wheeling provisions were the seeds that blossomed into full-blown competitive wholesale power markets in the 1990s, which in turn hastened the end of the older "public utility consensus" in favor of a new regulatory model that embraced competition.[180] What PURPA did most fundamentally, however, was to harness the power of the public utility model to advance a larger set of policy objectives. Indeed, each of the innovations noted above, as well as those that were enacted in later years (such as integrated resource planning and net metering[181]) depended not on getting rid of public utility regulation but on channeling it in new directions. These were exactly the kinds of innovations in regulatory design that the earlier realists and institutional economists would have celebrated, and they are better seen as extensions of the public utility model rather than as inadvertent moves toward deregulation.

There was also considerable innovation in the responses of state legislatures and PUCs to the events of the 1970s. Specifically, a number of states adopted conservation and efficiency programs and initiated integrated resource planning exercises to replace the older approach to evaluating generation alternatives with a broader effort that assessed non-generation alternatives such as conservation and demand-side management.[182] Certain states, such

177. *Id.* §§ 111–112.
178. *Id.* §§ 202–204.
179. *Id.* § 210.
180. *See* HIRSH, *supra* note 39, at 119 ("Through its mostly unintended consequences, PURPA inaugurated the process by which the traditional structure of the utility system disintegrated.").
181. The Energy Policy Act of 1992 (EPAct 1992) amended PURPA to encourage Integrated Resource Planning (IRP) processes that would count investments in non-generation alternatives on an equal footing with new generation. Energy Policy Act of 1992, Pub. L. No. 102-486, § 111(a), 106 Stat. 2776, 2795 (codified as amended at 16 U.S.C. § 2621(d)(7)–(9) (2012)); *see also* discussion *infra* Part III.A. The Energy Policy Act of 2005 (EPAct 2005) established net metering standards. Energy Policy Act of 2005, Pub. L. No. 109-58, § 1251(a), 119 Stat. 594, 962 (codified as amended at 16 U.S.C. § 2621(d)(11)–(13) (2012)).
182. *See* Cynthia Mitchell, *Integrated Resource Planning Survey: Where the States Stand*, 5 ELEC. J. 10, 13 (1992) ("A fundamental premise of IRP [integrated resource planning] has been that DSM [demand side management] represents both a cost effective and underutilized resource alternative."); Ralph C. Cavanagh, *Least-Cost Planning Imperatives for Electric Utilities and their Regulators*, 10 HARV. ENVT'L L. REV. 299, 327–28 (1986) (discussing efforts by U.S. states to integrate conservation in resource planning exercises).

as California, also adopted generous contract provisions to compensate QFs pursuant to PURPA, which gave the nascent renewable power industry in that state a boost.[183]

And yet, notwithstanding the innovations that PURPA embodied and the efforts by various states to adapt utility regulation to new circumstances, the concept of public utility continued to suffer in the face of an ongoing economic crisis that some blamed on overregulation—all of which served to reinforce the general criticisms advanced by the Chicago School economists and other advocates of regulatory reform.[184] In fact, it is at least arguable that these criticisms benefited as much from these external developments as from the force of the criticisms themselves. In matters of critique, timing can sometimes be as important as substance. At a minimum, it seems doubtful that these criticisms would have gained as much traction as they did had economies of scale not been exhausted, the energy and environmental crises of the 1970s not occurred, and prices continued to come down.

D. Deregulation and the Uneasy Embrace of Competition

By the 1990s, in the wake of several successful efforts to deregulate other sectors of the economy (trucking, airlines, banking, natural gas, and telecommunications), there was a concerted move at federal and state levels to introduce competition to various parts of the electric power industry.[185] Building on the forces unleashed by PURPA (both in stimulating independent power producers through its QF requirements and in taking the first steps toward open access transmission), Congress and, more importantly, FERC moved to further unbundle power generation from transmission and to establish an open-access, common carrier regime for interstate transmission that

183. *See* HIRSH, *supra* note 39, at 96–98 (discussing California qualifying facilities contracts); Ryan Wiser et al., *Renewable Energy Policy and Electricity Restructuring: A California Case Study*, 26 ENERGY POL'Y 465, 469 (1998) [hereinafter Wiser et al., *California Case Study*] ("In response to [PURPA], California developed several 'standard offer' contracts that were open to renewable and cogeneration powerplants. Because of high fuel costs forecasts at the time, some of these contracts proved very lucrative in hindsight.").

184. *See, e.g.*, Pierce, *supra* note 175.

185. Two legal scholars concluded that the move to deregulate common carriers and public utilities, which they described as "[t]he great transformation in regulated industries law," marked a shift from "hostility to competition to the maximum promotion of competition[,]" with regulatory agencies moving from a posture of industry oversight to "ensure reliable and uniform service[]" to a "primary role . . . as the facilitator of competition." *See* Joseph D. Kearney & Thomas W. Merrill, *The Great Transformation of Regulated Industries Law*, 98 COLUM. L. REV. 1323, 1408–09 (1998).

would allow competitive wholesale power markets to flourish.[186] Although FERC ultimately failed in its effort to extend this model to the whole country,[187] large sections of the country did embrace the general model, while others (notably the Southeast and much of the West) stayed with the traditional vertically integrated cost-of-service model. Writing at the time, two law professors framed the choice confronting the country as nothing less than one between markets and central planning,[188] and it is surely somewhat ironic that many of the states that have stayed with the "central planning" model are those with popular majorities that are generally skeptical of government regulation. Perhaps the road to serfdom is not always apparent to those who are traveling on it.[189]

186. *See e.g.*, Energy Policy Act of 1992, Pub L. No. 102-486, § 711, 106 Stat. 2776, 2905 (establishing an exemption under PUHCA for "exempt wholesale generators," defined as entities engaged exclusively in the sale of electricity at wholesale, in order to facilitate the growth of independent power producers); *id.* § 721, 106 Stat. 2776, 2915 (amending section 211 of the Federal Power Act to allow wholesale generators to apply to FERC for an order requiring that transmission owners provide transmission service to applicants); *id.* § 722, 106 Stat. 2776, 2916 (amending section 212 of the Federal Power Act to require that rates, charges, terms, and conditions for transmission service provided under section 211 are just and reasonable and not unduly discriminatory or preferential); FERC Order No. 888, Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 61 Fed. Reg. 21,540, 21,541–543 (May 10, 1996) (codified at 18 C.F.R. pts. 35, 385) (summarizing final rules designed to require open access non-discriminatory transmission service in order to promote competitive wholesale power markets).

187. *See* Remedying Undue Discrimination Through Open Access Transmission Service and Standard Electricity Market Design, 67 Fed. Reg. 55,452 (proposed Aug. 29, 2002) (to be codified at 18 C.F.R. pt. 35). This came to be known as Standard Market Design (SMD) rulemaking. The Federal Energy Regulatory Commission (FERC) terminated the rulemaking in 2005 in response to pressure form Congress, which was considering multiple draft provisions as part of EPAct 2005 that would have prohibited or delayed finalization of the SMD rulemaking. *See* Order Terminating Proceeding, 70 Fed. Reg. 43, 140 (July 26, 2005).

188. *See* Bernard S. Black & Richard J. Pierce, Jr., *The Choice Between Markets and Central Planning in Regulating the U.S. Electricity Industry*, 93 COLUM. L. REV. 1339, 1341–42 (1993) ("We must choose between two revolutionary visions of the future of the electricity sector of the U.S. economy. The first vision . . . relies where possible on markets, private incentives, and decentralized decisions to produce optimal pricing and consumption of electric power and least-cost pollution control. . . . The second vision . . . distrusts consumer choice and relies on central planners, housed in regulated utilities, state utility commissions, and federal regulatory agencies, to correct perceived large-scale imperfections in the electricity market. This vision's faith in central planning ('integrated resource planning' is the new phrase) bears an uncomfortable resemblance to the system previously used to govern the economies of eastern Europe and the former Soviet Union.").

189. *Cf.* FRIEDRICH A. HAYEK, THE ROAD TO SERFDOM (1944). It is worth recalling that Hayek did in fact recognize that planning was an important response to some of the problems and complexities generated by modern industrial society, including public utilities. *See id.* at

Notwithstanding these broader ideological overtones, at the core of these new wholesale markets were important new organizational forms: independent system operators (ISOs) and regional transmission organizations (RTOs).[190] These entities grew out of the so-called tightpower pools that had emerged in the Northeast and elsewhere to coordinate dispatch among neighboring IOU systems.[191] As elaborated in various FERC Orders, notably Orders 888 and 2000, RTOs and ISOs would operate the transmission systems of member utilities in an independent manner under a single open access transmission tariff.[192] Regulated as public utilities by FERC, RTOs and ISOs are nonprofit entities governed by their members.[193] Key functions include tariff administration; congestion management; dispatch and scheduling of generation; administration and oversight of various markets for energy, capacity, and ancillary services; planning; and interregional coordination.[194]

In operating day-ahead and real-time markets for wholesale power, as well as related markets for capacity and ancillary services, RTOs and ISOs play a crucial role in matching electricity supply with demand in a manner that maintains reliability. Unlike typical markets for goods and services, where demand and supply can vary freely with respect to price, these wholesale power markets are highly constrained and carefully designed around a uniform or

48 (noting that problems associated with town planning and "pubic utilities" were of the type "not adequately solved by competition").

190. For a map of current regional transmission organizations (RTOs) and independent system operators (ISOs), see *Regional Transmission Organizations*, *supra* note 56.

191. *See* JEREMIAH D. LAMBERT, CREATING COMPETITIVE POWER MARKETS: THE PJM MODEL 23 (2001) (discussing early history of Pennsylvania-New Jersey-Maryland (PJM) RTO in "tight power pool" agreement of 1927 between three Pennsylvania and New Jersey utilities); JOSKOW & SCHMALENSEE, *supra* note 31, at 66–77 (discussing interutility coordination and power pooling arrangements including the "tight power pools" in New England, New York, and Pennsylvania-New Jersey-Maryland (PJM)).

192. *See* FERC Order No. 888, 61 Fed. Reg. at 21, 591 to 21,597 (encouraging formation of ISOs as vehicle for administering open access transmission and elaborating principles for ISO governance and operation); FERC Order No. 2000, Regional Transmission Organizations, 65 Fed. Reg. 810, 876–77 (Mar. 8, 2000) (to be codified at 18 C.F.R. pt. 35) (discussing function of RTOs in designing and administering open access transmission tariff).

193. FERC Order 2000, Regional Transmission Organizations, 65 Fed. Reg. at 841–911 (identifying key characteristics and functions of RTOs). There is no legal prohibition on RTOs operating as for-profit entities, but to date all RTOs and ISOs operate as non-profit entities.

194. *Id.*; *see also* Michael H. Dworkin & Rachel Aslin Goldwasser, *Ensuring Consideration of the Public Interest in the Governances and Accountability of Regional Transmission Organizations*, 28 ENERGY L.J. 543, 554–57 (2007) (discussing various functions of RTOs and the challenges of fitting them into traditional categories or definitions); Hari M. Osofsky & Hannah J. Wiseman, *Hybrid Energy Governance*, 2014 U. ILL. L. REV. 1, 7–11 (describing RTOs as hybrid institutions). One could, of course, consider the entire history of public utility regulation as an effort to create and sustain various types of hybrid institutions.

single clearing price auction structure.[195] Under this design, generators bid in various blocks of supply that, under sufficiently competitive conditions, should be priced at their short-run marginal cost.[196] In an effort to police against the exercise of market power, the RTOs and ISOs have adopted strict market monitoring procedures and deploy independent market monitors to ensure that generators do not strategically withhold generation to increase prices.[197] The bids are then stacked by price, and the last unit of generation necessary to meet demand (the last unit needed to clear the market) provides the uniform clearing price that all other generators who bid below that price will receive.[198]

195. There is an extensive technical literature on auction design, including the merits of specific designs for electricity markets, that is beyond the scope of this article. *See, e.g.*, Par Holmberg & David Newberry, *The Supply Function Equilibrium and its Policy Implications for Wholesale Electricity Auctions*, 18 UTILITIES POL. 209, 211–13 (2010) (surveying economic literature regarding wholesale electricity auctions). In the U.S., the ISO and RTO markets all employ some version of the "uniform-price" auction for day-ahead and real-time electricity markets. Specific rules with respect to bidding formats, schedules, and settlements vary across the RTOs and ISOs, but the basic framework is the same. *See* MATHEW J. MOREY, POWER MARKET AUCTION DESIGN: RULES AND LESSONS IN MARKET-BASED CONTROL FOR THE NEW ELECTRICITY INDUSTRY 8, 70–76 (2001) (discussing basic design features of electricity auctions in U.S. regional power markets).

196. *See* MOREY, *supra* note 195, at 42 ("In principle, so long as generators receive the market-clearing price, and there is a sufficient number of competitors so that each generator assumes it will not be able to influence the determination of the marginal plant (and hence, the marginal cost market-clearing price), each generator's optimal bid should be based on short-run marginal cost. For a generator to submit a bid significantly above its short-run marginal cost would only lessen the chance of being dispatched without changing the market clearing price.").

197. *See* Udi Helman, *Market Power Monitoring and Mitigation in the US Wholesale Power Markets*, 31 ENERGY 877, 888–92 (2006) (discussing rules and practices in RTOs and ISOs for monitoring and mitigating market power); *see also* MONITORING ANALYTICS, STATE OF THE MARKET REPORT FOR PJM, Vol. 1, 7–9 (2013) (discussing role of the PJM market monitor in reporting on the state of the PJM market, monitoring market behavior, and evaluating existing and proposed market design rules); FERC Order 719, *Wholesale Competition in Regions with Organized Electric Markets*, 73 FED. REG. 64,100, 64,137–154 (2008) (codified at 18 CFR Part 35) (amending rules to enhance the independence and functioning of market monitoring in RTO and ISO markets); FERC, *Policy Statement on Market Monitoring Units*, Docket No PL-05-1-000, 1–4 (May 27, 2005) (providing guidance on market monitoring in RTO and ISO markets).

198. This differs from a "pay-as-bid" auction design that would compensate each generator based on the bid that it submitted rather than the single clearing price. There is an ongoing debate about whether this design produces more efficient results than the uniform-price design. *See, e.g.*, Natalia Fabra et al., *Designing Electricity Auctions*, 37 RAND J. ECON. 23, 23–25 (2006) (developing model to compare uniform-price and pay-as-bid auction designs); Alfred E. Kahn et al., *Uniform Pricing or Pay-as-Bid Pricing: A Dilemma for California and Beyond*, 14 ELECTRICITY J. 70, 71–76 (2001) (comparing uniform-price and pay-as-bid auction designs).

The stacking of bids also creates the so-called merit order for dispatching generation, determining the order (from lowest bid to highest clearing bid) in which power plants will be dispatched by the RTO or ISO to meet load.[199] Thus, the lowest-cost units will be dispatched first but will receive the same higher price that the marginal clearing bid receives.[200] By allowing low-cost generators to capture infra-marginal rents (the difference between their costs and the prices they receive), the uniform-price auction design should incentivize generators to price their bids at short-run marginal cost, and allow those who bid below the clearing price to cover some of their fixed costs with the infra-marginal rents that they receive.[201] This differs from the traditional cost-of-service model used in rate regulation, where each generation asset is (at least in theory) included in rate base on the basis of its particular cost structure.[202]

The great advantage of the uniform-price auction design is that it facilitates efficient dispatch—that is, it ensures that, absent congestion constraints and the exercise of market power, low-cost generation is bid in at its short-run marginal cost and dispatched ahead of more expensive generation.[203] This is one of the reasons why operating efficiencies (capacity factors) at low-cost, older nuclear power plants have increased in the competitive markets.[204] One possible disadvantage, however, is that the benefits or savings from these efficiencies are captured by the merchant generators rather than being passed on to consumers.[205]

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199. *See* MOREY, *supra* note 195, at 36–37 (discussing merit ordering of generation bids ranked from least to most expensive unit).

200. *Id.*

201. *See, e.g.*, PAUL L. JOSKOW, MIT CTR. FOR ENERGY & ENVTL. POLICY RES., COMPETITIVE ELECTRICITY MARKETS AND INVESTMENT IN NEW GENERATING CAPACITY 9 (2006) ("Inframarginal generating units earn net revenues or quasi-rents that contribute to the recovery of their fixed operating and capital costs whenever the market clearing price exceeds their own marginal generation costs.").

202. The phenomenon of "regulatory lag," which refers to the time between rate cases, means that rates are not adjusted in cost-of-service regimes on a continuous basis, creating situations of temporary over- and under-recovery. *See* Joskow, *Regulatory Failure*, *supra* note 39, at 137 (discussing the problems of regulatory lag).

203. *See* Peter Cramton & Steven Soft, *Why We Need to Stick with Uniform Price Auctions in Electricity Markets*, 20 ELECTRICITY J. 26, 27 (2006) (noting that the "clearing-price plays a critical role in the least-cost scheduling and dispatch of resources")

204. *See* Lucas W. Davis & Catherine Wolfram, *Deregulation, Consolidation, and Efficiency: Evidence From US Nuclear Power*, 4 AM. ECON. J.: APPLIED ECON. 194, 194 (2012) (finding that deregulation and consolidation are associated with a 10 percent increase in operating efficiency at nuclear power plants, primarily as a result of reduced frequency and duration of reactor outages).

205. *See* Lave et al., *supra* note 12, at 17, 19 (finding that improved operations and lower costs at generating plants as a result of electricity restructuring did not result in lower electricity prices

A potentially more fundamental problem, discussed in more detail in Part III.A *infra*, is that the uniform-price auction design does not provide sufficient incentives for long-term investments in capacity. Because of the uncertainty regarding future prices and the fact that the clearing prices are not tied in any way to the fixed costs associated with particular technologies, some analysts and commentators have argued that "energy-only" markets do not provide sufficient incentives for generators to invest in new capacity.[206] As a result, several ISOs and RTOs have created mandatory forward capacity markets that provide additional payments to generators for future capacity.[207] By increasing the incentives to build new generation via additional payments for future capacity, these markets work to maintain sufficient reserves, thereby ensuring reliability.[208]

In sum, the wholesale power markets are still works-in-progress. FERC, together with the RTOs and ISOs, continues to develop and refine

to consumers and concluding that electricity restructuring in general has not delivered benefits to consumers).

206. The "energy-only" market refers to day-ahead and real-time wholesale power markets in which generators sell electricity to load-serving entities. This differs from markets for future generating capacity, which some RTOs and ISOs have embraced as a means to incentivize investment in new generation. *See, e.g.*, FERC, *Centralized Capacity Market Design Elements*, Commission Staff Report, AD13-7-000, 2 (Aug. 23, 2013) (discussing concerns with early market-based capacity constructs and the implementation of centralized capacity markets in the eastern RTOs and ISOs "to provide more lead time and certainty for investment in new capacity resources, including an adequate opportunity for all resources to recover both their variable and fixed costs over time"); Dominique Finon & Virginie Pignon, *Electricity and Long-Term Capacity Adequacy: The Quest for Regulatory Mechanism Compatible with Electricity Market*, 16 UTILITIES POL. 143, 143 (2008) ("Insufficient attention was paid to the issue of investment in generating capacity during the period of designing the competitive electricity reforms."). As discussed in Part III.A, the challenge of creating sufficient incentives for new investment is particularly important in the case of certain renewable and low-carbon generation technologies, which have a higher capital intensity than traditional fossil generation and thus are more sensitive to the cost of capital.

207. *See* Elise Caplan & Patrick E. McCullar, *Markets in Name Only: Mandatory Capacity Markets and Their Adverse Impact on Load-Serving Entities*, 26 ELECTRICITY J. 52 (2013) (discussing efforts to create capacity markets in PJM and the New England Independent System Operator (ISO-New England)); Joseph E. Bowring, *The Evolution of the PJM Capacity Market: Does it Address the Revenue Sufficiency Problem?*, *in* EVOLUTION OF GLOBAL ELECTRICITY MARKETS: NEW PARADIGMS, NEW CHALLENGES, NEW APPROACHES 227, 232–42 (Fereidoon P. Sioshansi ed., 2013) (discussing efforts to design and implement a capacity market in PJM); Daniel Breslau, *Designing a Market-Like Entity: Economics in the Politics of Market Formation*, 43 SOC. STD. SCI. 829, 836–41 (2013) (providing a detailed case study of the design of the PJM capacity market, including fights over the shape of the "administratively determined" demand curve for the capacity market auctions).

208. *See* FERC, *supra* note 206, at 2 (noting that although RTOs and ISOs have flexibility in designing capacity markets, "the primary goal of these markets is the same: ensure resource adequacy at just and reasonable rates through a market-based mechanism that is not unduly discriminatory or preferential as to the procurement of resources").

the rules for design and operation of these markets, with the different RTOs and ISOs taking different approaches to various design elements.[209] Without question, there has been considerable learning over the last couple of decades, with many improvements in basic design and operation. As suggested previously, moreover, the diversity of experiences across these different markets has been an important source of policy innovation. But there is still much work to be done, particularly in the face of growing imperatives to decarbonize the power sector and accommodate the growth of variable and distributed energy resources.

In parallel to the federal effort to establish wholesale power markets, several states also moved ahead during the 1990s with electricity restructuring efforts. Most notably, California initiated an ambitious effort in 1996 to restructure its electric power markets.[210] In addition to creating an independent system operator (the California ISO or CAISO) that would manage the transmission systems of the larger California IOUs, the California restructuring plan required that the three IOUs divest much of their generation capacity, prohibited them from entering into long-term power contracts, and forced them to purchase their power in the spot market (the California Power Exchange or Cal PX). California's restructuring plan also provided for retail choice, stranded cost recovery, and a transitional rate freeze (set at 10 percent below then-current rates) that would stay in effect for four years or until the utilities recovered their stranded costs.[211]

Although the California market functioned relatively well for the first couple of years, by the middle of 2000 the market was in crisis.[212] During the

209. *See, e.g.*, MONITORING ANALYTICS, *supra* note 197, at 9–11 (summarizing current recommendations for changes to PJM market design and market rules); FERC Order 719, *Wholesale Competition in Regions with Organized Electric Markets*, 73 FED. REG. 64,100 (2008) (codified at 18 CFR Part 35) (amending regulations to improve operation of organized wholesale electric markets).

210. *See* A.B. 1890, 1995–96 Reg. Sess. (Cal. 1996).

211. *See* James Bushnell, *California's Electricity Crisis: A Market Apart?*, 32 ENERGY POL'Y 1045, 1046–47 (2004) (discussing key elements of the California restructuring plan).

212. There is a voluminous literature on the California electricity crisis. *See, e.g.*, Frank A. Wolak, *Diagnosing the California Electricity Crisis*, 16 ELECTRICITY J. 11, 20 (2003) (noting "that average market performance during the first two years of the market, from April 1998 to April 2000, was close to the average competitive benchmark price" and compared favorably to performance in the eastern ISOs); CHRISTOPHER WEARE, THE CALIFORNIA ELECTRICITY CRISIS: CAUSES AND POLICY OPTIONS 1–2 (2003) (describing the severe malfunctioning of the California electricity market beginning in the late spring of 2001); Severin Borenstein, *The Trouble with Electricity Markets: Understanding California's Restructuring Disaster*, 16 J. ECON. PERSP. 191, 198–200 (2002) (discussing substantial increases in California wholesale power prices in summer of 2000).

summer of 2000, California's wholesale power prices increased by 500 percent relative to a year earlier, while retail rates remained capped.[213] In the first four months of 2001, wholesale spot market prices averaged ten times what they had been in 1998 and 1999.[214] Forced to buy high and sell low, the large California IOUs teetered on the edge of insolvency, with Pacific Gas and Electric (PG&E) filing for bankruptcy in April 2001.[215] Subsequent investigations pointed to a host of factors that contributed to the crisis, including shortages of generation capacity, faulty market design, market manipulation, and a lack of enforcement.[216] One estimate put the total cost of the crisis to the California economy at $40 to $45 billion.[217] As of early 2014, the State had recovered more than $5 billion through litigation and enforcement actions.[218]

The lessons of the California experience were not lost on other states.[219] Whereas in the years preceding the crisis roughly half of the states had initiated restructuring, by the mid-2000s, in the wake of the California crisis, many of these states had suspended or abandoned their efforts.[220] Today, some fifteen states allow for some form of retail electric choice.[221] While switching rates have varied across states, they have generally been quite low for residen-

213. *See* Paul L. Joskow, *California's Electricity Crisis*, 17 OXFORD REV. ECON. 365, 365, 377–78 (2001) (discussing increases in wholesale electricity prices in California) [hereinafter Joskow, *California's Electricity Crisis*].

214. *Id.* at 365.

215. *See* David Lazarus, *PG&E Files for Bankruptcy $9 Billion in Debt, Firm Abandons Bailout Talks With State*, S.F. CHRON., April 7, 2001, at A-1.

216. *See* WEARE, *supra* note 212, at 15–50 (discussing various factors that contributed to the California electricity crisis); *see also* Joskow, *California's Electricity Crisis*, *supra* note 213, at 386–87 (discussing key contributing factors and lessons learned from the crisis).

217. *See* WEARE, *supra* note 212, at 3–4 (estimating $40 billion in added energy costs as of 2003 and $40–45 billion in total costs, which include added costs from blackouts and reductions in economic growth, which at the time was around 3.5 percent of the state's total annual economic output).

218. *See Energy Unit*, ST. CAL. DEPARTMENT JUST. OFF. ATT'Y GEN., http://oag.ca.gov/cfs/energy (last visited Feb. 4, 2014).

219. *See* David B. Spence, *The Politics of Electricity Restructuring*, 40 WAKE FOREST L. REV. 417, 417 (2005) ("California's disastrous experience with restructured electricity markets has given pause to restructuring's proponents and ammunition to restructuring's opponents."); Joel B. Eisen, *Regulatory Linearity, Commerce Clause Brinksmanship, and Retrenchment in Electric Utility Deregulation*, 40 WAKE FOREST L. REV. 545, 557–58 (2005) ("In the aftermath of competition's disastrous failure in the early 2000s in California, states are beginning to slow, alter, or even reject progress toward restructuring, even where it had been embraced earlier.").

220. *See* Joskow, *The Difficult Transition to Competitive Electricity Markets in the United States, supra* note 54, at 32 (reporting that after 2000 no additional states had announced plans to pursue electricity restructuring and nine states that had planned to implement reforms had "delayed, canceled, or significantly scaled back their electricity competition programs").

221. *See Status of Electricity Restructuring by State*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/electricity/policies/restructuring/restructure_elect.html (last updated Sept. 2010).

tial customers, with higher rates of switching for larger industrial and commercial customers.[222]

The move to introduce competition into various segments of the electric power sector also raised concerns that these new markets would undermine existing programs favoring more expensive forms of renewable energy and investments in efficiency.[223] In response, several states adopted renewable portfolio standards (RPSs) in conjunction with their efforts to restructure, in order to ensure that renewables would continue to grow in the newly-created electricity markets.[224] Considerable attention was also directed to the challenge of maintaining and expanding existing utility programs to support energy efficiency and conservation in the context of restructuring.[225] All of these efforts stemmed from the conviction that markets alone would not be able to promote low-carbon electricity.

Recognizing that electricity markets are still evolving, several important lessons can be gleaned from the effort to introduce competition into various parts of the electricity sector. First, not all markets are created equal, and

222. *See State Electric Retail Choice Programs Are Popular With Commercial and Industrial Customers*, U.S. ENERGY INFO. ADMIN. (May 14, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=6250 ("While residential customer participation rates are low in almost all of these [restructured] states, a majority of commercial customers have signed up with competitive suppliers in 9 states and a majority of industrial customers have signed up in 12 states."); *see also id.* ("The highest participation rates are found in the Northeast, Mid-Atlantic states, and Texas where electricity is supplied through Regional Transmission Organizations (RTOs) and states have unbundled generation from retail delivery and sales.").

223. *See, e.g.*, JOSEPH ETO ET AL., LAWRENCE BERKELEY NAT'L LAB., RATEPAYER-FUNDED ENERGY-EFFICIENCY PROGRAMS IN A RESTRUCTURED ELECTRICITY INDUSTRY: ISSUES AND OPTIONS FOR REGULATORS AND LEGISLATORS 1–5 (1978) (discussing challenges facing efficiency programs in context of electricity restructuring); Nancy A. Rader & Richard B. Norgaard, *Efficiency and Sustainability in Restructured Electricity Markets: The Renewables Portfolio Standards,* 9 ELECTRICITY J. 37, 37–38 (1996) (discussing debates over policy options for promoting renewables in context of electricity restricting); Ryan Wiser et al., *Renewable Energy and Restructuring: Policy Solutions for the Financing Dilemma*, 10 ELECTRICITY J. 65, 66 (1997) ("Absent the development of new policies, many are concerned that renewables could be an inadvertent casualty in the transition to competitive power markets.").

224. The California PUC included a renewable portfolio standard (RPS) as part of its restructuring order, but the legislature removed the RPS in its subsequent legislation on restructuring (AB 1890) in favor of a surcharge-funded program. In 2002, in the wake of the electricity crisis, California adopted an RPS. In the meantime, several other states, including Maine, Arizona, Nevada, and Massachusetts, adopted RPSs as part of their restructuring processes. *See* Wiser et al., *California Case Study*, *supra* note 183, at 468–70 (discussing efforts by California and other states to include RPS as part of the restructuring process).

225. *See, e.g.*, Eric Hirst et al., *The Future of DSM in a Restructured US Electricity Industry*, 24 ENERGY POL. 303, 311–13 (1996) (discussing efforts to maintain efficiency and DSM [(demand side management)] programs in the context of electricity restructuring).

market design matters a great deal. Given the considerable complexity of electric power systems and certain characteristics that make electricity markets very difficult to design and manage, the introduction of competition into the sector proved to be more challenging than some advocates may have initially realized.[226] Competition could indeed be an important tool to discipline certain forms of behavior, but its overall success in doing so would depend upon careful institutional design.

Second, introducing competition requires quite a bit of regulation and ongoing oversight. Today's organized wholesale power markets are not ordinary markets where individuals are free to interact as buyers and sellers based on their own decentralized decision-making. Because electricity flows through the grid according to the laws of physics and because supply and demand must be balanced in real time, central coordination is necessary to make these markets work. Such coordination includes central control over dispatch to meet the requirements of systems operation, carefully designed markets for capacity and ancillary services, and long-term planning for new investment. What we have, in other words, are not really markets in any traditional sense, but an open-access system run by a central administrator (an ISO or RTO) according to a previously-agreed-on set of rules and dispatch algorithms that govern auctions for power, capacity, and other services—all embedded within a large, multi-stakeholder process for governance, long-term planning, and cost allocation. As noted above, moreover, these ISOs and RTOs are closely regulated by FERC as public utilities, and they have all adopted strict rules to govern market behavior that are carefully enforced by independent market monitors. As various commentators have pointed out, this results in multiple layers of regulation that arguably exceed the overall regulatory burden present in traditional cost-of-service regulation.[227] And the cost of managing these systems is not trivial. PJM, for example, spends almost $300 million per year on operational and administrative costs.[228]

Third, as with any form of regulation, the introduction of competition is always going to be subject to political compromises. In the same way that real world regulation never matches the ideals of legal and political theory, real world markets never live up to the idealized models of economic theory. This was a basic

226. *Cf.* Paul L. Joskow, *How Will it End? The Electric Utility Industry in 2005*, 9 ELECTRICITY J. 67, 69 (1996) ("[A]n electric power system is an integrated physical network that operates as one large machine, not a set of straws through which electrons flow. While the laws of supply and demand and the invisible hand are very powerful, they are not more powerful than the laws of physics and can operate efficiently only by accommodating physical realities.").

227. *See, e.g.*, Lave et al., *supra* note 12, at 16 ("If anything there are more layers of regulation now.").

228. *See* PA.-N.J.-MD. INTERCONNECTION, PJM 2012 FINANCIAL REPORT 21 (2013).

lesson that the realists and institutional economists had pointed out decades earlier.[229] Pure market designs such as the California Power Exchange proved to be a disaster, not least because they could be manipulated and provided limited opportunities for hedging by load serving entities. And while there is ongoing debate about the causes of the California crisis (the transitional rate freeze was one obvious design flaw that market reform advocates could rightly point to as an example of a lingering government control that impeded the price signals necessary to make these markets work), it seems naïve to presume that proper market designs will emerge out of a political process.[230] Perhaps we need to think not only about the pathologies affecting the performance of the firm under regulatory constraints, pace Averch-Johnson, but also about those that arise from the performance of the market under political constraints.

Fourth, and related to the prior point, in all of these markets the process of market design has emerged as an intense object of interest for market participants. Rent-seeking behavior thus seems to have moved from the more open, public process of rate cases to the highly technical and possibly less transparent process of developing rules for how these markets will work.[231]

229. *See* discussion *supra* Part II.A; *see also* Harry M. Trebing, *Changing Nature*, *supra* note 38, at 269 ("[T]he real world differs sharply from the vision of an unfettered free market economy promoted by the champions of deregulation. This dichotomy between vision and reality can have profound consequences for the general welfare."); Hamilton, *supra* note 97, at 311 (concluding that neoclassical or value economics, as contrasted with institutional economics, suffers from "a failure to recognize the complexity of the relations which bind human welfare to industry").

230. *Cf.* Wolak, *supra* note 212, at 11 (concluding that "the California electricity crisis was fundamentally a regulatory crisis rather than an economic crisis"). Notwithstanding the merits of Professor Wolak's argument that regulators, particularly FERC, failed to anticipate and respond adequately to the California electricity crisis, it is also important to recognize that the effort to assign blame for the crisis either to regulation or to economics simply begs the question of whether any real-world economic institution can ever be separated from the regulatory framework that determines how it operates. *See* Oliver E. Williamson, *Why Law, Economics, and Organization?*, 1 ANN REV. LAW. SOC. SCI. 369, 384 (2005) ("In the California electricity restructuring effort 'good theories' were naively expected to be implemented without making provision for the realities of the political and regulatory process. Failing to make ex ante provision for these realities, politics and regulation are conveniently made the ex post scapegoats for behaving in perverse and unanticipated ways that, in large measure, were foreseeable and should have been factored into the calculus.").

231. *See* Marc K. Landy et al., *Creating Competitive Markets: The Politics of Market Design, in* CREATING COMPETITIVE MARKETS: THE POLITICS OF REGULATORY REFORM 1, 9–11 (Landy et al. eds., 2007) (discussing pervasive rent-seeking behavior in the context of market design as part of various deregulation initiatives); Richard O'Neill & Udi Helman, *Regulatory Reform of the U.S Wholesale Electricity Markets, in* CREATING COMPETITIVE MARKETS: THE POLITICS OF REGULATORY REFORM 128, 132–33 (Landy et al. eds., 2007) (discussing rent-seeking behavior by various actors in the design of U.S. wholesale power markets).

The current fights over the design of capacity markets in New England, New York, and PJM are good examples.[232]

Fifth, even if economic efficiency was the stated goal of electricity restructuring, it was always less important than maintaining system reliability.[233] Indeed, in the organized markets, systems operators employ what is known as "security constrained economic dispatch"—the term for the algorithms used to dispatch generation (supply) to meet load (demand) in a manner that mimics the approach taken by the vertically integrated utilities for their own systems, replacing engineering estimates of loads and costs with bids and offers for power in the context of day-ahead and hourly auctions.[234] Over time, various other markets for capacity and ancillary services have been established to ensure balancing, reserve capacity, and other characteristics necessary to maintain a high level of reliability. And, as noted, RTOs and ISOs have developed extensive planning exercises to guide new investments in generation and transmission in order to maintain reliability and promote certain kinds of investments.

Finally, while there is evidence of more efficient use of generation and other nongeneration alternatives in the wholesale power markets, questions remain regarding who is capturing the benefits of competition.[235] Notwithstand-

232. *See generally* Breslau, *supra* note 207, at 15–18 (discussing intense conflict over the shape of the administered demand curve in the PJM capacity market); Caplan & McCullar, *supra* note 207, at 52–53 (observing that in the RTO capacity markets "complex rules have been rewritten to create barriers to entry and anti-competitive conditions that provide an optimal earnings scenario for one group of sellers (incumbent merchant generators) by restricting the entry of new supply"). *See also* Electricity Consumers Resource Council v. FERC, 407 F.3d 1232, 1233–34 (D.C. Cir. 2005) (rejecting challenge by large industrial customers to FERC approval of the New York ISO's proposed new demand curve for its capacity market).

233. *See* William W. Hogan, *Electricity Wholesale Market Design in a Low Carbon Future*, *in* HARNESSING RENEWABLE ENERGY IN ELECTRIC POWER SYSTEMS 115 (B. Moselle et al. eds., 2013) ("Economic efficiency always played a secondary role to maintaining system reliability, keeping the lights on. Gold plating the system a little might produce some inconvenient questions on occasion, but major blackouts or even relatively minor but frequent local supply interruptions could limit a career and were deemed unacceptable. The common approach for the wholesale power system was, and continues to be, treating reliability as a constraint and economic efficiency as a goal to be sought subject to that constraint.").

234. *Id.*

235. There is evidence that capacity factors and operating efficiencies at particular types of generation plants—notably, nuclear power plants—have increased in the wholesale power markets. *See, e.g.*, Davis & Wolfram, *supra* note 204, at 194 (finding that improved operating efficiencies at nuclear power plants as a result of restructuring produced approximately $2.5 billion in annual savings (at average wholesale prices) and resulted in an annual decrease of almost 40 million metric tons of carbon dioxide emissions); Kira R. Fabrizio et al., *Do Markets Reduce Costs? Assessing the Impact of Regulatory Restructuring on US Electric Generation Capacity*, 97 AM. ECON. REV. 1250, 1272 (2007) (concluding that restructuring led to gains in plant-level efficiencies); Alexander Sharabaroff et al., *The Environmental and Efficiency*

ing the difficulties of comparing the current restructured world to a counterfactual world without restructuring, some analysts point to evidence demonstrating that owners of low-cost baseload generation have been the primary beneficiaries while residential customers have seen few benefits.[236]

None of which is intended to suggest that the organized markets do not provide important benefits and opportunities for innovation, including efforts to integrate renewables and demand response onto the grid.[237] The mistake, this Article contends, is to see these markets as antithetical to a broader understanding of public utility. In fact, RTOs and ISOs share many of the characteristics of public utilities and are regulated as such. The markets that they administer are carefully designed and highly regulated, mimicking in some respects the actions of systems operators in vertically integrated utilities. Planning is and always will be a key part of the effort to maintain reliability and enhance the grid. In many respects, the organized wholesale electricity markets stand as working examples of how competition can be deployed to discipline certain forms of behavior and to open up certain components of formerly regulated industries—a basic insight that realists and institutional

Effects of Restructuring on the Electric Power Sector in the United States: An Empirical Analysis, 37 ENERGY POL'Y 4884, 4892 (2009) (concluding that restructuring has contributed to improved efficiency and environmental performance of electricity generation). Regardless of the precise role of the wholesale markets in delivering improved efficiencies, there are still important questions regarding who is capturing the benefits of those efficiencies. *See* Lave et al., *supra* note 12, at 19 (concluding that restructuring has failed to accomplish its major goals and has not benefitted consumers).

236. *See* Lave et al., *supra* note 12, at 18–19 (observing that the uniform-price auction structure greatly benefitted low-cost baseload generation and concluding that customers have not benefitted from restructuring); *see also* Richard D. Cudahy, *Electric Deregulation After California: Down But Not Out*, 54 ADMIN. L. REV. 333, 358 (2002) (asking "whether the loss of vertical integration and the fragmentation of the electric delivery system, which competition demands, creates costs that equal or exceed any savings resulting from competition").

237. *See, e.g.*, Midwest Independent Transmission System Operator, Inc., 134 FERC ¶ 61,141 (2011) (accepting Midwest Independent Transmission System Operator (MISO) tariff adjustments for new Dispatchable Intermittent Resources (DIR) program to facilitate integration of wind and other renewables); FERC Order No. 764, *Integration of Variable Energy Resources*, 139 FERC ¶ 61,246 (2012) (removing barriers to integration of variable energy resources). Demand response has also increased in some of the wholesale markets, but there is ongoing debate about the role (and legality) of recent FERC rules in promoting this growth by allowing for the aggregation of demand response and its compensation as a resource in these markets. The D.C. Circuit recently vacated FERC Order 745, which created a framework for the compensation of demand response in the organized markets, on the grounds that it impermissibly intruded upon the jurisdiction of the States over retail electricity markets. *See* Elec. Power Supply Ass'n v. FERC, No. 11-1486 (D.C. Cir. May 23, 2014) (vacating FERC Order 745); *see also* Peter Cappers et al., *Demand Response in U.S. Electricity Markets: Empirical Evidence*, 35 ENERGY 1526, 1534–35 (2010) (discussing growth of demand response in wholesale markets).

economists advanced in the early twentieth century in their elaboration of public utility.

Still, despite the challenges of electricity restructuring, the mixed record of success, and the complex, highly regulated nature of electricity markets, much of the contemporary policy discussion regarding the power sector tends to frame questions regarding the future of the sector as a choice between markets and regulation.[238] This framing reinforces the narrow economic conception of public utility, leading to the conclusion that additional deregulation will be necessary to complete the task of restructuring and to fully realize the benefits of competitive electricity markets. While there is surely some truth in that view, it is also the case that framing the matter this way is overly simplistic. "The folklore of deregulation," to use Judge Richard D. Cudahy's phrase, has shaped for too long the ways that policymakers, regulators, and various stakeholders think about the introduction of competition into complex, network industries such as electric power.[239]

As a consequence, we still do not have an adequate vocabulary to talk about these organized markets and the RTOs and ISOs that administer them. From one vantage point, they look more like super utilities than markets—nonprofit versions of the large regional holding companies that were once viewed by systems engineers and business leaders as the key to building and operating large regional power grids. From another perspective, they look like agents of FERC, enforcing just and reasonable rates by promoting and protecting competition. From still another, they look like voluntary, multi-stakeholder forms of governance—more formal versions of the tight power pools that existed in various parts of the country during the middle decades of the twentieth century.[240] In all cases, the increasingly prominent role of the RTOs and ISOs in the organization and management of the electric power system raises important questions about the appropriate mix of competition and regulation in the sector and the viability of different forms of governance in the face of growing decarbonization imperatives.

238. This is perhaps most apparent in ongoing discussions regarding traditional utility business models and the regulatory frameworks that support them in the face of rapid growth in distributed energy resources. *See* discussion *infra* Part II.E.

239. *See* Richard D. Cudahy, *The Folklore of Deregulation (With Apologies to Thurman Arnold)*, 15 YALE J. REG. 427, 428 (1998) ("Reform today means deregulation, competition, privatization, and the unconstrained reign of the free market. Thus, a wonderful belief system has emerged around the process of deregulation.").

240. *See* Dworkin & Goldwasser, *supra* note 194, at 555–56 (discussing challenges of defining RTOs).

E. Public Utility in an Age of Disruption

During the push to deregulate the electricity industry, the major threats to the traditional utility business model were on the generation side, starting with PURPA's QF program and maturing into a fully developed independent power sector in large parts of the country that took advantage of new generation technologies (combined cycle natural gas turbines in particular) to challenge incumbent utilities. Today, the biggest threats are coming from the customer side in the form of increased demand response, efficiency, and distributed generation (collectively known as distributed energy resources), which are reducing load for utilities and raising important questions about whether the current IOU business model can survive. Indeed, current trends in load growth, which are well below their historical average, suggest that the traditional revenue model for these utilities needs to be replaced.[241] The considerable and growing interest in revenue decoupling as an alternative model represents one response to these changes, but it is not clear whether decoupling offers a sustainable, long-term solution.[242]

Like the previous debates over restructuring, moreover, the contemporary discussion is often framed as a battle between old and new, with entrenched monopolies seeking to preserve the status quo pitted against new entrants and new technologies promising disruptive innovation. Consultants and industry analysts talk constantly about the forces of disruption and the need for new, twenty-first-century business models.[243] With the phrase

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241. *See* ANNUAL ENERGY OUTLOOK 2014, *supra* note 26, at MT-16 (projecting annual growth in electricity demand of 0.9 percent for 2013–2040). Growth in electricity demand has slowed in every decade since the 1950s, from 9.8 percent per year during that decade to 0.7 percent per year during the 2000s. *Id.*

242. *See* REGULATORY ASSISTANCE PROJECT, REVENUE REGULATION AND DECOUPLING: A GUIDE TO THEORY AND APPLICATION (2011) (discussing the concept and practice of decoupling); PAMELA MORGAN, A DECADE OF DECOUPLING FOR US ENERGY UTILITIES: RATE IMPACTS, DESIGNS, AND OBSERVATIONS (2012) (reviewing recent experience with decoupling in US); *see also* NY DPS, REFORMING THE ENERGY VISION, *supra* note 66, at 49 (observing that revenue decoupling "provides no positive incentive for utility bill management and exposes the utility and customers to the risk that as some customers reduce demand, the cost of service is borne by the remaining customers").

243. *See* EDISON ELEC. INST., *supra* note 9, at 1–2 (discussing disruptive challenges facing electric utilities); GREGORY ALIFF, BEYOND THE MATH: PREPARING FOR DISRUPTION AND INNOVATION IN US ELECTRIC POWER INDUSTRY 3 (2013) ("The electric power industry could soon be facing its most disruptive period of change since the commercialization of electricity in the 19th century. The time is ripe for significant transformation because the potential for dramatic disruption to the existing electricity operating model is coming not from one direction but from many—demand, technology,

"death spiral" being bandied about in the popular press, it seems that rhetorical excess may be getting the better of some.[244] Nonetheless, significant changes are in play that pose important challenges to the traditional IOU business model. One need only look to Germany, which has engaged in a massive support program of feed-in tariffs and other policies to promote distributed solar power over the last decade, to see how such pressures may play out.[245]

For U.S. utilities, the standard argument holds that a combination of limited growth prospects for overall electricity demand (largely as a result of a slow-growing economy combined with increased efficiency and demand-side programs) and rapid uptake of distributed generation poses a new type of threat.[246] As more customers take advantage of incentives and support programs for these various distributed energy resources, system costs are increasingly shifted to nonparticipating customers. With limited load growth, utilities are left with no alternative but to raise rates, which further incentivizes customers to participate in programs to reduce their electricity use. On top of this, utilities are facing capital investment requirements close to twice the rate of depreciation to enhance the grid and meet regulatory mandates, leaving them little choice but to further raise rates, which simply adds to existing customer incentives to reduce usage or adopt distributed alternatives. According to industry analysts, such a dynamic, if it continues, could lead to a reduction in utility credit ratings, which would raise utilities' cost of capital and further increase costs and rates, thereby reinforcing customer incentives to further reduce demand and adopt distributed generation.[247] This positive feedback loop is what some refer to as the "death spiral."[248]

Although the prospect of disruption applies broadly to the full range of distributed energy resources, it is most apparent in the case of rooftop solar photovoltaic (PV) systems, which have enjoyed explosive growth in the U.S.

regulation, new products, and new competitors."); BINZ ET AL., *supra* note 23, at 5 (summarizing the "tremendous challenges" facing the electric power sector).

244. *See, e.g.*, Denning, *supra* note 7; Martin et al., *Power Grid*, *supra* note 7.

245. *See* Mario Richter, *Business Model Innovation for Sustainable Energy: German Utilities and Renewable Energy*, 62 ENERGY POL'Y 1226 (2013) (discussing the implications of growth in distributed generation for German utilities); Denning, *supra* note 7 (reporting that the combined market value of German utilities E.ON and RWE has declined by 56 percent over the past four years and in the context of a rising German stock market).

246. *See* EDISON ELEC. INST., *supra* note 9, at 1 (observing that current "disruptive challenges," including falling costs of distributed generation and other distributed energy resources, limited demand growth, and increased customer participation in demand-side management, are potential "game changers" for the U.S. electric utility industry).

247. *See id.* at 3, 11, 13.

248. *See, e.g.*, Martin et al., *Power Grid*, *supra* note 7.

over the last five years.[249] Given the rapidly declining costs of solar PV panels, the incentives embedded in net metering programs, and innovative financing techniques (notably the third-party solar lease), consumers have been able to put no or very little money down for the installation of these distributed systems and end up paying less for their electricity than they did before.[250] Incumbent utilities, in contrast, are left with significant reductions in demand from their higher-end distributed generation (DG) customers and a shrinking number of non-DG customers left to pay systems costs.[251]

In their current iteration, of course, these DG programs are made possible by the traditional model of utility regulation. Indeed, far from being a disruptive technology thrown up by unfettered market forces, DG has been a major beneficiary of utility regulation, principally in the form of net metering policies, which allow owners of DG to get the full retail price of power sold back to the grid.[252] And although it is surely the case that non-DG customers stand to benefit from the growth in DG to the extent that it reduces the need for investments in new generation, transmission, and distribution and to the extent that it promotes a more reliable and resilient grid, several recent analyses have raised concerns about the implications of DG growth for non-DG

249. *See* U.S. DEP'T OF ENERGY, REVOLUTION NOW: THE FUTURE ARRIVES FOR FOUR CLEAN ENERGY TECHNOLOGIES 4 (2013) ("In 2012, rooftop solar panels cost about 1% of what they did 35 years ago, and since 2008, total U.S. solar PV deployment has jumped by about 10 times—from 735 megawatts to over 7200 megawatts."). Advances in energy storage, when combined with rooftop solar PV systems, have the potential to radically disrupt the power sector, allowing for the possibility of full grid defection by some customers. *See* BRONSKI ET AL., ECONOMICS OF GRID DEFECTION, *supra* note 32, at 39 (discussing prospects for solar-plus-battery systems to reach grid parity and to facilitate grid defection).

250. *See id.*; Easan Drury et al., *The Transformation of Southern California's Residential Photovoltaics Market Through Third-Party Ownership*, 42 ENERGY POL'Y 681, 689 (2012) (observing that "[t]hird-party owned residential PV systems are rapidly gaining market share in the United States in the regions where they are allowed to enter the market" and concluding that "[p]olicies that enable third-party PV products to enter new markets . . . represent strong opportunities for stimulating PV demand in concert with traditional incentives that reduce system costs or increase revenues").

251. *See* LORI BIRD ET AL., REGULATORY CONSIDERATIONS ASSOCIATED WITH THE EXPANDED ADOPTION OF DISTRIBUTED SOLAR 8–17 (2013) (discussing various costs and benefits associated with increased adoption of distributed solar); CAL. PUB. UTILS. COMM'N (CPUC), CALIFORNIA NET ENERGY METERING (NEM) DRAFT COST-EFFECTIVENESS EVALUATION (2013) [hereinafter CPUC REPORT] (analyzing the costs and benefits of net metering program in California).

252. *See* BIRD et al., *supra* note 251, at 29–30 (discussing net metering policies). Nearly all states have adopted some form of net metering tariff. *See Net Metering*, DSIRE, http://www.dsireusa.org/solar/solarpolicyguide/?id=17 (last visited Jan. 24, 2014) (reporting that forty-three states plus the District of Columbia have established net metering policies).

customers who are left paying for a larger share of the utility's fixed costs.[253] As long as DG accounts for a very small portion of a utility's customer base, this is not much of an issue. As participation in net metering grows, however, the cross-subsidy issues become more important and contentious.

The recent and ongoing fights over net metering in several states have put the cross-subsidy issue, together with the broader question of how to properly assess the costs and benefits of solar DG, squarely on the policy agenda. In California, for example, a recent study performed on behalf of the California Public Utilities Commission (CPUC) estimated that the total costs of DG with full participation in the state's net metering program through 2020 would be $1.1 billion, or about 3.5 percent of IOU revenues.[254] New legislation enacted in late 2013 requires the CPUC to develop a tariff for DG customers by the end of 2015 (for offer in 2017) and gives the CPUC new authority to approve standby charges assessed to DG customers.[255] The law also requires that the new tariff be "based on the costs and benefits of the renewable electrical generation facility" and directs the CPUC to ensure that the "total benefits of the tariff to all customers . . . are approximately equal to the total costs."[256]

In Arizona, the Arizona Public Service Company filed an application in July 2013 with the state's Corporation Commission, which regulates the state's utilities, requesting a "cost shift solution" (that is, a new fee for DG customers) to address the $18 million cross subsidy that the company claims

253. *See* CPUC REPORT, *supra* note 251, at 30–38 (estimating systems costs borne by non-distributed-generation (non-DG) customers); CARL LINVILL ET AL., DESIGNING DISTRIBUTED GENERATION TARIFFS WELL: FAIR COMPENSATION IN A TIME OF TRANSITION 8 (2013) ("Because bundled rates typically include distribution system costs, costs that exist with or without the deployment of DG systems, net energy metering (NEM) customers sometimes make no contribution toward those costs."); NY DPS, REFORMING THE ENERGY VISION, *supra* note 66, at 62 ("[A] rate structure that is based solely on volumetric energy charges could be most favorable to DER [(distributed energy resources)], because it allows the customer to avoid any distribution charges when operating their own generation; but the rates for non-participant ratepayers would necessarily have to cover the other costs not paid by standby customers. Non-participant customers would in effect be subsidizing the DER customer's rates."). *But see* ROCKY MOUNTAIN INST., NET ENERGY METERING, ZERO NET ENERGY AND THE DISTRIBUTED ENERGY RESOURCE FUTURE: ADAPTING ELECTRIC UTILITY BUSINESS MODELS FOR THE 21ST CENTURY 36, 40 (2012) (noting that many questions about the net impacts of distributed energy resources remain to be answered and that "[u]nder current volumetric rate structures, net metering does not accurately recover the costs of a customer's use of the grid network and, simultaneously, it may not be compensating the customer for the value of the power they are providing").

254. *See* CPUC REPORT, *supra* note 251, at 7 (estimating the net cost of all net energy metering generation in California in 2020 under current net metering policies).

255. A.B. 327 §11 (Cal. 2013).

256. *Id.* § 11(b)(3)–(4).

is being provided to DG customers under the state's net metering policy.[257] In November 2013, the Arizona Corporation Commission voted (3–2) to approve a new fixed charge (seventy cents per kilowatt of installed DG capacity per month) on new solar DG customers starting in 2014.[258]

In Minnesota, legislation enacted in 2013 allows the state's investor-owned utilities to apply to the PUC for a "value of solar" tariff as an alternative to net metering.[259] Under the new law, the state Department of Commerce has developed a methodology for calculating the rates and charges under the value of solar tariff that separates the various components of solar DG, including delivered energy; avoided generation, transmission, and distribution; and avoided environmental costs.[260] The PUC approved the value of solar methodology in April 2014.[261]

Although California, Arizona, and Minnesota appear to have resolved (at least for now) conflicts over net metering in their jurisdictions, fights are brewing in several other states, including Colorado, Georgia, Kansas, Nevada, and Vermont.[262] One possible consequence of these ongoing fights between DG advocates and electric utilities is that electricity will no longer be viewed as a common enterprise but rather one more sector in need of disruption. As utilities find themselves in the unenviable position of having to take money from poorer customers to pay for systems costs and, in the process, subsidize the net metering programs that have fueled the growth of DG, they are seeking to impose additional systems charges or to adjust rate structures to cover some of these costs.[263] In doing so, they reinforce the view advanced by some

257. *See* Application of Arizona Public Service Company for Approval of Net Metering Cost Shift Solution, Ariz. Corp. Comm'n No. E-01345A-13-0248 (July 12, 2013).

258. *See* Arizona Public Service Company's Application for Approval of Net Metering Cost Shift Solution, Decision No. 74202, Ariz. Corp. Comm'n No. E-01345A-13-0248, at 29–31 (Dec. 3, 2013).

259. *See* MINN. STAT. § 216B.164, Subd. 10 (2013).

260. *See* MINNESOTA DEP'T OF COMMERCE, MINNESOTA VALUE OF SOLAR: METHODOLOGY (2014).

261. *See* Minn. PUC, Order Approving Distributed SolarValue Methodology, Docket No. E-999/M-14-65 (April 1, 2014).

262. *See, e.g*, Mark Jaffe, *Battle over Rooftop Solar Heads to Public Utilities Commission,* DEN. POST, Jan. 12, 2014, *available at* http://www. denverpost.com/business/ci_24889841/battle-over-rooftop-solar-heads-public-utilities-commission (discussing fight over net metering in Colorado); Edward Humes, *Throwing Shade: Fearing Lost Profits, the Nation's Investor-Owned Utilities are Moving to Blot out the Solar Revolution*, SIERRA, June 2014, *available at* http://content.sierraclub.org/new/sierra/2014-3-may-june/feature/throwing-shade (describing fights over net metering in various states).

263. *See, e.g.*, Application of Arizona Public Service Company for Approval of Net Metering Cost Shift Solution, Ariz. Corp. Comm'n No. E-01345A-13-0248 (July 12, 2013) (seeking a new surcharge to cover systems costs).

DG advocates that electric utilities are entrenched, anti-innovation rent-seekers with limited capacity to relate to customers. The IOU business model, according to these critics, is what stands in the way of efforts to realize the benefits of disruptive technologies.[264]

As evidence of these potential benefits, critics sometimes point to the telecommunications sector, where technological disruption has diminished the power of regulated monopolies, lowered costs, and brought a whole range of new products and services to consumers. Some observers suggest that electricity is now where telecommunications was in the 1990s—on the cusp of a major transformation.[265] Maybe. But it is not clear that the telecommunications analogy is that instructive for electricity.[266] It may be, in other words, that there are as many differences as similarities between the two and that those differences matter with respect to how fast competition and disruptive technologies can change the electric power sector. In particular, it seems unlikely that electricity will witness the emergence of alternative networks in the way that wireless and cable networks emerged to challenge the traditional landline network. Moreover, the prospect of substantial numbers of customers exiting the grid entirely is likely a decade or more away (if it ever happens), and, according to one recent analysis, would not allow for optimal utilization of assets.[267] Finally, and perhaps most importantly, the growing importance of policies seeking to reduce the carbon emissions associated with electric power generation (not to mention other environmental impacts) surely imposes an additional layer of complexity that does not exist in the telecommunications sector. Thus, rather than looking to the telecommunications experience for guidance regarding the potential for disruptive change in the power sector, it might be more constructive to recognize the distinctiveness of the power sector and to engage it on its own terms.

264. *See, e.g.*, Humes, *supra* note 262, (characterizing fights over net metering as effort by utilities to "blot out the solar revolution"); Martin et al., *Power Grid*, *supra* note 7 (discussing IOU resistance to growth of solar DG).

265. *See* Martin et al., *Power Grid*, *supra* note 7 (analogizing disruption of current electric power sector to telecommunications); EDISON ELEC. INST., *supra* note 9, at 14–17 (discussing history of disruption in telecommunications and its implications for the power sector).

266. Joskow and Schmalensee made this point in the early 1980s in the context of discussions over electricity deregulation and the possible lessons for the sector from the telecommunications deregulation experience. *See* JOSKOW & SCHMALENSEE, *supra* note 31, at 42–43 (discussing key differences between the telephone industry and electric power and observing that "casual reasoning by analogy produces sound policy only by chance").

267. *See* BRONSKI ET AL., ECONOMICS OF GRID DEFECTION, *supra* note 32, at 39 (concluding that customers with solar-plus-battery systems will realize more value when connected to the broader grid).

In doing so, it is important to recognize that, despite the rhetoric of disruption that DG advocates sometimes embrace, the fight over net metering policies is really just another example of rent seeking (on both sides)—another effort to shift the system of entitlements embedded in the current system of utility regulation to favor a particular set of technologies and actors. Taken on its own terms, moreover, the notion of disruption reflects an uncritical acceptance of the idea that we are all better off if individual economic actors are allowed to operate free of the constraints imposed by social norms and institutions. Celebrating disruptive innovation thus tends to undermine support for existing institutions—putting in their place a neoliberal faith in individuals whose freedom and capacity for creative destruction can only be realized by breaking down old barriers and habits. No doubt this view of society can bring about positive and important changes, but a society seen as devoid of institutions makes it difficult to build the forms of social life and cooperation necessary to effect lasting changes in collective behavior. In the specific case of electricity, the rhetoric of disruption ignores the possibility of any sort of positive reform agenda attached to the notion of broader public utility. By emphasizing radical change rather than pragmatic adjustment of existing institutions, it constrains our ability to think about electricity (and energy) as a collective, social enterprise precisely at the time when we are becoming more active participants in that enterprise.[268]

Rather than viewing the rapid growth of distributed energy resources through the lens of disruption, a more positive agenda would recognize the vital role that these resources can play in a clean energy future and would work to design rates and systems-integration policies to accommodate these resources in a fair and open way.[269] It would recognize that the effort to ac-

268. The current enthusiasm for disruptive transformation of the power sector also has important implications for social equity, something that regulators (and public utilities) cannot ignore. *See, e.g,* NY DPS, REFORMING THE ENERGY VISION, supra note 66, at 54 ("The threat of disruptive transformation may be a strong motivator for utilities, but it is not by itself a constructive way to regulate. The risk inherent in this approach can inhibit financing and could ultimately lead to higher rates for remaining captive customers. Reliance on this threat, to motivate utilities, places risk on the most vulnerable customers that lack the means to participate in the disruptive trends."); LINVILL ET AL., *supra* note 253, at 6 (discussing inability of low-income consumers to participate in DG and need to ensure that incentives and rate designs intended to support DG will protect low-income consumers from being over-charged).

269. This is the basic position being advanced by the staff of the New York Department of Public Service in their effort to develop a new framework for New York's electricity system that can accommodate, among other things, substantial growth in distributed energy resources. *See, e.g.*, NY DPS, REFORMING THE ENERGY VISION, *supra* note 66, at 62 ("The central issue that should be considered is what rate design will reflect the most economic proposition to

commodate bidirectional power flows across distribution systems will require significant upgrades that all users should pay for, and that the resulting system will be more complex and thus require more careful planning and coordination.[270] It would also acknowledge that distributed generation will not be enough by itself to get us to a low-carbon future; that any effort to reduce power sector emissions by 80 percent by 2050 will require a broad portfolio of approaches—of which distributed energy is just a part.[271] Finally, it would embrace the notion that as the electric power system becomes more participatory, the importance of a broad public utility framework to support planning, coordination, and innovation only increases. Business models and individual companies will surely come and go, but some notion of public utility would seem to be vital, even fundamental, to motivating and sustaining public commitment to and investment in a grid that can facilitate and sustain substantial decarbonization by midcentury.

III. PUBLIC UTILITY AND THE LOW-CARBON FUTURE

By any account, decarbonizing the U.S. electric power sector will require large new investments (at multiple scales), sustained technological innovation, extensive reform of regulatory and market structures, and the development of new business models. As noted, there are various possible pathways to such a future and no single, optimal mix of technologies, institutions, and practices to achieve an electric power system in 2050 with 80 percent fewer greenhouse gas (GHG) emissions than the current system.[272] Whatever the

DER [(distributed energy resources)] customers without harming non-participant ratepayers."). California has recently enacted legislation that requires each IOU to submit a "distribution resources plan proposal" that will "identify optimal locations for the deployment of distributed resources" and guide future investments in the distribution system. *See* A.B. 327 § 8 (Cal. 2013).

270. *Id.* §§ 9–10, 22–23 (discussing enhanced role for distribution utilities as "distributed system platform provider" in managing advanced distribution systems capable of handling widespread integration of DER with increasing bi-directional power flows).

271. *See* NREL, RENEWABLE ELECTRICITY FUTURES STUDY: VOLUME 1, EXPLORATION OF HIGH-PENETRATION RENEWABLE ELECTRICITY FUTURES 3–11, Table 3.1 (2012) (reporting rooftop solar photovoltaic (PV) as percentage of total 80 percent renewables mix in 2050 as ranging from 2.6 percent in low-demand scenario and 5.2 percent in high-demand scenario). *But see* James Newcomb et al., *Distributed Energy Resources: Policy Implications of Decentralization*, 26 ELECTRICITY J. 65, 66 (2013) (reporting results from an analysis finding that "distributed resources could provide half of renewable electricity supply in an 80 percent renewables future").

272. *See, e.g.*, REINVENTING FIRE, *supra* note 20, at 169 (presenting multiple scenarios for the power sector including 80 percent renewables by 2050); RENEWABLE ELECTRICITY FUTURES STUDY: EXECUTIVE SUMMARY, *supra* note 20, at 27 ("At 80% renewable electricity in

mix, moreover, the process will take decades, requiring a level of planning, coordination, and new investment far beyond anything engaged in to date.[273] It will necessarily involve actors and institutions at multiple levels, taking shape out of the diverse array of business models and regulatory frameworks that mark the current system. Disruptive technologies and practices will surely play some role, but the prospect of wholesale disruption of the sector seems unlikely.

If we accept the premise that any future low-carbon electricity system, however it comes to be organized, will include a more diverse and interconnected set of actors with widely varying assets, behaviors, and motivations, it seems that a broader concept of public utility has much to offer. Mobilizing and channeling the investments in generation, transmission, distribution, and end use needed to reduce emissions across the power sector by 80 percent or more by midcentury will require a level of certainty regarding cost recovery that markets alone seem unable to provide. Coordinating an increasingly diverse array of supply- and demand-side resources, owned and operated by thousands (if not millions) of independent actors, will place demands on systems operators that far exceed anything experienced to date. Creating space for innovation, experimentation, and demonstration at scale calls for durable policy supports, a level of public-private cooperation, and a shared commitment that go well beyond current approaches. These three sets of activities—planning and investment, coordination and systems operation, and experimentation and innovation—are central to the broader concept of public utility advanced here. This Part discusses each in turn.

A. Planning and Investment

Planning was a core aspect of the social control of business that animated the agenda of Progressives, realists, and institutional economists during the first half of the twentieth century.[274] To be sure, discussions of economic planning,

2050, annual generation from both coal-fired and natural gas-fired sources was reduced by about 80%, resulting in reductions in annual greenhouse gases of about 80% (on a direct combustion basis and on a full life cycle basis) . . . .").

273. *See, e.g.*, Todd Foley et al., *Finance Policy: Removing Investment Barriers and Managing Risk*, 26 ELECTRICITY J. 54, 55 (2013) ("In total, moving to an 80 percent renewables future will require investing roughly $50–70 billion per year over the next decade, increasing to between $100 and $200 billion per year as we approach 2050. This is roughly two to five times larger than current levels of investment in new transmission and generation assets in the electricity sector.").

274. *See, e.g.*, CLARK, *supra* note 2, at 455–72 (discussing various approaches to economic planning); CHARLES R. MCCANN, JR., ORDER AND CONTROL IN AMERICAN SOCIO-

particularly during and after the New Deal, were often freighted with the heavy baggage that came with the seemingly inevitable comparisons to Soviet-style central planning.[275] But there was also a recognition that more modest forms of planning provided indispensible tools in the larger effort to guide certain industries, mitigate against economic disruptions, and protect the public interest. From Henry Carter Adams to John Commons, Louis Brandeis, Walton Hamilton, and on to James Landis (among others), there was a shared notion of "statecraft" (Hamilton's phrase) that recognized the government's affirmative role in providing intelligent guidance to ensure ordered change in a dynamic industrial economy.[276]

That said, it is also true that the actual practice of planning by public utility commissions (PUCs) was rarely explored in much depth by these scholars, operating more as a background assumption than an explicit duty in their conception of public utility regulation.[277] To take one example, the prudent investment standard, which Hale and others advocated for during the middle decades of the twentieth century and which remains at the heart of

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ECONOMIC THOUGHT: SOCIAL SCIENTISTS AND PROGRESSIVE-ERA REFORM 1 (2012) (describing the project of American Progressivism as "nothing less than the direction of human development through systematic, rational planning").

275. For the canonical statement on the perils of central planning and the superiority of markets as coordination mechanisms, see F.A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 524–26 (1945) (discussing epistemic limitations of central planning and superiority of price system as a mechanism for coordinating economic activity). As noted above, Hayek recognized that competition sometimes fell short as an appropriate tool for coordinating activity in certain areas, including those relating to the services provided by public utilities. *See* HAYEK, *supra* note 189, at 48 (noting that problems posed by public utilities could not be solved adequately by competition).

276. *See* HAMILTON, POLITICS OF INDUSTRY, *supra* note 14, at 18 ("All industries are, in their several degrees, instruments of the general welfare; where there is failure in performance, the call is for statecraft.").

277. *See, e.g.*, *id.* at 155–56 (observing that regulatory commissions had generally failed to address the "larger questions of holding the regulated industry to its function, of improving its capacity to serve the public, of looking to the hazards ahead and guarding against them, and of making of it a more effective instrument of the general welfare. . . . Matters of policy get immersed in the quagmire of detail. The agency fails to direct the activities of the industry to public objectives . . . ."). Those who might be referred to as part of the second generation of institutional economists and public utility experts, some of whom were students of John Commons, embraced a more expansive view of planning and bemoaned the marginalization of planning and creative policymaking that resulted from the judicialization of the public utility commissions (PUCs). *See, e.g.*, GLAESER, *supra* note 91, at 252 (emphasizing the vital role of PUCs in "their capacity as experts to contribute, with a minimum of political interference, to the solution of long-run problems of the industries"); JOHN BAUER, TRANSFORMING PUBLIC UTILITY REGULATION: A DEFINITE ADMINISTRATIVE PROGRAM 296–312 (1950) (discussing problems inhibiting more dynamic forms of public utility regulation and arguing for a more active role for PUCs as public-planning agencies).

modern cost-of-service regulation, embodied (in concept if not always in practice) a commitment to load forecasting and planning for new investments based on available knowledge.[278] Likewise, a chief responsibility of the PUC as elaborated by John Commons and others was to investigate and gather facts regarding proposed utility investments in order to determine a reasonable or prudent course of action, often in the context of an adjudicatory setting where utilities, ratepayers, and other stakeholders presented their respective cases for or against a particular course of action.[279]

Embedded within all of this was a recognition that rate regulation provided the key mechanism for securing capital on favorable terms and directing it toward large investments in generation, transmission, and distribution. As discussed above, the move to monopoly franchises regulated by state PUCs in the early twentieth century was driven in part by the need to lower the financing costs of building large electric power systems.[280] Planning and investment thus constituted central activities for utilities and their regulators, allowing them to sequence the financing and building of different projects across the various components of the system. During the first three quarters of the twentieth century, the utilities dominated the process, focusing on diversity of supply (known as "economic mix") and diversity of load ("load factor") in order to maximize the utilization of the system.[281] Investment projects were subject to approval by PUCs, with capital budgeting and accounting performed according to standard procedures, and prudency reviews providing a check against the proclivity for over-building.[282]

That many commissions did not always perform their roles with the diligence or creativity that they deserved is not in dispute. During the post-World War II economic boom—a time of increasing economies of scale in power generation, sustained growth in demand, and declining real prices—there seemed to be little reason to consider a future that might turn out differently

278. *See, e.g.*, CHARLES F. PHILLIPS, JR., THE REGULATION OF PUBLIC UTILITIES: THEORY AND PRACTICE 340–41 (1993) (discussing prudent investment as the exercise of reasonable foresight based on what the company knew or should have known in the circumstances at the time the investment was made); JAMES C. BONBRIGHT ET AL., PRINCIPLES OF PUBLIC UTILITY RATES 223 (2nd ed. 1988) ("Prudent investment is the original historical cost minus any fraudulent, unwise, or extravagant outlays that should not be a burden on ratepayers.").

279. *See, e.g.*, GLAESER, *supra* note 91, at 256–58 (discussing PUC responsibilities for investigation and adjudication).

280. *See supra* Part II.A.

281. *See* HUGHES, *supra* note 16, at 367–70 (discussing concepts of "economic mix" and "load factor" in the development of regional power systems in the U.S.).

282. *See* PHILLIPS, *supra* note 278, at 338–57 (discussing standard practice of determining how investments should be incorporated into rate base).

than the past. Deciding when, rather than if, to build ever-larger power plants and folding them into rate base occupied much of the attention of utility regulators.[283] The problems with this approach became all too apparent in the 1970s as the rosy forecasts of prior decades gave way to the realities of technological limits, lower electricity demand, and environmental challenges.[284] The waste associated with overbuilding, particularly with respect to nuclear power plants, was pinned, at least in part, on the perverse incentives embedded in rate regulation and the general lack of care and foresight regarding future possibilities.[285]

While the reactions to the events of the 1970s varied, in many respects it was this experience, combined with the sustained critique of public utility regulation mounted by economists and lawyers starting in the 1960s, that planted the seeds for deregulation in the decades to come. The promise of deregulation, in short, was that it would allow the market to coordinate investments through price signals, shifting the risks associated with investments in new generation from ratepayers to investors. By unbundling generation from transmission and distribution, a truly open-access regime would facilitate competition among wholesale generators sufficient to ensure just and reasonable prices and deliver cost savings to customers.[286]

From a climate change perspective, however, the looming question is whether electricity markets can deliver significant carbon reductions over the

283. *See* EDWARD KAHN, ELECTRIC UTILITY PLANNING AND REGULATION 12–13 (1991) ("The regulatory procedures developed during the declining-cost period addressed the politically pleasant task of deciding how much to reduce prices. . . . Most regulatory attention . . . was devoted to determining the value of capital invested (rate base) and fixing the level of reasonable earnings. Because of the underlying scale economies, new capital investment always lowered operating costs.").

284. *See supra* Part II.C.

285. *See* Pierce, *supra* note 175, at 500–07 (discussing forecasts of the early 1970s and comparing them to the realities of the late 1970s and early 1980s); PHILLIPS, *supra* note 278, at 341–42 (discussing disallowances under prudency reviews on the basis of excess capacity, cost overruns, failure to cancel construction, and other factors).

286. *See supra* Part II.C; Spence, *Politics of Electricity Restructuring*, *supra* note 219, at 422 (recounting the rationale for electricity restructuring). As Professor Spence points out, the question of whether (or when) so-called market-based rates satisfy the just and reasonable standard under the Federal Power Act is not settled, and the Supreme Court has not yet spoken directly on the issue. *See id.* at 429–36 (discussing debates over whether market based rates satisfy the just and reasonable standard); *see also* Morgan Stanley Capital Group Inc. v. Public Utility District No. 1 of Snohomish County, 554 U.S. 529, 538 (2008) ("Both the Ninth Circuit and the D.C. Circuit have generally approved FERC's scheme of market-based tariffs. We have not hitherto approved, and express no opinion today, on the lawfulness of the market-based tariff system, which is not one of the issues before us." (citations omitted)).

next several decades.[287] Obviously, in a world where renewables and other sources of low-carbon generation continue to have difficulties competing on price with fossil generation (specifically gas-fired generation), such markets will not promote investment in low-carbon alternatives.[288] This could change either through the adoption of a robust carbon price or continued technological advances that allow low-carbon alternatives to compete head-to-head with fossil generation. In the absence of either of these, GHG regulations under the Clean Air Act[289] for fossil generators and increased subsidies for renewables and other low-carbon generation will continue to be the biggest drivers of new investments in low-carbon alternatives.[290] Consequently, much of the

287. *Cf.* David M. Newberry, *Reforming Competitive Electricity Markets to Meet Environmental Targets*, 1 ECON. ENERGY & ENVTL POL. 69, 71 (2012) (discussing electricity market reforms in the UK and noting that "[t]he deeper concern is whether liberalized electricity markets are compatible with a low-carbon electricity industry").

288. While it is certainly true that fossil hydrocarbons continue to enjoy significant subsidies that are larger than those for renewable energy in the aggregate (not to mention the issue of environmental externalities), the subsidy per kilowatt-hour for fossil generation is quite small (excluding externalities) compared to that for renewables. *See* Severin Borenstein, *The Private and Public Economics of Renewable Electricity Generation*, 26 J. ECON. PERSP. 67, 77 (2012) (reporting estimates of subsidies to fossil generation in the U.S., based on generous assumptions, of $0.0011 per kilowatt hour). For comparison, the current production tax credit for wind energy is $0.023 per kilowatt hour. *See* U.S. Dep't of Energy, *Renewable Electricity Production Tax Credit (PTC)*, http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc.

289. 42 U.S.C. §§ 7401–7671 (2006).

290. EPA's proposals under section 111 of the Clean Air Act to establish GHG emissions performance standards for new and existing fossil fuel-fired electric generating units are the most obvious and important examples of such regulations. *See* Standards of Performance for New Stationary Sources, 42 U.S.C. § 7411 (2013); Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, Proposed Rule, 79 FED. REG. 1430, 1430 (Jan. 8, 2014) [hereinafter Proposed NSPS Rule for New Power Plants] (proposing new source performance standards for carbon dioxide emissions from fossil-fuel fired electric generating units); Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Generating Units, Proposed Rule, 12–13 (June 2, 2014) [hereinafter Proposed NSPS Rule for Existing Power Plants], *available at* http://www2.epa.gov/sites/production/files/2014-05/documents/20140602proposal-cleanpowerplan.pdf (proposing emission guidelines for states to follow in developing plans to reduce greenhouse gas emissions from existing fossil fuel-fired electric generating units). If these rules survive the inevitable legal challenges, they will have a major impact on the generation mix and emissions profile of the U.S. electric power sector, with significant implications for federal and state electricity regulation. In particular, the proposed rule for existing power plants, which gives individual states significant flexibility in determining how to meet the proposed emissions standards, contemplates an expansive role for PUCs and for RTOs and ISOs in planning for and guiding the investments and activities that will allow states to achieve the "best system of emissions reduction" for the power sector in their jurisdictions. *See, e.g.*, Proposed NSPS Rule for Existing Power Plants, *supra*, at 22, 271 (discussing PUC integrated resource planning exercises and RTOs and ISOs as possible vehicles for implementing best system of emissions reduction).

ongoing growth in renewable energy in U.S. electricity markets is made possible by specific policy supports and renewable portfolio standard (RPS) mandates, with the vast majority of new renewable energy generation sold through fixed price, long-term power purchase agreements (PPAs) with utilities rather than through the spot markets.[291]

Current auction designs in the wholesale power markets create additional challenges for efforts to drive investments into low-carbon alternatives. Because of the uniform clearing price design, which translates into strong incentives for generators to bid their power into the auction at their short-run marginal cost, higher levels of renewables in these markets depress prices and make it difficult to recover capital costs.[292] To take the most important example, electricity generated from wind is being bid into the wholesale auctions at zero or below. That is, because wind generation (like solar) has no fuel costs, it has a short-run marginal cost of zero. In fact, at times, wind is being bid into the auctions at negative prices in order to ensure dispatch and thereby allow wind generators to capture the non-market revenues available from the production tax credit (PTC) and sales of renewable energy credits (RECs), both of which are tied to the actual production of electricity from the wind project.[293] These

291. *See* K. CORY ET AL., NAT'L RENEWABLE ENERGY LAB., INNOVATIONS IN WIND AND SOLAR PV FINANCING 1, 3 (2008) (discussing the impact of policy supports on growth of renewable energy and noting that renewable energy projects are typically financed through long-term power purchase agreements (PPAs)); RACHEL GELMAN, NAT'L RENEWABLE ENERGY LAB., 2012 RENEWABLE ENERGY DATA BOOK 64 (Mike Meshek ed., 2013), *available at* http://www.nrel.gov/docs/fy14osti/60197.pdf; DIPA SHARIF ET AL., BLOOMBERG NEW ENERGY FINANCE, THE RETURN—AND RETURNS—OF TAX EQUITY FOR US RENEWABLE PROJECTS 2 (2011) (reporting on the importance of tax credits for growth of renewable energy).

292. *See* Michael Milligan et al., *Bulk Electric Power Systems: Operations and Transmission Planning*, *in* 4 NAT'L RENEWABLE ENERGY LAB., RENEWABLE ELECTRICITY FUTURES STUDY 21–27 (2012) ("During periods when zero-marginal-cost units are on the margin, prices collapse and there is no ability to recover capital costs. Therefore, cost recovery for installed equipment that is based primarily on selling energy at its marginal price would be difficult in such a system where energy prices could be near zero for much of the year—such a market would not be sustainable because the average price would be less than average total cost. As such, high levels of renewable electricity generation may require re-examination of market structures for energy and consideration of a broader range of factors, such as capacity or others, for cost recovery.").

293. *See* MONITORING ANALYTICS, LLC, STATE OF THE MARKET REPORT FOR PJM, *supra* note 197, at 30 ("[O]ut of market payments in the form of RECs and federal production tax credit mean that these units [wind and solar] have an incentive to generate MWh until the LMP [(locational marginal price)] is equal to the marginal cost of producing minus the credit received for each MWh. As the net of LMP and credits can be negative, the credits can provide an incentive to make negative energy offers. These subsidies affect the offer behavior of these resources in PJM markets and thus the market prices and the mix of clearing resources.").

market effects occur even in cases where most renewable energy is sold through PPAs, because these resources are still self-scheduled into the power markets and thus suppress the auction clearing prices and affect the merit order for dispatch.[294] During periods of high renewables availability, prices in particular regional transmission organization (RTO) zones can be zero and even negative.[295]

Obviously, such a situation is not a viable model for recovering the large fixed costs associated with renewable generation. It is also problematic for incentivizing investments in fossil-based generation, which has reliability implications because of the need for fossil generation to balance the intermittency of renewable generation.[296] Thus, other means of recovering costs, whether through new market structures (such as capacity markets), policy supports, or reregulation, would seem to be necessary to provide appropriate investment incentives and to allow for significant penetration of renewables in the wholesale markets.

In addition to the difficulties of promoting investments in renewables, the current wholesale power markets also appear limited in their ability to support investments in large, capital-intensive, low-carbon generation facilities such as nuclear or coal plants with carbon capture and storage.[297] The

294. *See* PHILLIP BROWN, CONG. RESEARCH SERV., R42818, U.S. RENEWABLE ELECTRICITY: HOW DOES WIND GENERATION IMPACT COMPETITIVE POWER MARKETS? 10–13 (2012) (discussing the impacts of increased penetration of wind energy on the depression of prices in wholesale power markets).

295. Because of the additional revenues from tax credits and renewable energy credit (REC) sales, wind power is sometime bid into these markets at a negative price in order to ensure dispatch, which is obviously essential to capture the production tax credit and the RECs. During periods of high wind availability, this structure has created negative prices in some of the regional transmission organization (RTO) markets. *See id.* at 13 ("The ability of wind to bid negatively priced electricity is a result of value received from federal production tax credit incentives and the potential opportunity to sell renewable energy credits (RECs) to third parties."). During 2011, in certain locations during periods of high wind availability, Midwest Independent Transmission System Operator's (MISO's) independent market monitor reported an average price of negative twenty dollars per megawatt hour. *See id.* at 15.

296. *See* BROWN, *supra* note 294 ("[S]hould wind power generation continue to grow, it is uncertain if current RTO market designs will provide the signals needed to encourage specific types of generation capacity (e.g., operating and spinning reserves) necessary to manage the variable nature of wind power."); *see also* Thure Traber & Claudia Kemfert, *Gone With the Wind?—Electricity Market Prices and Incentives to Invest in Thermal Power Plants Under Increasing Wind Energy Supply*, 33 ENERGY ECON. 249, 255 (2011) (concluding, based on a model of the German power sector, that incentives to invest in flexible natural gas plants are reduced by increased supply of wind energy).

297. *See* Jay Apt et al., *Promoting Low Carbon Electricity Production*, ISSUES SCI. & TECH., Spring 2007, at 37, 41; Tim Laing & Michael Grubb, *Low Carbon Electricity Investment: The Limitations of Traditional Approaches and a Radical Alternative* 4–7 (Univ. of Cambridge Elec. Policy Research Grp., Working Paper No. 1032, 2010).

long time horizons associated with these investments together with the uncertainty regarding performance, future prices, and regulations translates into a relatively high cost of capital, which makes financing very challenging in the market context.[298] It is hardly surprising, therefore, that current investments in new nuclear power units and in advanced coal plants with carbon capture and storage are taking place in traditional cost-of-service states where cost recovery mechanisms provide more certainty with respect to future revenues sufficient to pay financing costs.[299]

Put another way, without some ability to socialize the costs of these investments (whether through rates, subsidies, or some combination of the two), the capital markets are unlikely to provide financing on favorable terms.

298. This is particularly true in the current environment of cheap natural gas. Witness the words of John Rowe, former CEO of Exelon Corp., the largest U.S. producer of nuclear power: "As long as natural gas is anywhere near current price forecasts, you can't economically build a merchant nuclear plant." Mark Clayton, *Nuclear power a Viable Competitor in US Energy Market, Study Finds,* CHRIST. SCI. MONITOR, Sept. 17, 2010.

299. To date, the Nuclear Regulatory Commission (NRC) has issued licenses for the construction of new nuclear reactors in Georgia and South Carolina. *See* Mathew L. Wald, *Federal Regulators Approve Two Nuclear Reactors in Georgia*, NY TIMES Feb., 9, 2012, at B-3 (reporting on NRC decision to issue licenses to Georgia Power for two new reactors in Georgia); Ryan Tracy, *U.S. Approves Nuclear Plants in South Carolina,* WALL ST. J., March 30, 2012 (reporting on NRC decision to issues licenses to Scana Corp. for two new reactors in South Carolina). In addition to various federal incentives, both Georgia and South Carolina enacted legislation that provides favorable rate base treatment and automatic prudence determinations for much of the new reactors. *See, e.g.*, Georgia Nuclear Energy Financing Act, Ga. Code Ann. § 46-2-25 et seq. (2013) (providing prudence determination and favorable rate recovery for costs of approved new nuclear power plants); Base Load Review Act, Art. 4, S.C. Code Ann. § 58-33-210 et seq. (2013) (providing favorable rate treatment and prudence determinations for costs of new nuclear power plants). The most ambitious commercial-scale demonstration clean coal plant currently under construction in the United States is the Kemper Integrated Gasification and Combined Cycle Plant in Mississippi (owned by the Mississippi Power Company, a subsidiary of the Southern Company). This facility will include carbon capture and storage technology, with a goal of capturing 65 percent of the carbon dioxide emissions from the plant, giving it an emissions profile similar to that of a combined cycle natural gas plant. The Kemper Plant was initially projected to cost $2.2 billion, but is now expected to cost $5.5 billion. In addition to receiving $270 million in direct financing and another potential $133 million in investment tax credits from the federal government, the project will also benefit from favorable rate treatment for the initial $2.3 billion in costs under Mississippi's 2008 Base Load Act. *See* Steven Mufson, *The Coal Plant to End All Coal Plants?*, WASH. POST, May 18, 2014 (discussing history and status of Kemper plant); Alternate Method of Cost Recovery on Certain Base Load Generation, Miss. Code Ann. § 77-3-101 et seq (2013) (providing prudence determination and favorable cost recovery for certain baseload generation investments in Mississippi); Miss. Public Service Commission, Final Order on Remand Granting a Certificate of Public Convenience and Necessity, Authorizing Application of Baseload Act, and Approving Prudent Pre-Construction Costs, Docket No. 2009-UA-014, at 9–10, 99 (2012) (confirming application of Baseload Act to Kemper Plant and capping rate recovery for costs associated with the Kemper Plant at $2.4 billion).

Carbon pricing schemes could shift these incentives, making low-carbon generation more attractive, but recent analysis suggests that a carbon price may not be enough by itself to channel large investments into low-carbon generation.[300] In the European Union Emissions Trading System (EU ETS), for example, several recent studies indicate that allowance prices have had only limited impacts on investment decisions in the power sector.[301] While this may be due in part to historically low allowance prices resulting from, among other things, a depressed economy, it is the uncertainty with respect to future prices that makes long-term investments challenging.

In the United States, allowance prices in the Regional Greenhouse Gas Initiative market have only recently moved above their very low floor price of less than two dollars, and they appear to have had only limited impact on dispatch decisions, much less investment choices, in that region.[302] California's cap-and-trade program, which has an escalating floor price that started at ten dollars per ton of carbon dioxide in 2012, provides more certainty going forward, but that system faces much more pressing challenges from emissions leakage in the power sector.[303]

300. *See* Laing & Grubb, *supra* note 297, at 4–7 (discussing challenges of stimulating necessary investment in low-carbon electricity through liberalized electricity markets combined with carbon pricing schemes).

301. *See, e.g*, Karoline S. Rogge & Volker H. Hoffmann, *The Impact of the EU ETS on the Sectoral Innovation System for Power Generation Technologies—Findings for Germany*, 38 ENERGY POL'Y 7639, 7650 (2010) ("[T]he . . . EU ETS [(European Union Emissions Trading System)] [is] itself insufficient . . . to decarbonize the power sector."); Karoline S. Rogge et al., *The Innovation Impact of the EU Emission Trading System-Findings of Company Case Studies in the German Power Sector,* 70 ECOL. ECON. 513, 521 (2011) ("[T]he EU ETS by itself is highly unlikely to lead to RD&D and adoption decisions in line with reaching the EU's proposed 2050 targets.").

302. *See* POTOMAC ECONOMICS, RGGI, MARKET MONITOR REPORT FOR AUCTION 23, at 3 (2014) (reporting that Regional Greenhouse Gas Initiative (RGGI) Auction held on March 5, 2014 was oversubscribed and that the market cleared at the $4.00 per ton cost containment reserve price for the first time). The current floor price for allowances in RGGI is around $2.00 per ton. Most previous auctions have traded at or very close to the floor price, but the decision in 2012 to lower the overall cap under RGGI starting in 2014 has created additional demand for RGGI allowances. Still, the relatively low prices of RGGI allowances, as in the EU ETS, have likely had limited impacts on long-term investment behavior. *See* SEVREIN BORENSTEIN ET AL., EXPECTING THE UNEXPECTED: EMISSIONS UNCERTAINTY AND ENVIRONMENTAL MARKET DESIGN 2 (2014), *available at* http://tiger-forum.com/Media/speakers/abstract/561405pm/borenstein_bushnell_wolak_zaragoza-watkins.pdf (noting the need for stable and predictable carbon prices to incent long-term investments and observing that volatile and low average emissions prices in the EU ETS and RGGI "probably do little to achieve the long-term climate policy goals of significant investments in low-carbon technologies").

303. Emissions leakage refers to the effect of an emissions reduction program in transferring emissions outside of the jurisdictional boundaries of the program rather than actually

In sum, the appealingly simple idea that pricing carbon emissions will allow liberalized electricity markets to coordinate investment in low-carbon generation appears to be more challenging than expected. The current iterations of carbon pricing schemes are simply not sufficient to mobilize and channel the investments necessary to decarbonize the power sector by 2050.[304] Making carbon emissions more expensive, in other words, appears to offer only a partial solution to decarbonizing the power sector, especially when future prices are uncertain. Given the higher capital intensity of a low-carbon electricity system compared to the current fossil-based system, and given the long-lived nature of many of these assets, finding ways to de-risk and thus reduce the cost of capital for these investments is a critical task for policy.[305] This raises important questions about the relative merits of different coordination mechanisms as they work in practice rather than in the abstract models of economic theory.

The United Kingdom's ongoing electricity market reform effort is instructive in this respect. According to one recent analysis, "[t]hese reforms are widely seen as a watershed for the sector, involving a substantial shift from a 'pure' liberalized market model to one requiring more centralized direction."[306] In recognition of the inability of electricity markets combined with the EU ETS to drive sufficient investment in low-carbon generation to meet the United Kingdom's legally binding GHG reduction target of 80 percent below 1990 levels by 2050,[307] the Government's proposal would adopt a system of feed-in tariffs for low-carbon generation, a guaranteed carbon price floor (developed via a tax that operates in addition to the EU ETS price), an emissions performance standard, and capacity markets.[308] In effect, the United

reducing them. Because imported electricity accounts for about half of power sector emissions in California, the potential for emissions leakage under the California cap-and-trade program is substantial. *See, e.g.*, James Bushnell et al., *Downstream Regulation of CO2 Emissions in California's Electricity Sector,* 64 ENERGY POL. 313, 314, 320 (2014) (discussing leakage problems for electricity sector under California cap-and-trade program).

304. *See* Newberry, *supra* note 287, at 71 (concluding that because of the "fundamental" design flaw of EU ETS in "setting a quota on EU emissions rather than a price, the resulting carbon price signals that are intended to guide long-term investment decisions are unstable, and lack[] credibility").

305. *See* Robert Gross et al., *Risks, Revenues, and Investment in Electricity Generation: Why Policy Needs to Look Beyond Costs*, 32 ENERGY ECON. 796, 801 (2010) (emphasizing importance of policies to reduce investment risk associated with low-carbon generation).

306. *See* MALCOLM KEAY ET AL., OXFORD INST. FOR ENERGY STUDIES, DECARBONIZATION OF THE ELECTRICITY INDUSTRY–IS THERE STILL A PLACE FOR MARKETS? (2012).

307. *See* Climate Change Act, ch. 27, § 1.1(1) (U.K. 2008).

308. *See* U.K. DEP'T OF ENERGY & CLIMATE CHANGE, ELECTRICITY MARKET REFORM: POLICY OVERVIEW 8, 12–18 (2012) (discussing key features of the electricity market reform

Kingdom, which pioneered electricity market liberalization in the early 1990s, is moving toward "a system where most new investment will be driven, and remunerated, by non-market means."[309]

The dominant motivation behind these reforms is to reduce the investment risks associated with low-carbon generation, something that liberalized electricity markets combined with emissions prices have not been able to do.[310] As one commentator put it, these reforms appear to require, at least in the minds of the policymakers and analysts in the United Kingdom, a return to the "p word"—planning, that is.[311] Thus, the Government's white paper that launched the reform effort was appropriately titled *Planning Our Electric Future*.[312]

In the United States, as discussed above, planning has long been at the heart of traditional utility regulation and is a major focus of the RTOs and ISOs. During the 1980s and 1990s, many state PUCs embraced more formal planning exercises, largely in reaction to the overbuilding disasters that became apparent in the late 1970s and early 1980s.[313] Known initially as least cost planning and later as integrated resource planning (IRP), these efforts were intended to assert more regulatory oversight over the utility-centric planning

proposal); KEAY ET AL., *supra* note 306, at 11–12 (summarizing main components of the United Kingdom's electricity market reform initiative).

309. Malcolm Keay, *Return of the P-Word: The Government's Electricity White Paper,* OXFORD ENERGY COMMENT 6 (The Oxford Institute for Energy Studies, 2011); *see also* Michael G. Pollitt & Aoife Brophy Haney, *Dismantling a Competitive Electricity Sector: The U.K.'s Electricity Market Reform*, 26 ELEC. J. 8, 9 (2013) ("The upshot of the EMR [Electricity Market Reform] is to effectively end competitive investments in one of the most competitive electricity markets in the world and replace it with a system of administered energy and capacity prices.").

310. *See* Newberry, *supra* note 287, at 73–75 (discussing proposed U.K. reforms and overall goal of "de-risking" investments in low-carbon generation to reduce the cost of capital).

311. KEAY, *supra* note 309, at 1.

312. UK DEP'T OF ENERGY & CLIMATE CHANGE, PLANNING OUR ELECTRIC FUTURE: A WHITE PAPER FOR SECURE, AFFORDABLE AND LOW-CARBON ELECTRICITY 16 (2011) ("Without reform, the existing market will not deliver the scale of long-term investment, at the pace that is needed, nor will it be able to ensure that consumers get the best deal. If we are to meet our long-term carbon and security of supply objectives, we need to reform the market now, and make investment in low-carbon generation in the UK more attractive.").

313. *See* David Berry, *The Structure of Electric Utility Least Cost Planning*, 26 J. ECON. ISSUES 769, 769 (1992) ("Since the mid-1980s, at least half of the state utility regulatory commissions have adopted or are developing some form of least cost planning for electric utilities. . . . The need for least cost planning stems from failure to develop a flexible set of options to deal with uncertainty, weak coordination among decisionmakers responsible for supply- and demand-side planning, neglect of cost-effective conservation, inadequate implementation of alternate generating technologies, and a record of poor load forecasting.").

exercises that had prevailed in the past.[314] More importantly, they were also meant to widen the scope of such exercises to include assessment and evaluation of alternatives to generation, such as transmission, efficiency, and conservation, as well as the use of "environmental adders" and other tools to force consideration of the environmental impacts of particular investments.[315]

Although a number of states abandoned IRP requirements during the push for retail competition in the 1990s and 2000s, PUCs in regulated cost-of-service states continued to require and even expand the IRP process.[316] Even in restructured states, moreover, a number of PUCs are now requiring long-term procurement planning (LTPP) to ensure that load-serving entities are considering options on longer time horizons than markets allow.[317] Today, twenty-eight states have formal IRP filing requirements and eleven other states have LTPP requirements.[318]

While the actual practice of resource planning varies by state, most of the planning processes proceed on the basis of three main steps: (1) forecasting load (demand) over the relevant time horizon; (2) determining portfolios

314. *See* Mark Hanson et al., *Electric Utility Least-Cost Planning: Making it Work Within a Multiattribute Decision-Making Framework*, 57 J. AM. PLAN. ASSOC. 34, 35–36 (1991) (noting that under least-cost planning the "regulatory focus shifts and the commission becomes more deeply involved in planning areas traditionally viewed as the prerogative of utility management"); Eric Hirst, *Integrated Resource Planning at Electric Utilities: The Planning Process*, 12 EVAL. & PROG. PLANNING 213, 213, 221–22 (1989) (discussing least-cost and integrated resource planning and stressing importance of active PUC involvement in and oversight of the planning process); Berry, *The Structure of Electric Utility Least Cost Planning*, *supra* note 313, at 769 ("Least cost planning is a deliberate attempt by state regulatory commissions to create new institutions for long-range planning for electric utilities.").

315. *See* Berry, *The Structure of Electric Utility Least Cost Planning*, *supra* note 313, at 769; Ralph C. Cavanagh, *Least-Cost Planning Imperatives for Electric Utilities and Their Regulators*, 10 HARV. ENVT'L L. REV. 299 (1986). This broader set of considerations could be viewed as an effort to fulfill the promise of prudence reviews in the context of increased economic uncertainty and new environmental challenges.

316. *See* Pamela Lesh, *Planning for the Future*, 22 ELECTRICITY J. 45, 48 (2009) (noting that while restructuring led some states to abandon or scale back IRP "[t]he last several years . . . have seen a resurgence of IRP, both in states that did not restructure the electric industry and even in some states that did").

317. Long-term procurement planning (LTPP) requirements are similar to integrated resource planning (IRP), but typically have shorter time horizons (five to ten years) and are required to be updated more frequently (every year). Because these LTPPs apply to utilities operating in deregulated markets, they focus less on building new generation and more on purchases of energy and capacity as well as demand-side and efficiency programs. *See* RACHEL WILSON & BRUCE BIEWALD, SYNAPSE ENERGY ECON., BEST PRACTICES IN ELECTRIC UTILITY INTEGRATED RESOURCE PLANNING 8–9 (2013) (discussing LTPP requirements).

318. *See* Jordan Wilkerson et al., *Survey of Western U.S. Electric Utility Resource Plans*, 66 ENERGY POL'Y 90, 91 (2014); *see also* WILSON & BIEWALD, *supra* note 317, at 5 (reporting on states that have IRP or LTPP requirements).

of existing and future resources to meet demand; and (3) evaluating the costs and risks associated with each portfolio.[319] All of these planning exercises generally require consideration of feasible supply-side, demand-side, and transmission resources.[320] Most have time horizons of ten years or more, and most require updating on a regular (two to four year) basis.[321] Many planning exercises have also embraced more participatory frameworks that include ratepayer advocates and other stakeholders.[322]

None of which is to suggest that existing IRP processes cannot be improved, and a number of states, though legislation and regulation, have continued to adjust and revise their planning exercises.[323] But at their best, these IRP exercises look like the kind of iterative, multistakeholder processes that new governance theorists often celebrate.[324] More importantly, by bringing a broader set of considerations and constituencies into the utility planning process and by taking a long time frame as the planning horizon, with a commitment to regular review and revision, robust IRP processes can play important roles in guiding utility investments and practices toward a low-carbon future.

The evidence for this is readily apparent. Given the prospect of future carbon regulations, IRP exercises in a number of states have for years used

319. Wilkerson et al., *supra* note 318, at 91 (identifying basic steps in resource planning).

320. *See* WILSON & BIEWALD, *supra* note 317, at 7 (discussing resources evaluated in the IRP processes).

321. *See id.* at 6 (detailing the IRP planning horizons and frequency of updates for different states).

322. *See, e.g.*, Wilkerson et al., *supra* note 318, at 90 ("Many utilities are required to publicly release and defend their integrated resource plans (IRPs) in front of consumer advocates, Public Utility Commissions (PUCs), and other stakeholders."). Hanson et al., *supra* note 314, at 36 ("An important difference between the least-cost and traditional processes is the involvement of the public and of various interested parties in all stages of the planning process. Under least-cost planning, . . . different parties have the opportunity to propose and evaluate options from the perspective of their explicitly stated preferences. Differences in these values and outcomes must then be negotiated or mediated in the regulatory decision-making process."). Colorado's IRP rules require that the utility, Commission staff, and the office of Consumer Counsel agree upon an "independent evaluator" to review all documents and data used by the utility in preparing the resource plan and submit a report to the Commission evaluating the plan. *See* COLO. CODE REGS. § 723-3:3612 (2014); *see also* WILSON & BIEWALD, *supra* note 317, at 13 (discussing Colorado planning procedures).

323. *See* Wilkerson et al., *supra* note 318, at 91 (reviewing literature on problems of IRPs, including availability, consistency, and completeness of data and reporting methods); WILSON & BIEWALD, *supra* note 317, at 9–15 (discussing evolution of IRP rules and practices in Arizona, Colorado, and Oregon).

324. *See, e.g.*, Hanson et al., *supra* note 314, at 36 (discussing multi-stakeholder, "iterative" nature of the utility planning process); Charles F. Sabel and William H. Simon, *Minimalism and Experimentalism in the Administrative State*, 100 GEORGETOWN L. J. 53, 80–82 (2011) (discussing key features of experimentalist governance including dynamic, iterative planning and multi-stakeholder deliberation).

"carbon adders" (the incorporation of a shadow price for carbon emissions) in evaluating and guiding future investments.[325] This has allowed utilities, regulators, and stakeholders in the IRP process to look out over multidecade time horizons and to compare investments under various potential carbon constraints.[326] Likewise, careful consideration of distributed and demand-side programs in the IRP process has resulted in decisions to forgo investment in new generation.[327] Commitment to a diverse portfolio of resources has also worked to shift attention away from an exclusive focus on short-term fuel prices. All of which has made it possible for PUCs and regulated utilities to consider investments that might not be cost-effective today, but that do make economic sense over longer time frames that incorporate carbon constraints. It is no surprise, in this respect, that EPA's recently proposed rule to regulate carbon dioxide emissions from existing fossil fuel-fired power plants identifies state IRP processes as a possible vehicle for developing the state emissions reduction plans required under the rule.[328]

At the federal level, FERC has also pushed for a more expansive approach to regional transmission planning and cost allocation that explicitly takes account of the transmission needs associated with public policy objectives such as renewables mandates.[329] In accordance with Order 1000, which

325. *See, e.g.*, GALEN BARBOSE ET AL., LAWRENCE BERKELEY NAT'L LAB., MANAGING CARBON REGULATORY RISK IN UTILITY RESOURCE PLANNING: CURRENT PRACTICES IN THE WESTERN UNITED STATES (2009), *available at* http://escholarship.org/uc/item/3rd811t9 (discussing current efforts to include carbon prices in utility planning); WILSON & BIEWALD, *supra* note 317, at 16–25 (describing use of carbon price adders as part of IRP best practices in Arizona, Colorado, and the six-state territory of PacificCorp.); Jonas J. Monast & Sarah K. Adair, *A Triple Bottom Line for Electric Utility Regulation: Aligning State-Level Energy, Environmental, and Consumer Protection Goals*, 38 COLUM. J. ENVTL. L. 1, 40–44 (2013) (discussing the incorporation of possible future carbon dioxide regulations and prices in long-term planning by various PUCs).

326. *See, e.g.*, WILSON & BIEWALD, *supra* note 317, at 16–25; A.B. 327 § 8 (Cal. 2013) (requiring California IOUs to develop distribution system plans to accommodate distributed energy resources).

327. Public Service Company of Colorado, for example, reduced its projected 2018 resource needs from one thousand megawatts to less than three hundred megawatts as a result of its demand-side management (DSM) and solar distributed generation (DG) programs. *See, e.g.*, 1 PUB. SERV. CO. OF COLO., 2011 ELECTRIC RESOURCE PLAN 5 (2011). *See also* ELECTRIC POWER RESEARCH INSTITUTE, *supra* note 66, at 28–29 (discussing importance of integrating distributed energy resources into transmission and distribution planning).

328. *See* Proposed NSPS Rule for Existing Power Plants, *supra* note 290, at 22 (proposing that states with existing IRP processes "would be able to establish their CO_2 reduction plans within that framework").

329. *See* FERC Order No. 1000, Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities, 76 Fed. Reg. 49,842, 49,876 (Aug. 11, 2011) (codified at 18 C.F.R. pt. 35) (calling for regional transmission planning processes that take account of transmission needs driven by public policy requirements); Tracy C. Davis, *FERC's*

establishes a general framework for transmission planning and cost allocation, regional planning efforts have been established across the country, providing the basis for new investment (and cost allocation) in high voltage transmission intended to bring more renewables onto the grid.[330] The Midcontinent Independent System Operator (MISO), for example, has established a process to identify so-called multi-value projects for new transmission with particular attention to wind integration.[331] The California ISO (CAISO) has also developed innovative approaches in its planning process to evaluate system needs in the context of high penetration of renewable resources.[332]

Finally, resource planning at both the federal and state levels has also emerged as a critical tool in the ongoing effort to manage the impact of new environmental regulations and cheap natural gas on the existing fleet of coal-fired power plants. Recent estimates indicate that between 50 and 110 gigawatts of coal-fired generation capacity could be retired between now and 2040.[333] Indeed, if EPA's recently proposed GHG rules for new and existing fossil fuel-fired electric generating units survive the inevitable legal challenges, there is little question that, barring significant advances in carbon capture and

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Regional Transmission Planning Policy Takes Shape, 26 ELECTRICITY J. 22, 25 (2013) (discussing FERC's Order 1000 and its requirement to consider transmission needs driven by public policies).

330. *See* FERC Order 1000, *supra* note 329, at 49,845–47 (summarizing new requirements for regional transmission planning processes and cost allocation). A legal challenge to Order 1000 is currently pending in the D.C. Circuit. South Carolina Public Service Authority, et al. v. FERC No. 12-1232, et al. (D.C. Cir., argued Mar. 20, 2014). In addition to FERC's efforts under Order 1000 to promote regional transmission planning, the Department of Energy is supporting several larger interconnection-wide transmission planning processes. *See* John W. Jimison and Bill White, *Transmission Policy: Planning for and Investing in Wires*, 26 ELECTRICITY J. 109, 115 (2013) (discussing Department of Energy funded interconnection planning efforts).

331. *See* MISO, MULTI-VALUE PROJECTS PORTFOLIO (2012) (discussing projects initiated under MISO's multi-value project (MVP) Tariff intended to increase transmission access for renewables); Illinois Commerce Comm'n v. FERC, 721 F.3d 764 (7th Cir. 2013) (upholding key features of MISO MVP tariff); *see also* Alexandra B. Klass & Elizabeth J. Wilson, *Interstate Transmission Challenges for Renewable Energy: A Federalism Mismatch*, 65 VAND. L. REV. 1801, 1849–55 (2012) (discussing MISO efforts to develop transmission planning and cost allocation rules to accommodate increasing demand for renewables).

332. *See* Lorenzo Kristov & Stephen Keehn, *From the Brink of Abyss to a Green, Clean, and Smart Future: The Evolution of California's Electricity Market, in* EVOLUTION OF GLOBAL ELECTRICITY MARKETS: NEW PARADIGMS, NEW CHALLENGES, NEW APPROACHES 297, 319–20 (Fereidoon P. Sioshansi ed., 2013) (discussing California independent system operator (CAISO) approach).

333. *See* ANNUAL ENERGY OUTLOOK 2014, *supra* note 26, at IF-34–IF-35 (projecting retirement of 50 gigawatts of coal-fired generating capacity by 2020 under reference scenario and 110 gigawatts by 2040 under accelerated retirement scenario). This compares to 310 gigawatts of installed coal-fired generating capacity at the end of 2012. *Id.* at IF-34.

storage technology, coal's share of the U.S. electricity mix will decline, perhaps significantly.[334] As a result, the reliability impacts of these expected retirements have become a source of increasing concern among PUCs and FERC and have led to calls for careful consideration of these retirements in resource planning exercises.[335]

In short, planning has been and will continue to be central to the organization and management of the electric power system. In these contexts at least, it makes little sense to view it in stark Hayekian terms.[336] Rather, planning is a tool that can complement and even sustain competitive markets and that, in any event, will be a critical part of the electric power sector under almost any future organizational form. Instead of viewing it as a misguided quest for synoptic rationality, in other words, planning in the power sector should be seen for what it is: a vitally important and fundamentally pragmatic knowledge practice for dealing with complex, highly interdependent systems that require intense coordination and management across various spatial and temporal scales. As current IRP practices indicate, moreover, such exercises need not be rigid and unaccountable. They can be (and in their best instances are) provisional, recursive, and participatory—living examples of the kind of "pragmatic adjustment" that earlier conceptions of public utility embraced.

In his 1960 *Report on Regulatory Agencies to the President-Elect*, James Landis pointed to the general lack of attention to planning and creative policymaking as among the most important shortcomings of the regulatory agencies.[337] While his attention was directed to the federal agencies, and although

334. *See* Proposed NSPS Rule for New Power Plants, *supra* note 290; Proposed NSPS Rule for Existing Power Plants, *supra* note 290.

335. FERC has convened a series of technical conferences and opened dockets to take input from PUCs, RTOs, ISOs, industry representatives, and others on the potential reliability implications of coal plant retirements. The most recent conference was held in June of 2014. *See* FERC, Reliability Technical Conference, Docket No. AD14-9-00 (April 16, 2014) (providing notice of technical conference to discuss policy issues related to the reliability of the bulk-power system). The first such conference was held in 2012 under Docket No. AD12-1-000.

336. *Cf.* Black & Pierce, *supra* note 188 at 1341–42 (suggesting that integrated resource planning in the power sector "bears an uncomfortable resemblance to the systems previously used to govern the economies of eastern Europe and the former Soviet Union"). *But see* Cudahy, *Electric Deregulation After California, supra* note 236, at 338 ("With due respect to [Professors Black and Pierce], I cannot imagine central planning coming out ahead in any rhetorical contest with markets, especially in light of the giddy triumphalism following the collapse of the Soviet Union. However, the fact is there may be a place for central planning even in economies where most decisions are left to the market.").

337. *See* JAMES M. LANDIS, REPORT ON REGULATORY AGENCIES TO THE PRESIDENT-ELECT 18 (1960) ("[M]any of the commissions have neglected their planning or creative functions. This is due in large part to the burden of routine business thrust upon them and

his conception of regulatory planning and policy formulation was obviously broader than the PUC resource planning exercises considered here, Landis's general admonitions hold for the PUC experience and serve as an important reminder that planning should be at the heart of what these administrative agencies do. Problems of judiciailization, lack of qualified personnel, and inadequate resources have conspired for too long to narrow PUC responsibilities and confine the thinking of Commissioners and their staff. In a world of increasing complexity, and in the face of the truly daunting challenge of decarbonizing the power sector by midcentury, recovering a more affirmative and expansive approach to planning is a crucial part of any realistic pathway to a low-carbon future.

B. Coordination and Systems Operation

If planning provides an important tool for managing the electric power system and sequencing investments over time frames spanning years and decades, coordination and systems operation are essential to managing the grid on time scales of milliseconds, hours, days, and weeks.[338] Given the distinctive features of the electric power system, specifically the lack of storage and the need for the system to be perfectly balanced in real time, there are considerable constraints on the kinds of coordination mechanisms that can be used to maintain balance across these different time scales. As a more diverse and intermittent set of resources distributed at multiple levels up and down the electricity supply chain involving many thousands, if not millions, of individual actors are brought onto the grid, these coordination and systems operation challenges increase substantially.

Simply put, for a complex network infrastructure such as electricity, reliance on the spontaneous ordering of markets to coordinate such activities seems naïve.[339] With the push to integrate ever-larger amounts of intermit-

also to the caliber of appointment which have been made in recent years."); *id.* at 22 ("[T]he greatest gaps . . . are in the planning for foreseeable problems. Absent such planning the need for *ad hoc* solutions to the particular manifestations of the problem precede and, indeed, may preclude any basic policy formulation.").

338. *See* VON MEIER, *supra* note 34, at 260–68 (discussing operation and control of power systems on different time scales).

339. *See* William W. Hogan, *Electricity Wholesale Market Design in a Low-Carbon Future, in* HARNESSING RENEWABLE ENERGY IN ELECTRIC POWER SYSTEMS: THEORY, PRACTICE, POLICY 117 (Moselle et al. eds., 2010) ("[I]t is impossible to operate the system with only decentralized decisions about generation and load. There must be central coordination of everything and central control of enough of the dispatch to meet the requirements of system operations.").

tent renewable generation and a whole suite of distributed energy resources, it seems positively utopian. To be sure, advances in digital communication technologies hold great promise for automating many of these coordination activities (this is part of the promise of the so-called smart grid), but whether such activities are regulated by previously-agreed-to invisible algorithms, by human systems operators, or by some combination of the two, they will be regulated.[340]

These activities have always been at the heart of the general understanding of electric utilities, even if the details have remained more the province of power system engineers than lawyers. Managing the transmission and distribution systems, of course, has long been recognized as an activity requiring regulation given the natural monopoly characteristics of these parts of the system.[341] Scheduling and dispatching generation to meet load, ensuring sufficient reserve capacity, balancing the grid in real time, and maintaining reliability clearly require some form of central administration—whether it be from systems operators in the vertically integrated utilities, regional balancing authorities, or ISOs and RTOs in the organized markets.

With respect to efforts to decarbonize the power sector, two of the biggest challenges facing systems operators are the integration of large amounts of variable utility-scale renewables (wind and solar) and the proliferation of distributed energy resources that will connect to the grid. Responding to these challenges will require more rather than less coordination and control as well as significant increases in investment to modernize and expand the bulk transmission grid and to build more robust and intelligent distribution systems.

A number of studies have examined the operational challenges in specific regions associated with efforts to integrate higher levels of renewables, specifically wind and solar.[342] As the costs of electricity generated from wind and solar

340. *Cf.* LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE 6 (1999) (discussing how code serves to regulate cyberspace).

341. *See* JOSKOW & SCHMALENSEE, *supra* note 31, at 60, 65 (noting that electricity transmission and distribution systems have long been viewed as classic natural monopolies).

342. *See, e.g.*, ENERNEX CORP., EASTERN WIND INTEGRATION AND TRANSMISSION STUDY: EXECUTIVE SUMMARY AND PROJECT OVERVIEW 8–9 (2011), *available at* http://www.nrel.gov/docs/fy11osti/47086.pdf (investigating a 20 percent wind scenario for the Eastern Interconnection); GE ENERGY, WESTERN WIND AND SOLAR INTEGRATION STUDY, at ES-1 (2010), *available at* http://www.nrel.gov/docs/fy10osti/47434.pdf (investigating "the operational impact of up to 35% energy penetration of wind, photovoltaics (PVs), and concentrating solar power (CSP) on the power system operated by the WestConnect group of utilities in Arizona, Colorado, Nevada, New Mexico, and Wyoming"); D. LEW ET AL., NAT'L RENEWABLE ENERGY LAB. ET AL., THE WESTERN WIND AND SOLAR INTEGRATION STUDY, at vii (2013), *available at* http://www.nrel.gov/docs/fy13osti/55588.pdf (investigating impacts and costs of higher

continue to decline and as renewable portfolio standard (RPS) requirements increase in various states, these analyses provide important perspectives on how the operation and management of the current grid will need to adjust to accommodate a growing amount of variable resources. The general conclusion from these integration studies, which is hardly a surprise, is that the balancing demands associated with higher penetrations of variable resources will require more system flexibility, more dispatchable capacity, faster ramping rates, shorter scheduling intervals, increased transmission capacity, and new systems operation capabilities.[343]

In short, adding more intermittent, non-dispatchable resources to the grid increases the overall complexity of grid operation and management, which in turn requires new rules and procedures to accommodate such complexity and to ensure that such resources will be able to access the grid in a fair and open manner while also maintaining system reliability. FERC's recent order on the Integration of Variable Energy Resources (Order 764) represents an important effort in this respect to modify some of the rules associated with transmission access and interconnection to accommodate variable energy resources.[344] Various ISOs and RTOs are likewise adopting their own rules to facilitate renewables integration under existing market structures.[345]

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penetration of wind and solar on the existing fossil fuel generation fleet in the WestConnect subregion).

343. *See* LORI BIRD ET AL., NAT'L RENEWABLE ENERGY LAB., INTEGRATING VARIABLE ENERGY: CHALLENGES AND SOLUTIONS (2013) (discussing various renewables integration studies and key challenges); D. LEW ET AL., *supra* note 342, at ES-1 (finding no technical barriers to integrating 35 percent wind and solar energy in the WestConnect subregion if adequate transmission was available and if certain operational changes were adopted, including increased balancing authority cooperation and increased use of subhourly scheduling). The California Independent System Operator (CAISO) has produced two renewables integration studies, both of which confirmed that significant increases in ramping flexibility and load following resources would be needed to balance the grid at higher penetrations of renewables. *See* CAL. INDEP. SYS. OPERATOR, INTEGRATION OF RENEWABLE RESOURCES: OPERATIONAL REQUIREMENTS AND GENERATION FLEET CAPABILITY AT 20% RPS (2010); CAL. INDEP. SYS. OPERATOR, SUMMARY OF PRELIMINARY RESULTS OF 33% RENEWABLES INTEGRATION STUDY 2010 CPUC LTPP No. R.10-05-006 (2011).

344. *See* FERC Order No. 764, *Integration of Variable Energy Resources*, 77 Fed. Reg. 41,482, 41,482–483 (July 13, 2012) (codified at 18 C.F.R. pt. 35) (summarizing the objective of the rule to remove barriers to integration of variable energy resources by requiring each public utility transmission provider to offer intra-hourly transmission scheduling and incorporating new provisions into the *pro forma* Large Generator Interconnection Agreement in order to better accommodate such resources).

345. *See, e.g.*, LIN XU & DONALD TRETHEWAY, CAL. ISO, FLEXIBLE RAMPING PRODUCTS: SECOND REVISED DRAFT FINAL PROPOSAL (2012), *available at* http://www.caiso.com/Documents/SecondRevisedDraftFinalProposal-FlexibleRampingProduct.pdf (proposing new

Similarly, increasing the amount of distributed energy resources (distributed generation, storage, and demand response) on the grid will require more coordination and control as well as significant upgrades of existing distribution systems to accommodate bidirectional power flows associated with increasing amounts of such resources.[346] Because many of these resources are behind the meter, systems operators cannot see them in any direct sense. Instead, increasing deployment of distributed energy resources looks like increasing variability in load.[347] As more utility customers begin to play a more active role in generating, storing, and managing electricity—that is, as more customers adopt distributed generation, storage, demand-response, or some combination of these—the distribution system is changing from a one-way radial network that delivered electricity to meet load to a much more dynamic, multi-directional network.[348]

What is perhaps most distinctive today is the highly interrelated nature of these developments and their growing intelligence. As the power sector becomes embedded within the emerging "internet of things," what has long been referred to as the demand side looks less like a collection of individual activities and behaviors and more like a complex, distributed network of intelligent devices that is connecting behaviors and technologies in new ways.[349]

CAISO rules for flexible ramping services to accommodate increased penetrations of variable energy resources).

346. *See, e.g.*, Rick Fioravanti & Nicholas Abi-Samra, *Working at the Edge of the Grid: How to Find Value in Distributed Energy Resources*, 152 PUB. UTIL. FORTNIGHTLY 32, 33 (2014) ("The mono-directional flow of electricity from centralized generation assets to end-users is becoming multi-directional."); ELECTRIC POWER RESEARCH INSTITUTE, *supra* note 66, at 28–29 (noting importance of including distributed energy resources in the planning an operation of distribution systems).

347. *See* ELECTRIC POWER RESEARCH INSTITUTE, *supra* note 66, at 29 (noting that at present most distributed energy resources are "invisible" to grid operators, creating coordination and systems operation challenges).

348. *See* NY DPS, REFORMING THE ENERGY VISION, *supra* note 66, at 22 ("The widespread integration of DER [distributed energy resources] will present new complexities and challenges to the continued reliable supply of electricity. Relatively predictable, one-way power flows within distribution systems required less sophisticated system monitoring and power flow management tools. In an enhanced grid, however, power flow will be bi-directional. Energy supplies will come from multiple new technologies, and various sources, of varying sizes and capabilities. Such changes will cause more complex challenges at the local level relating to network power flows, electrical constraints, voltage fluctuations, and reactive power characteristics.").

349. *See, e.g.*, David Ferris, *Smart Thermostats Join the 'Internet of Things' to Turn up the Heat on Utilities,* ENERGYWIRE (April 14, 2014), *available at* http://www.eenews.net/energywire/stories/1059997834 (discussing growth of smart appliances and other devices connected through an "internet of things" and implications for utilities); Neil Gershenfeld & J.P. Vasseur, *As Objects Go Online: The Promise (and Pitfalls) of the Internet of Things*, 93 FOR. AFF. 60, 61 (2014) (discussing how the emerging "internet of things" will faciliate smart buildings and houses that will greatly increase energy efficiency).

Traditional categories of generation and load (supply and demand) no longer make sense in the face of these developments. What was previously viewed as an object of regulation and incentives programs (demand-side management) is in the process of becoming the most active part of the power sector with its own generative, emergent properties. Coordinating and enabling these bottom-up processes will require smarter policies and programs that align business models and regulatory frameworks at multiple levels and across multiple sectors, that empower consumers to become active participants in the grid, and that are durable enough to provide the necessary signals for long-term investments while also flexible enough to accommodate an increasingly dynamic set of activities.[350]

There has been a great deal of discussion recently about what this means for the traditional IOU business model. In some scenarios, IOUs operate like orchestra conductors, managing and coordinating the system, rather than like traditional providers of energy. In others, they continue to provide bundled services. In still others, they are replaced by independent market actors operating across various segments of the industry.[351] But however the grid comes to be organized, there will be a set of institutions layered on top of it that have responsibility for regulating and coordinating various transactions, managing and operating the transmission and distribution systems, and maintaining system reliability. It is these institutions that must operate in the public interest by providing an essential public service—that is, managing a shared infrastructure as part of a larger collective undertaking. It is these institutions that have the obligations and responsibilities of public utility in its broadest sense.

350. *See, e.g.*, Ann E. Carlson & Robert W. Fri, *Designing a Durable Energy Policy*, 142 DAEDALUS 119, 121–26 (2013) (discussing importance of policies that combine durability and flexibility in driving the transition to a low-carbon energy system).

351. *See, e.g.*, NY DPS, REFORMING THE ENERGY VISION, *supra* note 66, at 9 (discussing enhanced role for distribution utilities as "Distributed System Platform Provider" in coordinating among customers on the distribution system and between an increasingly active distribution system and the bulk power system); ROCKY MOUNTAIN INST., NEW BUSINESS MODELS FOR THE DISTRIBUTION EDGE: THE TRANSITION FROM VALUE CHAIN TO VALUE CONSTELLATION 1 (2013) ("The regulated distribution utility of the future can be an important partner in helping to coordinate the deployment and integration of distributed resources—investing in grid infrastructure to support this new and more dynamic system, conveying signals about system conditions, and integrating disparate resources to harvest the benefits of diversity for all stakeholders.").

C. Experimentation and Innovation

If asked to identify those parts of modern government that are particularly innovative, it seems rather unlikely that anyone would put state PUCs at the top of their list. And yet, if we look at what some of these PUCs are actually doing, it is clear that they have been and continue to be important sites for policy innovation as well as key mechanisms for advancing technological innovation in the power sector. In this respect, it is perhaps not purely a coincidence that Justice Brandeis's famous description of the states as laboratories of democracy came in a dissenting opinion in a 1932 case involving Oklahoma's effort to extend a scheme of quasi-public utility regulation to the manufacture and sale of ice.[352]

As discussed above, moreover, the idea of public utility elaborated by Progressives, legal realists, and institutional economists in the early twentieth century was expressly conceived in experimentalist terms.[353] To be sure, the historical record is not exactly overflowing with examples of Brandeisian experimentalism by PUCs. But neither is it dominated entirely by the kind of anti-innovation, rent-seeking behavior that public choice critics and others have pointed to as the default for PUCs.[354] While more research is needed to understand the role of PUCs in policy innovation and in advancing new technologies, anecdotal evidence from across the country suggests that PUCs are actively engaged in various policy experiments and are playing important roles in the effort to demonstrate the viability of various low-carbon generation options.

Ongoing PUC efforts to experiment with new rate designs and other incentive programs are important examples in this respect. Specifically, a number of PUCs have moved away from traditional cost-of-service rate making to toward various types of performance-based rates in order to provide better incentives for utilities to adopt certain practices and improve their performance.[355]

352. *See* New State Ice Co. v. Liebmann, 285 U.S. 262, 311 (1931) (Brandeis, J., dissenting) ("It is one of the happy incidents of the federal system that a single courageous State may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country.")

353. *See* discussion *supra* Part II.A.

354. *See* discussion *supra* Part II.B.

355. *See* Sonia Aggarwal & Hal Harvey, *Rethinking Policy to Deliver a Clean Energy Future*, 26 ELECTRICITY J. 7, 16–19 (2013) (discussing role of performance-based regulation in the effort to decarbonize the power sector); Jeff D. Makholm et al., *North American Performance-Based Regulation for the 21st Century*, 25 ELECTRICITY J. 33, 37–45 (2012) (discussing various examples of performance-based regulation of electric utilities in the United States and Canada); MIT, *supra* note 15, at 186–87 (reporting that as of 2005, sixteen states had some form of performance-based regulation and an additional twenty-three states had established service targets); Joskow, *supra* note 164, at 552–56 (discussing use of price cap mechanisms

Likewise, PUCs across the country have adopted programs that allow utilities to offer more dynamic rates, including so-called time-of-day or time-of-use rates as well as real-time pricing, that provide price signals to retail customers that more accurately reflect the wholesale costs of electricity during different periods.[356] Finally, some PUCs have embarked on broad reform of rate designs and regulatory frameworks to accommodate the growth of distributed energy resources. In New York, for example, the Department of Public Service has initiated an ambitious effort to reform its current regulatory framework and rate designs to facilitate a robust, "transactive" platform that allows for high levels of distributed energy resources.[357]

A handful of PUCs have also worked with regulated utilities to develop policies and programs to test the deployment of new technologies. Smart grid demonstration projects of various types, for example, have been initiated in multiple jurisdictions, with PUCs playing important roles in some cases.[358]

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and service quality incentives in utility regulation in the U.S. and other countries). As discussed above, performance-based or incentive rates have a long history in public utility regulation. The Wisconsin Public Utilities Act of 1907, for example, expressly contemplated the use of "sliding-scale" rates to incentivize "progressive" performance by utilities and revenue sharing with customers. *See* Gilmore, *supra* note 95, at 523–24 (discussing sliding-scale provisions in Wisconsin's public utilities law).

356. *See, e.g.*, Theresa Faim et al., *Pilot Paralysis: Why Dynamic Pricing Remains Over-Hyped and Underacheived,* 26 ELECTRICITY J. 8, 10–17 (2013) (reviewing results of recent pilots and large scale field trials of dynamic pricing). Dynamic rates also have a long, though largely forgotten, history in public utility regulation. *See, e.g.*, William J. Hausman & John L. Neufeld, *Time-of-Day Pricing in the U.S. Electric Power Industry at the Turn of the Century*, 15 RAND J. ECON. 116, 118–23 (1984) (discussing debates over rate structure and time-of-day pricing during late nineteenth and early twentieth centuries). The more recent push for dynamic pricing (that is, retail prices that reflect the time-varying marginal costs of generating electricity) can be traced to the seminal work of Alfred E. Kahn. *See* ALFRED E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS 63–122 (1988) (providing detailed discussion of the theory and application of marginal cost pricing). Kahn served as Chairman of the New York Public Service Commission from 1974 to 1977, during which time he initiated regulatory proceedings to reform electric utility rates to better reflect marginal cost pricing principles. *See* Alfred E. Khan, *Applications of Economics to an Imperfect World*, 69 AM. ECON. REV. 1, 2 (1979) ("One of my proudest accomplishments [as Chairman of the New York Public Service Commission] . . . was the progress we made in requiring the electric and telephone companies to introduce marginal cost-related prices."); *see also* Paul L. Joskow & Catherine D. Wolfram, *Dynamic Pricing of Electricity*, 102 AM. ECON. REV. 381, 381–83 (2012) (discussing Kahn's work on marginal cost pricing and status of efforts to expand dynamic pricing).

357. *See* NY DPS, REFORMING THE ENERGY VISION, *supra* note 66, at 50–54, 58–65 (discussing potential changes to "ratemaking paradigm" and rate design to facilitate a more "transactive grid" with high levels of distributed energy resources).

358. *See* Joel B. Eisen, *Smart Regulation and Federalism for the Smart Grid*, 37 HARV. ENVTL. L. REV. 1, 17–20 (2013) (discussing limited PUC involvement in smart grid pilots); Paul L. Joskow, *Creating a Smarter U.S. Electricity Grid,* 26 J. ECON. PERSP. 29, 31 (2012) (discussing federal and state support for smart grid pilot projects and investments). Currently, twenty-four

PUCs across the country have developed specific initiatives to promote and test the deployment of plug-in electric vehicles.[359] And the California Public Utilities Commission has recently issued an order establishing an energy storage target and procurement framework for the state's three largest IOUs.[360]

At the same time, other PUCs are also working with utilities to support large investments in commercial-scale demonstration projects of advanced low-carbon technologies.[361] To take an important example discussed previously, the Mississippi Public Service Commission, together with the federal government, has been actively involved in the Mississippi Power Company's Kemper plant, a commercial scale demonstration project that combines an advanced coal-fired power plant based on integrated gasification combined cycle technology with carbon capture and storage.[362] Although a significant portion of this project is being financed through rates, the Mississippi Commission has also capped ratepayer exposure to cost overruns.[363]

Regardless of the individual merits of this project (and others like it), it will clearly have broad social benefits. No one knows how much it will cost to build a "clean coal" plant because no one has ever done it at scale. No one knows how well such a plant will work once it is operational because no one has ever

states and the District of Columbia have enacted legislation or adopted policies authorizing smart metering. *See States Providing For Smart Metering,* National Council of State Legislatures, *available at* http://www.ncsl.org/research/energy/states-providing-for-smart-metering.aspx. For two examples of ongoing state efforts to monitor and promote smart grid development, see Missouri Public Service Commission, Missouri Smart Grid Report, EW-2011-0175 at 34–39 (Feb. 14, 2014) (discussing smart grid demonstration projects and investments by investor-owned utilities in the state); CPUC, *California Smart Grid—2012*, Report to the Governor and the Legislature, 5–9 (May 2013) (discussing status of smart grid efforts in California).

359. *See* ENERGETICS INC., COMPILATION OF UTILITY COMMISSION INITIATIVES RELATED TO PLUG-IN ELECTRIC VEHICLES AND ELECTRIC VEHICLE SUPPLY EQUIPMENT 1–2 (2013) (discussing policies and initiatives adopted by utility commissions across the country to promote the deployment of plug-in electric vehicles).

360. *See* Cal. Pub. Util. Comm'n, Decision Adopting Energy Storage Procurement Framework and Design Program, R.10-12-007 (Oct. 17, 2013) (establishing a framework for energy storage procurement and directing the state's investor-owned utilities to procure 1,325 megawatts of storage by 2020 with installations required no later than 2024); *see also* Elliot Hinds & Jonathan Boyer-Dry, *The Emergence of an Electric Energy Storage Market*, 27 ELECTRICITY J. 6, 8–10 (2014) (discussing features of California energy storage procurement order).

361. *See* Jonas J. Monast & Sarah K. Adair, *Completing the Energy Innovation Cycle: The View from the Public Utility Commission*, HAST. L.J. (forthcoming 2014) (manuscript on file with author) (discussing important role of PUCs in commercial scale demonstration projects for new energy technologies).

362. *Id*. at 21–24 (discussing Mississippi Public Service Commission's involvement in Kemper plant); Mufson, *supra* note 299 (discussing history and status of Kemper plant).

363. *See* Miss. Public Service Commission, *supra* note 299, at 9–10, 99 (2012) (summarizing regulatory treatment of Kemper plant and capping rate recovery for costs associated with the plant at $2.4 billion).

operated one at scale. The only way to find out whether this technology will work at scale is to build one at scale. Thus, rather than view such a project as yet another example of the excesses of rate regulation, it would seem more productive to view it instead as a crucial experiment with a technology that could be a vitally important part of a low-carbon future. This is especially true in cases where the venture in question fails. Although such failures will surely be expensive, they could also prove invaluable in terms of the learning experience that they provide.

Innovation in the power sector poses a different set of challenges (both in kind and degree) than those confronting most other sectors. Proof-of-concept activities and demonstration projects often run well into the hundreds of millions and even billions of dollars.[364] Cost estimates for widespread deployment of advanced technologies to upgrade the transmission and distribution systems in the United States are typically in the hundreds of billions of dollars.[365] Without question, software and new digital technologies will play (and are playing) important roles in modernizing the grid and facilitating innovation across the power sector, but the ongoing digitalization of the grid will hardly be enough by itself to decarbonize the electricity system.

Given the highly interdependent nature of the power sector, it is unlikely that a single disruptive innovation will usher in the kind of creative destruction that technological enthusiasts celebrate in other sectors. Rather, innovation is more likely to come in clusters of technologies, practices, and regulatory frameworks. Creating space for that to happen will require a broader platform to support and test new technologies and approaches at multiple scales and a regulatory framework that views the overall innovation system as part and parcel of the enterprise of public utility.

Decarbonizing the U.S. electricity system by 2050 is a daunting prospect to even the most optimistic observer. Even if the technology and financing were readily available, the political and institutional challenges are im-

364. As noted, the current estimate of the total costs necessary to complete the Kemper plant in Mississippi is $5.5 billion. *See* Mufson, *supra* note at 299 (reporting current cost estimate of Kemper plant).

365. *See, e.g.*, EPRI, ESTIMATING THE COSTS AND BENEFITS OF THE SMART GRID: A PRELIMINARY ESTIMATE OF THE INVESTMENT REQUIREMENTS AND THE RESULTANT BENEFITS OF A FULLY FUNCTIONING SMART GRID 1-4–1-6 (2011) (estimating range of total investment necessary to enable a fully functioning smart grid, including investments in transmission, distribution, and consumer segments of the grid, as $338 billion to $476 billion).

mense.[366] The chances of reducing power sector emissions by 80 percent by midcentury are slim at best. But rather than bemoan the difficulties and argue in the abstract about the optimal mix of technologies and institutions needed to achieve this, it would seem prudent to look for promising activities that are underway and find ways to leverage them. PUCs have great potential in this respect. They are actively pursuing all kinds of different initiatives across the country, albeit unevenly and all too often without much coordination, and they have the capacity to do much more. Rather than viewing them as obstacles to be overcome, it is perhaps better to see PUCs as institutional resources that could be harnessed and redirected to meet the demands of a low-carbon future.

How individual utilities respond to all of this—whether they see it as threat or opportunity—is obviously important, but hardly the whole story. Individual companies will come and go; business models will inevitably change and adjust. But the notion of public utility is much broader, containing within it generative possibilities that its early proponents may not have emphasized—the germ of new insights and ways of thinking about possible pathways to a low-carbon future. A more active form of public utility regulation that combines broad responsibilities for planning and coordination across the whole system with a capacity for policy experimentation and learning offers a critical set of tools and resources that could play a major role in the effort to realize that future. As John Maurice Clark noted many years ago, a good system of public control must be democratic, powerful, wisely experimental, and adaptable.[367] Finding ways to realize and nurture those capabilities in the context of public utility is at least as important as the effort to mobilize the technology and financial resources that will be needed to realize a low-carbon future.

CONCLUSION

This Article has argued that a revitalized concept of public utility has much to offer for any effort to decarbonize the electric power sector. A key task is to recover the *public* in public utility as we confront the challenge of collectively building a low-carbon future. In saying this, it is important to recognize that we cannot simply adopt the older concept of public utility that

366. *See, e.g.*, Milligan et al., *supra* note 292, at 27-5 ("[E]xpanding the use of renewable electricity poses institutional challenges that are often more formidable, and less studied, than the technical challenges.").

367. *See* CLARK, *supra* note 2, at 17 (discussing various features of a good system of public control).

Progressives, realists, and institutional economists elaborated. Today's economy (our industrial system) together with our politics and legal arrangements are vastly different from those of the first half of the twentieth century. But neither should we assume that the diminished notion of public utility bequeathed to us by the economic critique represents the last word on the subject. As we set forth on the truly massive effort of building a low-carbon future, we will surely need new ideas and conceptual innovations, a new "public vocabulary," that make creative use of the concepts and institutions that we have used to build our current society.[368]

As a quintessential Progressive effort aimed at the "social control of business," public utility was oriented toward progress and innovation—a means for ensuring ordered change in a dynamic industrial economy and directing it toward the general welfare.[369] Today we seem to have abandoned the idea of ordered change in favor of disruption. But many of the investments we are making today in the electric power system will be with us for a generation or more, and the emissions that are embedded within those investments will determine in part whether we can realize a low-carbon future. It may be that in some sectors such as electric power, we still need a fair amount of "statecraft" to channel those investments in ways that promote the general welfare.[370] None of this will be easy, of course. As Justice Frankfurter noted many years ago, "[n]o task more profoundly tests the capacity of our government, both in nation and state, than its share in securing for society those essential services which are furnished by public utilities."[371]

Public choice and the broad economic critique of utility regulation have taught us to be wary of the Progressive faith in expertise and regulation by independent commission. Surely some skepticism is warranted, and there is plenty of evidence to support the public choice view of regulation. But if we push this to its limits, if we allow it to wholly replace any sense of the public interest, it will corrode our faith in institutions that we have built, however imperfectly, to provide a framework for policy innovation and action in our ongoing effort to manage a vital infrastructure that provides so many essential services to our economy and way of life.

368. *See* Jedediah Purdy, *The Politics of Nature: Climate Change, Environmental Law, and Democracy*, 119 YALE L.J. 1122, 1139 (2010) (discussing how environmental ideas and arguments become embedded within broader public vocabularies).
369. CLARK, *supra* note 2.
370. HAMILTON, POLITICS OF INDUSTRY, *supra* note 14, at 18.
371. FRANKFURTER, *supra* note 1, at 81.

Public utility is not a thing or a single type of enterprise, but an ongoing, open-ended project; a collective undertaking that is distinctively American and one that, even now, well past its hundredth birthday, is still very much up for grabs. The choice of making a low-carbon future can only be realized if it is approached as a shared, political choice—a choice that will require a significant amount of statecraft, public participation, and private enterprise, a choice that calls for a revitalized understanding of public utility.