
DECOMMODIFYING ELECTRICITY

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ABSTRACT

Electricity markets are struggling. Unprecedented energy price shocks, a deeply entrenched cost-of-living crisis, and the imperatives of decarbonization are challenging the ability of current market arrangements to deliver clean, affordable electricity at the scale and pace necessary to avoid widespread climate disruption. Over the last several years, mass protests around the world have put a vision of electricity as a primary social good and system of provisioning squarely on the public agenda for the first time in a generation. Regulators have responded with emergency packages of support and longer-term efforts to rethink and reform the basic design of electricity markets. In all of this, it is increasingly clear that the forty-year global experiment with neoliberal electricity has failed to deliver on even the most basic metrics and, more importantly, is no longer fit for purpose as electricity becomes the chief instrument of decarbonization for most economies around the world. This Article explains how and why electricity markets have failed and offers a series of prescriptions for where we go from here. The Article starts with a brief global history of neoliberal electricity that shows how the project of privatization and restructuring emerged and spread around the world and the consequences this entailed. It then discusses how these markets have struggled with persistent problems of market power, chronic underinvestment, high prices, and an inability to support renewable energy at scale. Finally, the Article offers some provisional thoughts on what an alternative, decommodified approach to electricity might look like as the clean energy transition accelerates, focusing specifically on the relationship between capital and infrastructure, the need for "social ratemaking" to ensure access and affordability, and the

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potential for a more cooperative approach to balancing the system as intermittent renewables come to dominate the supply of electricity. The Article draws on recent work in law and political economy as well as some of its precursors in legal realism and institutional economics. It also engages with a specific set of questions and concerns that have long preoccupied the fields of public utility and regulated industries law but have recently been revived and updated in the context of a new cross-sectoral approach to economic regulation known as networks, platforms, and utilities law. The key objective is to understand how law, politics, and economics have together structured distributional struggles over the design and maintenance of electricity markets and how they might be recombined in new ways to realize a vision of electricity as a key system of provisioning and vital infrastructure for the clean energy future.

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INTRODUCTION

In the summer of 2022, during the most severe energy crisis in half a century, grassroots organizers launched a new campaign across the United Kingdom known as "Don't Pay UK." The goal was simple and audacious: recruit one million households from across the country to join an "energy strike"—a mass movement to stop paying energy bills.[1] Drawing inspiration from the successful resistance to Margaret Thatcher's regressive "poll tax" proposal in the late 1980s and tapping into the growing rage across the country over a deeply entrenched cost-of-living crisis, Don't Pay UK was betting that if a large enough number of households simply refused to pay their energy bills, suppliers and the government would be forced to respond.[2]

As of early 2023, more than 250,000 people had signed up; well short of the one million household goal, but a substantial number with thousands engaged in a series of direct public protests, burning their energy bills and demanding action from the government.[3] Together with similar campaigns focused on ending fuel poverty, Don't Pay UK emerged directly out of the energy and economic crisis in the UK that had reached extreme levels by the second half of 2022. Indeed, by late summer 2022, some seven million households were estimated to be behind on their energy bills, and more than four million had been placed on prepayment meters, which, as the name suggests, require customers to constantly feed special meters in order to keep the lights on.[4] Although the government stepped in with an "Energy Price Guarantee" in September 2022 that capped "typical" household energy bills

1. *See FAQs*, DON'T PAY, https://dontpay.uk/about/faqs [https://web.archive.org/web/20230801102720/https://dontpay.uk/about/faqs/]*; see also* Alex Lawson, *Don't Pay: The Campaigners Urging Britons to 'Strike' Over Energy Bills*, GUARDIAN (Oct. 1, 2022), https://www.theguardian.com/uk-news/2022/oct/01/dont-pay-the-campaigners-urging-britons-to-strike-over-energy-bills (discussing the history and goals of Don't Pay UK); Kate Aronoff, *Big Energy Bill? Don't Pay!*, NEW REPUBLIC (Aug. 17, 2022), https://newrepublic.com/article/167435/dont-pay-uk-high-energy-bills (same).

2. The poll tax sought to replace the existing system of property taxes with a flat, per-capita tax on all individuals regardless of income. *See* Ella Glover, *The History of the Poll Tax and the Power of Direct Action*, HUCK MAG. (Oct. 6, 2022), https://www.huckmag.com/article/the-history-of-the-poll-tax-and-the-power-of-direct-action [https://perma.cc/L8QK-W3RM] (discussing the history of the poll tax and its influence on the Don't Pay UK movement).

3. *See* Robert Booth, *Britons to Burn Their Bills in Weekend Wave of Cost of Living Protests*, GUARDIAN (Oct. 1, 2022), https://www.theguardian.com/world/2022/oct/01/cost-of-living-protests-burn-energy-bills [https://perma.cc/J43B-VD7N].

4. In February 2023, the UK energy regulator Ofgem launched an investigation of the use of prepayment meters. *See Prepayment Rules and Protections: A Call for Evidence*, OFGEM (Feb. 21, 2023), https://www.ofgem.gov.uk/publications/prepayment-rules-and-protections-call-evidence [https://perma.cc/M5SG-XWM3]. *See also* Kerry Hudson, Opinion, *The Monster in My Home Was a Meter, and It Decided Whether I Ate and Slept*, N.Y. TIMES (Dec. 30, 2022), https://www.nytimes.com/2022/12/30/opinion/prepayment-meters-uk.html [https://perma.cc/FWQ8-UXPR].

at £2,500 per year (about $3,000 U.S. dollars), households were still paying double what they had paid the previous winter.[5] The price shocks of 2022 also squeezed retail providers who were unable to pass along the full costs to their customers. By July 2022, twenty-nine retail providers had failed, requiring expensive government bailouts and the transfer of 2.4 million customers to other providers.[6]

Don't Pay UK made three essential demands: (1) a reversal of energy utility price increases; (2) an end to the enforcement of prepayment meters; and (3) a social energy tariff that would ensure basic service for low-income households.[7] In essence, they wanted a just or fair price for energy and an end to the thirty-plus-year experiment with liberalized markets that had failed to deliver reliable and affordable electricity.[8] Although the energy strike never happened, Don't Pay UK succeeded in forcing the Government to respond with a package of support for households as well as a broad initiative to rethink and reform energy markets.[9] More importantly, Don't Pay UK, along with other campaigns like it around the world, has put a vision of energy as a primary social good and system of provisioning squarely on the policy agenda for the first time in at least a generation. The fact that this

5. *Energy Bills Support Factsheet*, U.K. DEP'T FOR BUS., ENERGY & INDUS. STRATEGY, (Nov. 1, 2022), https://www.gov.uk/government/publications/energy-bills-support/energy-bills-support-factsheet-8-september-2022 [https://web.archive.org/web/20221129035226/https://www.gov.uk/government/publications/energy-bills-support/energy-bills-support-factsheet-8-september-2022]; *see also* PAUL BOLTON & IONA STEWART, DOMESTIC ENERGY PRICES 14 (2024), https://commonslibrary.parliament.uk/research-briefings/cbp-9491 [https://perma.cc/W4G3-YPKM]. The energy price guarantee rose to £3,000 per year in April 2023. *Id.* at 4.

6. *See* HOUSE OF COMMONS, BUS., ENERGY, & INDUS. STRATEGY COMM., ENERGY PRICING AND THE FUTURE OF THE ENERGY MARKET: THIRD REPORT OF SESSION 2022–23 3 (2022), https://committees.parliament.uk/publications/23255/documents/169712/default [https://perma.cc/VD92-3E3U]. Several of these suppliers were too big to fail and had to be bailed out, including Bulb energy to the tune of £4 billion, which was the largest government bailout since the Royal Bank of Scotland bailout during the 2008 financial crisis. Gill Plimmer & David Sheppard, *Bulb Energy Bailout to Cost UK Taxpayers £6.5bn*, FIN. TIMES (Nov. 17, 2022), https://www.ft.com/content/2d19da21-b79f-4ee3-8c74-5c61abca7a13 [https://perma.cc/LW46-87HA].

7. *See What We're Striking For*, DON'T PAY, https://dontpay.uk/about/what-were-striking-for [https://web.archive.org/web/20230314184227/https://dontpay.uk/about/what-were-striking-for/].

8. *Cf.*, William Boyd, *Just Price, Public Utility, and the Long History of Economic Regulation in America*, 35 YALE J. ON REG. 721, 727–29 (2018).

9. U.K. DEP'T FOR BUS., ENERGY & INDUS. STRATEGY, REVIEW OF ELECTRICITY MARKET ARRANGEMENTS: CONSULTATION DOCUMENT (2022), https://assets.publishing.service.gov.uk/media/62fa281ee90e076cfe3649ed/review-electricity-market-arrangements.pdf [https://perma.cc/QAB3-XRNF]. As of early 2024, the Government was preparing for a second consultation, with specific proposals for reform expected later in the year. *See* Answer by Graham Stuart, *Question for Department for Energy Security and Net Zero*, U.K. PARLIAMENT (Jan. 30, 2024), https://questions-statements.parliament.uk/written-questions/detail/2024-01-23/11040 [https://web.archive.org/web/20240514230248/https://questions-statements.parliament.uk/written-questions/detail/2024-01-23/11040].

occurred in the UK is also notable because the UK was one of the first countries to privatize and restructure its electricity sector and has sometimes been held out as the "gold standard" for such efforts.[10]

Of course, the energy crisis of the early 2020s was hardly contained to Great Britain. Across Europe and around the world, energy price shocks have decimated household budgets and created substantial economic challenges for businesses and governments. The International Energy Agency has called it the first truly global energy crisis of the twenty-first century, and one has to go back half a century to the oil shocks of the 1970s to find precedent for the impact on domestic politics and world order.[11] Protests over high energy prices rocked cities in Germany, Italy, Spain, and other European countries during the summer and fall of 2022, leading governments to respond with very large aid packages intended to protect businesses and households from the full impact of the price shocks.[12] The amount of spending by European governments is staggering, close to 7% of GDP in some cases.[13] One report from June 2023 found that total spending across the EU block was around $700 billion, close to what these governments spent on COVID-19 pandemic relief.[14] Such numbers, of course, mask the uneven levels of spending across the EU member states, with some countries such as Germany spending far more than others, raising more than a few eyebrows among those who recall Germany's previous lectures to fellow member states on the virtues of

10. *See, e.g.*, Paul L. Joskow, *Introduction to Electricity Sector Liberalization: Lessons from Cross-Country Studies*, *in* ELECTRICITY MARKET REFORM: AN INTERNATIONAL PERSPECTIVE 8 (Sioshansi & Pfaffenberger eds., 2006) ("In my view, the gold standard for electricity reform is England and Wales . . . .").

11. *See* INT'L ENERGY AGENCY, WORLD ENERGY OUTLOOK 2022 3, 32 (2022), https://iea.blob.core.windows.net/assets/830fe099-5530-48f2-a7c1-11f35d510983/WorldEnergyOutlook2022.pdf [https://perma.cc/VEQ4-PG8W].

12. *See Monthly Update*, HOUSEHOLD ENERGY PRICE INDEX (Nov. 2022), https://web.archive.org/web/20221108073519/https://www.energypriceindex.com/price-data [https://perma.cc/FP7Y-HFK3]; Anil Ari, Nicolas Arregui, Simon Black, Oya Celasun, Dora Iakova, Aiko Mineshima, Victor Mylonas, Ian Parry, Iulia Teodoru & Karlygash Zhunussova, *Surging Energy Prices in Europe in the Aftermath of the War: How to Support the Vulnerable and Speed Up the Transition Away from Fossil Fuels* 20 (IMF, Working Paper No. 22/152, 2022); Giovanni Sgaravatti, Simone Tagliapietra, Cecilia Trasi & Georg Zachmann, *National Fiscal Policy Responses to the Energy Crisis*, BRUEGEL (June 26, 2023), https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices [https://perma.cc/W9UH-3WCQ]. In France, the increase in regulated gas and electricity bills was limited to just 4% in 2022 and 15% in 2023—a reflection of a system built on public ownership, a very significant amount of nuclear power, and the memory of the gilets jaunes fuel price protests of 2018. *See* Sophie Parsons, *How Your Gas and Electricity Bills Will Change in 2023*, CONNEXION (Oct. 26, 2022), https://www.connexionfrance.com/article/Practical/Everyday-Life/How-your-gas-and-electricity-bills-will-change-in-France-in-2023 [https://perma.cc/ZAY4-ZCC8]; *see also* Renaud Foucart, *Energy Crisis: Why French Households are Largely Protected from Soaring Costs While British Families Struggle*, CONVERSATION (Aug. 12, 2022), https://theconversation.com/energy-crisis-why-french-households-are-largely-protected-from-soaring-costs-while-british-families-struggle-188417 [https://perma.cc/W53U-K8BL].

13. *See* Sgaravatti et. al., *supra* note 12.

14. *Id.*

austerity and fiscal responsibility.[15] For governments in the Global South, of course, such spending is pure fantasy given much more limited fiscal capacity and a looming sovereign debt crisis.[16]

Although the U.S. did not experience the extreme price shocks affecting Europe and the UK, the substantial increase in exports of liquefied natural gas to Europe to compensate for the loss of Russian gas did lead to significantly higher prices for both natural gas and electricity across the country. In California and New England, for example, customers experienced "European style" price increases during the winter of 2022–23.[17] For households in many parts of the country, utility bills more than doubled during the early 2020s, leaving more than twenty million households unable to pay their bills.[18] This has been compounded by the expiration of utility shutoff moratoria during the pandemic, which led to a new round of shutoffs and an army of collections agents chasing down unpaid bills.[19] Even before the pandemic, close to a third of U.S. households suffered from chronic energy insecurity—often forced to choose between paying for food or paying for utilities.[20] It is, needless to say, a damning indictment on any register.

While it has been common to explain these price shocks of the last two years as a supply problem that started in the second half of 2021 and was

15. *Id; see also* Emily Rauhala, Rick Noack, Kate Brady & Beatriz Ríos, *Germany Takes Heat as E.U. Leaders Meet to Discuss Energy Crisis*, WASH. POST (Oct. 7, 2022, 4:21 AM), https://www.washingtonpost.com/world/2022/10/07/eu-energy-crisis-germany-criticism [https://perma.cc/N47Q-98AN].

16. DAVID AMAGLOBELI, EMINE HANEDAR, GEE HEE HONG & CELINE THEVENOT, IMF NOTES: FISCAL POLICY FOR MITIGATING THE SOCIAL IMPACT OF HIGH ENERGY AND FOOD PRICES 2–3 (2022), https://www.imf.org/en/Publications/IMF-Notes/Issues/2022/06/07/Fiscal-Policy-for-Mitigating-the-Social-Impact-of-High-Energy-and-Food-Prices-519013 [https://perma.cc/SW6U-QLYF].

17. *See, e.g.*, Derek Brower & Myles McCormick, *New England 'Importing European Prices' in Looming Gas Supply Crunch*, FIN. TIMES (Nov. 17, 2022), https://www.ft.com/content/f9374ff4-3bfd-4b5e-8542-58c3db81514b [https://perma.cc/EQ8M-EZER]. High natural gas prices in California during early 2023 prompted the California Public Utilities Commission to open a formal inquiry in March 2023. *See* CAL. PUB. UTILS. COMM'N, ORDER INSTITUTING INVESTIGATION ON THE COMMISSION'S OWN MOTION INTO NATURAL GAS PRICES AND RESULTING IMPACTS TO ENERGY MARKETS (Issued Mar. 20, 2023), https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M503/K823/503823381.PDF [https://perma.cc/VJ4N-HPLS].

18. Will Wade & Mark Chediak, *A Tsunami of Shutoffs: 20 Million US Homes Are Behind on Energy Bills*, BLOOMBERG (Aug. 23, 2022, 5:05 PM), https://www.bloomberg.com/news/articles/2022-08-23/can-t-pay-utility-bills-20-million-us-homes-behind-on-payments-facing-shutoffs [https://perma.cc/AA8A-VZM8].

19. SELAH GOODSON BELL, JEAN SU, MATT KASPER, SHELBY GREEN & CHRISTOPHER KUVEKE, POWERLESS IN THE UNITED STATES: HOW UTILITIES DRIVE SHUTOFFS AND ENERGY INJUSTICE 5, 17 (2023), https://www.biologicaldiversity.org/programs/energy-justice/pdfs/Powerless-in-the-US_Report.pdf [https://perma.cc/876A-4F3Z].

20. *In 2020, 27% of U.S. Households had Difficulty Meeting Their Energy Needs*, U.S. ENERGY INFO. ADMIN. (Apr. 11, 2022), https://www.eia.gov/todayinenergy/detail.php?id=51979 [https://perma.cc/AB2L-BWUZ].

greatly exacerbated by the Russian invasion of Ukraine, such a view misses important questions about market design and the distinctive ways of price making at the center of natural gas and electricity markets.[21] For electricity in particular, the current crisis has raised fundamental questions about the forty-year project of neoliberal electricity and the viability of current electricity market designs. Prices, in short, have become disconnected from the actual cost of providing electricity, raising basic questions of fairness. As EU President Ursula von der Leyen stated in her September 2022 State of the European Union, "the current electricity market design . . . is not doing justice to consumers anymore."[22] Similar concerns have been raised by UK government officials and by at least one sitting Federal Energy Regulatory Commission ("FERC") commissioner.[23]

At the center of these concerns is the uniform or single-clearing price auction design used in most electricity markets. As the name suggests, the single-clearing price design sets clearing prices based on the price of the last increment of generation needed to meet demand. All sellers who submit offers below the clearing price receive the clearing price, regardless of their original offer price. This means that when very expensive generators are necessary to meet demand, clearing prices can rise to extreme levels, and all the generators who submitted successful bids will receive that high clearing price regardless of their actual costs. Thus, when natural gas prices rose to unprecedented levels following the Russian invasion of Ukraine, electricity prices followed because natural gas power plants were on the margin setting the clearing price in the electricity markets. These high clearing prices, in turn, delivered substantial windfalls to non-gas generators and caused enormous pain for retail customers.[24]

21. *See* William Boyd, *Ways of Price Making and the Challenge of Market Governance in U.S. Energy Law*, 105 MINN. L. REV. 739, 759, 782 (2020) (discussing distinctive ways of price making in natural gas and electricity markets).

22. Ursula von der Leyen, President, EU, 2022 State of the Union Address (Sept. 14, 2022), https://ec.europa.eu/commission/presscorner/detail/en/speech_22_5493 [https://perma.cc/V3SV-KAT4].

23. *See, e.g.*, DEP'T FOR ENERGY SEC. & NET ZERO, *supra* note 9, at 23 (observing that there is a growing consensus in the UK that current electricity market designs are failing to deliver on decarbonization and affordability); Mark C. Christie, *It's Time to Reconsider Single-Clearing Price Mechanisms in U.S. Energy Markets*, 44 ENERGY L.J. 1, 3 (2023) ("[I]t is timely for the United States to join the UK and EU in a comprehensive reconsideration of the pricing mechanisms used in our power markets and to ask whether those pricing mechanisms can or will, in the future, deliver the best combination of cost savings and reliable power supply to consumers. It is especially timely to ask . . . whether single-clearing price mechanisms are best suited to deliver to consumers all of the potential cost savings from the increasing deployment of heavily subsidized, very low to below-zero marginal-cost resources such as wind and solar.").

24. *See* Alice Hancock & Barney Jopson, *EU Seeks Windfall Tax Threshold for Electricity Groups Well Below Market Rate*, FIN. TIMES (Sept. 7, 2022), https://www.ft.com/content/ab469e2d-8e87-44ee-855b-f46b5b2dd17e [https://perma.cc/HX9L-V5VX]. *See generally* DAVID ROBINSON, OXFORD INST. ENERGY STUD., CURRENT ENERGY CRISES, THE ENERGY TRANSITION AND THE DESIGN OF ELECTRICITY MARKETS (2022).

The single-clearing price design also means that prices in these markets can fluctuate dramatically and are often completely detached from the overall costs of providing electricity. In Texas, for example, a state that has long prided itself on having one of the best designed electricity markets in the world, spot market prices have fluctuated from negative prices—typically at night when demand is low and vast amounts of wind energy are on the system—to $9,000 per megawatt-hour ("MWh"), which was the price cap set by the state's scarcity pricing mechanism for periods of peak demand.[25] Although this kind of volatility might seem exceptional, it is actually hard wired into the logic of these markets and reflects the multi-decade effort to make electricity into a commodity.[26] While that might be good for traders and others who can profit from volatility, it is most assuredly not good for consumers. It is also not good for efforts to create the stable, long-term investment climate needed to scale up decarbonization. In fact, current electricity market designs are incompatible with a future dominated by renewables.[27] Virtually all of these markets were built on the assumption that fossil fuel generators such as natural gas plants with positive short-run

25. On the Texas electricity market, which is run by the Electric Reliability Council of Texas or ERCOT, see Parviz Adib, Jay Zarnilau & Ross Baldick, *Texas Electricity Market: Getting Better*, *in* EVOLUTION OF GLOBAL ELECTRICITY MARKETS: NEW PARADIGMS, NEW CHALLENGES, NEW APPROACHES 265, 265 (Sioshansi ed., 2013) (observing that the Texas ERCOT market "is frequently cited as North America's most successful in both generation and retail"). On the range of prices in the Texas ERCOT market, see POTOMAC ECONS., 2022 STATE OF THE MARKET REPORT FOR THE ERCOT ELECTRICITY MARKETS A-11 (2023), https://www.potomaceconomics.com/wp-content/uploads/2023/05/2022-State-of-the-Market-Report_Final_060623.pdf [https://perma.cc/V36Z-RPET]. *See also id.* at A-20 ("Negative ERCOT-wide prices may occur when wind is the marginal generation. More installed wind generation and additional transmission infrastructure led to increased occurrences of negative prices over the past few years. In 2022, there were 110 hours with ERCOT-wide prices at or below zero, a decrease from the 176 hours in 2021."). Wind projects will offer to sell electricity in the spot market at negative prices in order to ensure that they get dispatched so that they can produce and receive the production tax credit. *Id.*; *see also id.* at 85 (noting that the price cap under the ERCOT scarcity pricing mechanism was set at $9,000 per megawatt-hour ("MWh") in 2014 and reduced to $5,000 per MWh in January 2022 after the experience of Winter Storm Uri). Between 2014 and 2022, annual average prices across the entire ERCOT market have fluctuated from a low of $24.62 per MWh in 2016 to a high of $167.88 in 2021, which was largely due to the extreme prices that prevailed during Winter Storm Uri. *Id.* At 14.

26. *See, e.g.*, Severin Borenstein, *The Trouble with Electricity Markets: Understanding California's Restructuring Disaster*, 16 J. ECON. PERSPS. 191, 191–92 (2002) (discussing various attributes of electricity markets that "necessarily imply that short-term prices for electricity will be extremely volatile").

27. Various commentators, including some of the pioneers of electricity markets, have begun to recognize this over the last several years. *See, e.g.*, Fabien Roques & Dominique Finon, *Adapting Electricity Markets to Decarbonization and Security of Supply: Toward a Hybrid Regime*, 105 ENERGY POL'Y 584, 594 (2017); Paul L. Joskow, *From Hierarchies to Markets and Partially Back Again in Electricity: Responding to Decarbonization and Security of Supply Goals*, 18 J. INSTITUTIONAL ECON. 313, 318 (2022); *see also* BRETT CHRISTOPHERS, THE PRICE IS WRONG: WHY CAPITALISM WON'T SAVE THE PLANET xxi-xxii (2024) (arguing that liberalized electricity markets are not capable of delivering sufficient profits and investment stability for renewable electricity generators).

marginal costs (that is, fuel costs) would set the clearing price. A renewables-dominated electricity system does not work under such a market design for the simple reason that renewable electricity such as wind and solar do not have any short-run marginal costs. The uncertainty that this creates for renewables projects in terms of their ability to recover their fixed capital costs is one reason why virtually all renewables in markets around the world are compensated through some form of long-term contract with price terms that make them indifferent to market clearing prices.[28]

Electricity markets have also failed to deliver on the one metric for which they were supposed to be vastly superior to regulation: lower prices for consumers. Indeed, even as efficiencies have improved and wholesale costs have declined across these markets, retail prices have increased as generators and electricity providers have been able to capture the gains in performance while also pursuing substantial price markups, demonstrating the stubborn fact of market power in electricity.[29] This exercise of market power, moreover, has not been limited to periods of scarcity, when generation capacity is most constrained, but appears to be pervasive in these markets.[30] Notwithstanding the claims (and hopes) of the proponents of deregulation that the new electricity markets would be contestable, they have remained concentrated on the supply side, which has translated into ongoing pricing power for wholesale generators.[31]

In sum, the electricity markets that were adopted in the U.S. and around the world over the last several decades have not been able to deliver savings to consumers. They have not been able to ensure security of supply, and they

28. Roques & Finon, *supra* note 27, at 586.

29. *See, e.g.*, Alexander MacKay & Ignacia Mercadal, Do Markets Reduce Prices? Evidence from the U.S. Electricity Sector 3–4, 24 (March 30, 2024) (unpublished manuscript), https://ssrn.com/abstract=3793305 [https://perma.cc/JX3F-RE6Z] (documenting "that electric deregulation in the U.S. yielded higher wholesale prices, despite declines in generation costs," that the growing spread between wholesale prices and costs was consistent with the exercise of market power, and that these higher wholesale prices were in turn passed on to consumers in the form of higher retail prices). MacKay and Mercadal base their conclusions on an extensive dataset that for the first time includes purchases via bilateral contracts and through centralized markets, allowing them to develop a more comprehensive picture of upstream and downstream prices in electricity markets and to compare these prices to those in regulated states. *Id.* at 1–2, 9–16. Their conclusion is unambiguous:

> We find that restructuring lead to sharp increases in wholesale prices despite reductions in marginal fuel costs, such that generation facilities were able to charge prices at substantial margins above costs. We show that this can explain a large portion of the increase in retail rates after the restructuring of the electricity sector.

Id. at 34.

30. *Id.* at 26 ("The finding that wholesale prices increased while costs remained constant or decreased, and thus that the wedge between them went up, indicates that firms were increasingly able to set price above marginal cost. The most natural explanation for this is limited competition and market power . . . . At an annual level, we find substantial margin increases over the costs of the most expensive power plants. Thus, our findings suggest that market power may be a broad phenomenon.").

31. *See infra* Section II.A.

are not delivering renewable energy and other clean energy assets at the scale that is needed. While these markets have led to improved performance and efficiency for some existing assets, it is no longer feasible or appropriate to view the power sector as simply another legacy infrastructure industry in need of market discipline. It is now the chief instrument of decarbonization for most economies in the world, a project that entails a very different set of technologies with very different cost structures than those used as the basis for designing these markets in the 1980s and 1990s and one that will also involve much more extensive use of electricity in everyday life.

Put another way, given the radical shifts in the goals, underlying technologies, and cost structures of the power sector, it is increasingly clear that electricity markets are no longer fit for purpose. The vast subsidies available for renewable energy, clean energy manufacturing, and electric vehicles (among others) in the Inflation Reduction Act ("IRA") do not change this in any fundamental way. If anything, the IRA's core strategy of de-risking private investment in clean energy through tax credits accepts the status quo of markets and builds on the financialized approach to renewable energy that has dominated U.S. federal renewables policy since the early 1990s.[32] To be sure, the IRA's direct pay and transferability provisions do open up possibilities for alternative forms of project finance and ownership, including by governments and non-profit entities.[33] But the main thrust of the legislation is to lure private capital into clean energy by reducing the risk of investment, leaving the basic design and regulation of electricity markets intact. Thus, while the legislation is unprecedented in the scale and scope of investment that it could generate, and while it may well be the case that the IRA is the best that clean energy advocates could have hoped for given the demands of budget reconciliation and the highly polarized nature of our politics, it does beg the question whether other approaches will be needed in

32. *See, e.g.*, Sarah Knuth, *Rentiers of the Low-Carbon Economy? Renewable Energy's Extractive Fiscal Geographies*, 55 ENV'T & PLANNING A: ECON. & SPACE 1548, 1557–60 (2023) (discussing recent history of tax credit financing for renewable energy in the U.S.); Daniela Gabor, The (European) Derisking State 18 (May 17, 2023) (unpublished manuscript), https://osf.io/preprints/socarxiv/hpbj2 [https://perma.cc/2U72-MJDS] ("The US IRA organises the state relationship with private capital through a derisking logic.").

33. *See* Elective Payment of Applicable Credits, 89 Fed. Reg. 17546 (Mar. 11, 2024) (to be codified at 26 C.F.R. pts. 1, 301), https://www.federalregister.gov/documents/2024/03/11/2024-04604/elective-payment-of-applicable-credits-elective-payment-of-advanced-manufacturing-investment-credit [https://perma.cc/S7V3-UJQD] (providing guidance for IRA direct pay provisions); Transfer of Certain Credits, 89 Fed. Reg. 34770 (Apr. 30, 2024) (to be codified at 26 C.F.R. pt. 1), https://www.federalregister.gov/documents/2024/04/30/2024-08926/transfer-of-certain-credits [https://perma.cc/463S-2SED] (providing guidance for IRA transferability provisions); *see also* Gabor, *supra* note 32, at 23–24 (observing that the IRA direct pay provisions may constitute an important step toward more public ownership and control, "but the extent to which state ownership will replace public subsidies for private capital remains an open question of political struggle").

addition to the IRA to channel investment into new clean energy assets at the scale and pace required to decarbonize the power sector and electrify large segments of the economy. It also poses the broader question of what this heavy reliance on markets and the private sector means for the overall governance of electricity as a system of provisioning and vital infrastructure for everyday life.

One alternative that has been advanced by critics of the IRA's de-risking strategy is the so-called Big Green State marked by predominantly public investment and public ownership of clean energy assets.[34] This was part of the impulse behind some versions of the Green New Deal in the United States and the so-called European Green Deal.[35] To be sure, there is precedent for significant state ownership of electricity in the nationalized systems that prevailed in the UK and many European countries after World War II, across much of the Global South after independence, as well as in the United States with its large public hydropower projects, regional experiments such as the Tennessee Valley Authority, and municipally owned utilities. Despite the enthusiasm on the left for extensive public ownership, however, it seems at best aspirational in the current U.S. political environment, notwithstanding important ongoing efforts to build on and promote more public investment and ownership across the electricity sector.

But there is another alternative that has not received much attention in the current debate: U.S.-style public utility regulation with its reliance on cost-of-service rate making for regulated investor-owned utilities ("IOUs"). This model, which still operates in various ways across some parts of the United States, has long provided a vehicle for channeling large amounts of capital into physical assets as well as a platform for important experiments with new rate designs to socialize costs and to improve access and

34. *See* Gabor, *supra* note 32, at 25 ("The green capitalist state in the Global North is a derisking state."); Daniela Gabor & Benjamin Braun, Green Macrofinancial Regimes 3–4 (Oct. 21, 2023) (unpublished manuscript), https://osf.io/preprints/socarxiv/4pkv8 [https://perma.cc/QUJ2-DBQK] (identifying the "big green state" as one of four "green macrofinancial regimes" that "coordinates economic activity through state-led planning, prioritises public investment in both green infrastructure and green industrial sectors by tightening monetary-fiscal coordination, and closely controls private credit flows").

35. *See* Gabor & Braun, *supra* note 34, at 4*; see also* RONNIE BELMANS, ILARIA CONTI, ALBERT FERRARI, GIULIO GALDI, LEIGH HANCHER, JAMES KNEEBONE, LEONARDO MEEUS, ATHIR NOUICER, MARIA OLCZAK, ANDRIS PIEBALGS, ALBERTO POTOTSCHNIG, VALERIE REIF, DANIELE STAMPATORI & TIM SCHITTEKATTE, EUROPEAN UNIV. INST., THE EU GREEN DEAL 10–12 (2022), https://cadmus.eui.eu/handle/1814/75156 [https://perma.cc/LS43-3CV8]; Sean Sweeney, *Beyond Recovery: The Global Green New Deal and Public Ownership Of Energy* 9 (Trade Unions for Energy Democracy, Working Paper No. 16, 2023), https://assets-global.website-files.com/63276dc4e6b803208bf159df/64f1f5676c56f498e152e5ba_TUED_WP16_final%20(2).pdf [https://perma.cc/P52Y-5UV6].

affordability.[36] Without question, the basic public utility model in the U.S. has had its share of challenges, leading to intense criticism and repeated calls for reform and even wholesale abandonment. But in the current moment, given the need to significantly ramp-up investments in long-lived physical assets and secure a low cost of capital, it seems important to revisit the public utility model and ask what role it might play in the ongoing effort to decarbonize the power sector and electrify much of the rest of the economy.[37]

To say, then, that the forty-year experiment with electricity markets has failed is hardly a sufficient rejoinder to the question of what is to be done in the face of the looming climate crisis and the pressing need to address the twin challenges of investment and affordability at the heart of the clean energy transition. Before we turn to the question of where we might be headed, however, it is critical to understand how and why these markets emerged in the first place, and the nature of their failures. Put simply, we need to understand the multi-decade effort to make electricity into a commodity before we can understand the different ways in which it can be and already is being decommodified.

Given the rather large and longstanding literatures on commodification and decommodification in law and social science, it is important to specify here the way that this Article uses these concepts.[38] At a general level, the

36. *See* William Boyd, *Public Utility and the Low-Carbon Future*, 61 UCLA L. REV. 1614, 1683–99 (2014) (discussing the role of public utility regulation in planning and investment in low carbon infrastructure); William Boyd & Ann E. Carlson, *Accidents of Federalism: Ratemaking and Policy Innovation in Public Utility Law*, 63 UCLA L. REV. 810, 844–61 (2016) (discussing the role of public utility rate regulation in promoting low-carbon baseload generation and grid modernization).

37. *See* Boyd, *supra* note 36, at 1618–19.

38. Karl Marx famously began his investigation of the capitalist mode of production with a close analysis of the commodity form, the immense accumulation of commodities in capitalist society, and the way that the "fetishism of commodities" obscured the exploitation of labor and the production of surplus value. *See* KARL MARX, CAPITAL VOLUME I: THE PROCESS OF PRODUCTION OF CAPITAL 43–87 (Frederick Engels ed., 1867). This has in turn given rise to a massive literature on commodities, commodification, and value theory under capitalism, which is well beyond the scope of this Article. *See generally* Derek Hall, *'Commodification of Everything' Arguments in the Social Sciences: Variants, Specification, Evaluation, Critique*, 55 ENV'T & PLANNING A: ECON. & SPACE 544 (2023) (reviewing various arguments regarding commodification in the social sciences). Within law, there is an extensive normative literature on the effects (and limits) of commodification on personhood and the prospects for human flourishing. *See generally* MARGARET JANE RADIN, CONTESTED COMMODITIES (1996). And there is a large and growing literature on the commodification of nature (and its limits), much of which traces back to Karl Polanyi's notion of fictitious commodities. *See* KARL POLANYI, THE GREAT TRANSFORMATION: THE POLITICAL AND ECONOMIC ORIGINS OF OUR TIME 68–76 (1944) (observing that land, labor, and money are not truly commodities and that the extension of market logics to these "fictitious commodities" results in the degradation and destruction of the substance of society, which then manifests as crisis); *see also* Nancy Fraser, *Can Society be Commodities All the Way Down? Post-Polanyian Reflections on Capitalist Crisis*, *in* THE COMMON GROWL: TOWARD A POETICS OF PRECARIOUS COMMUNITY 139, 155–56 (Thomas Claviez ed., 2016). Brett Christophers argues that

effort to make electricity into a commodity can be seen as an effort to replace existing non-market modes of governing a key system of provisioning with a privatized, market-governed system of coordination.[39] More specifically, the entire effort was expressly conceived and directed at making electricity into a commodity like natural gas, oil, or other bulk commodities, with a mix of forward and spot markets, and a pricing system built around marginal cost. There were two important components to this effort that are important to keep in mind. First, on the upstream, wholesale side of the industry, the vertically integrated structures of existing state-owned and heavily regulated systems were unbundled and replaced with competition among private, unregulated generators through a mix of long-term forward markets and short-term spot markets. These markets were explicitly designed to operate in a manner like those prevailing in other commodity markets, with the single-clearing price in the auctions intended to capture the short-run marginal cost of producing the last increment of supply needed to meet demand. Although the effort has never been completely realized, in part given the distinctive challenges of electricity, the establishment of wholesale markets for electricity does represent a remarkable socio-technical achievement. Second, on the downstream, retail side of the industry, the goal was to replace the previous model of dedicated customers paying flat rates to regulated monopoly providers based on average costs with competition among retail providers and dynamic retail rates that would transmit the clearing prices in the wholesale markets directly to retail customers, thereby allowing the price system to deploy true marginal cost pricing all the way through to the end users. For reasons discussed in more detail below, this effort has also been partial and incomplete. The key point for now, though, is to underscore that the basic idea at the center of both wholesale and retail electricity restructuring was to create markets that would allow for the exchange of electricity between producers and consumers via pricing mechanisms based on marginal costs.

electricity should be viewed as a fictious commodity like land and labor because it was not originally produced for the market and that this is the source of many of the current problems with electricity markets. *See* CHRISTOPHERS, *supra* note 27, at 361–64. While these arguments are beyond the scope of this Article, it is not clear that electricity, like other energy carriers and unlike land and labor, cannot be produced as a commodity (as it has been for many decades), notwithstanding the fact that the underlying technologies and cost structures may render certain market structures problematic. And, of course, the question whether it is actually desirable to subject electricity to various market arrangements would seem to depend more on one's underlying normative commitments regarding electricity as a system of provisioning rather than something inherent in the nature of electricity.

39. A recent opinion from the D.C. Circuit illustrates the point for the United States. *See* Vistra Corp. v. FERC, No. 21-1214, slip op. at 5 (D.C. Cir. Aug. 15, 2023) ("Although today electricity is a commodity often bought and sold in a decentralized system, that was not always the case.").

The Article proceeds in three parts. First, it provides a brief global genealogy of "neoliberal electricity" that shows how the project of privatization and restructuring emerged and spread around the world, focusing on the intellectual, technical, and political histories that came together to support the move to electricity markets. The goal here is to show how various neoliberal experiments sought to turn electricity into a commodity and the consequences this brought forth. Second, the Article demonstrates how these efforts to create markets for electricity have struggled with persistent challenges of market power, chronic underinvestment, high prices, and an inability to support renewable energy at scale. The main takeaway here is that these markets have failed on multiple grounds and are no longer viable as electricity becomes the main instrument of decarbonization in most economies around the world and as more and more aspects of everyday life are electrified. Third, the Article articulates some of the features of what an alternative, decommodified approach to electricity might look like as the clean energy transition accelerates, focusing specifically on the relationship between capital and infrastructure and the possibilities (old and new) for driving investment and cost recovery, the need for "social ratemaking" to ensure access and affordability, and the potential for a more cooperative approach to balancing the system as intermittent renewables come to dominate the supply of electricity.

The Article draws inspiration from recent work traveling under the rubric of law and political economy as well as some of its precursors in legal realism and the old institutional economics.[40] It also focuses specifically on a set of questions and concerns that have long preoccupied the fields of public utility and regulated industries law but have recently been revived and updated in the context of a new cross-sectoral approach to economic regulation known as networks, platforms, and utilities ("NPU") law.[41] The

40. *See, e.g.*, Jedediah Britton-Purdy, David Singh Grewal, Amy Kapczynski & K. Sabeel Rahman, *Building a Law-and-Political-Economy Framework: Beyond the Twentieth-Century Synthesis*, 129 YALE L.J. 1784, 1790–94 (2020) (arguing for a new "law-and-political economy" approach to legal scholarship built on a reorientation from twentieth-century concerns with efficiency, neutrality, and anti-politics toward power, equality, and democracy); Yochai Benkler, Structure and Legitimation in Capitalism: Law, Power, and Justice in Market Society 18 (Oct. 26, 2023) (unpublished manuscript), https://ssrn.com/abstract=4614192 [https://perma.cc/3LBN-CW6J] ("At the broadest level, we can think of law as one of the primary systems modern capitalist societies use to structure social relations of production by institutionalizing market dependence for subsistence, production, and protection, and structuring the patterns and terms of coordinated collective action."); Robert Lee Hale, *Bargaining, Duress, and Economic Liberty*, 43 COLUM. L. REV. 603, 625–626 (1943) ("The market value of a property or a service is merely a measure of the strength of the bargaining power of the person who owns the one or renders the other, under the particular legal rights with which the law endows him, and the legal restrictions which it places on others."); 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 . . . .").

41. *See generally* MORGAN RICKS, GANESH SITARAMAN, SHELLEY WELTON & LEV MENAND,

key concern is to understand not so much how law regulates economic actors but how it structures industries and shapes markets; that is, how it constitutes distributional struggles over the design, maintenance, and restructuring of economic institutions and, specifically, those governing key infrastructures and systems of provisioning.[42] Much of this work, particularly in law and political economy, has focused on critiques of neoliberalism, and much of it has been domestic in orientation. This Article joins in the critique of neoliberalism, as manifest in the move to privatize and deregulate electricity over the last forty years, but it does so in a broader global context that seeks to properly situate the project of neoliberal electricity in all of its world-making ambitions. It also attempts to go beyond critique and offers some normative arguments regarding a new set of institutional arrangements for the coming age of electricity.[43]

I. NEOLIBERAL ELECTRICITY: A SHORT HISTORY

The move to restructure and liberalize both state-owned and heavily regulated electricity systems reflected a confluence of factors taking shape across multiple countries starting in the 1980s. The story played out differently in different places, given that the electricity sector, like other network industries, has always been place-bound and heavily domestic in orientation. But electricity, and neoliberal electricity in particular, has a global history that is important to understand as the industry transitions to a low-carbon future.

Recognizing that this history can be told in different ways, this Part focuses on three major strands that came together in the making of neoliberal electricity. First, a powerful and sustained economic critique directed at state-owned and heavily regulated public utility systems hit full stride in the 1970s and 1980s and provided an intellectual call-to-arms for efforts to privatize and liberalize electricity markets. Second, a series of innovations in mechanism design, operations research, and experimental economics provided the basic rules and techniques used to build the auctions that operate at the center of these markets. Third, domestic political developments that often reached to the very highest levels of government

NETWORKS, PLATFORMS, AND UTILITIES: LAW AND POLICY (2022) (providing an overview of NPU law).

42. *See* Benkler, *supra* note 40, at 18–26 (discussing how law structures social relations of production in modern capitalist society both functionally via the assignment of different entitlements and disentitlements to various groups and symbolically through various processes of legitimation).

43. *Cf.* Dieter Helm & Cameron Hepburn, *The Age of Electricity*, 35 OXFORD REV. ECON. POL'Y 183, 186 (2019) ("In sum, for powerful reasons both on the demand and the supply side, an age of electricity now appears to be inevitable. The only question is the pace of change. It will not be stopped by policy errors, but could be accelerated by sensible interventions. And acceleration matters enormously for the environment.").

opened new policy horizons for ambitious market experiments in leading jurisdictions.

A. INTELLECTUAL COMMITMENTS

Two important intellectual developments underwrote the move to privatize and restructure electricity. First, the powerful and sustained critique of economic regulation and state ownership that took shape during the 1970s provided the theoretical and normative case for the move to competitive markets. Second, the rich tradition of thinking about the challenges of marginal cost pricing for public utilities, and electricity in particular, led to a reconceptualization of the role of prices in the sector and their relationship to investment, cost recovery, and consumer behavior.

1. Economic Critiques

The standard critique of economic regulation advanced by economists and public choice theorists starting in the early 1970s has been well rehearsed.[44] Boiled down to its essentials, the critique consisted of three main points. First, the whole category of natural monopoly was unstable and incoherent and not a proper basis for regulation.[45] Second, Public Utility Commissions ("PUCs") were all too often captured by the industries they were supposed to regulate.[46] Third, cost-of-service rate making created incentives for regulated firms to overinvest in physical assets and overcharge

44. Boyd, *supra* note 36, at 1651–58 (discussing law and economics critique of rate regulation); David Spence, *Can Law Manage Competitive Energy Markets?*, 93 CORNELL L. REV. 765, 771–72 (2008) (discussing economic critiques of rate regulation as a basis for restructuring).

45. *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.").

46. *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).

ratepayers.[47] The combined effect of these critiques was simple and devastating: regulation did more harm than good.[48]

While the economic critique focused mainly on U.S. public utility regulation, it shared many of the basic commitments that animated the growing skepticism toward nationalized industries in the UK and other countries. These critiques of state ownership often rested on relatively simple complaints that state-owned enterprises were bloated and inefficient, but they drew upon a deeper hostility to planning and a conviction that unfettered markets were essential to a free society.[49] Without the discipline of competition, performance suffered, innovation was stunted, service was poor, the public paid too much, and individuals would never realize their full economic potential.[50]

As powerful as these criticisms were, however, they did not provide an obvious blueprint for restructuring.[51] In fact, the real "theory" of restructuring that underwrote liberalized electricity markets came not from the Chicago school or the enemies of state ownership but from work on contestable markets.[52] As the name suggests, contestable markets posited that as long as firms could enter and exit a market with relative ease to compete with the incumbents, this would discipline the prices charged by the incumbents even if no competing firm ever actually decided to enter and compete.[53] Put another way, as long as the market was contestable, prices

47. *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.

48. *See, e.g.*, Posner, *supra* note 45, at 625 ("[T]he social gain from public utility and common carrier regulation is quite possibly negative.").

49. *See* STEPHEN C. LITTLECHILD, THE FALLACY OF THE MIXED ECONOMY: AN AUSTRIAN CRITIQUE OF RECENT ECONOMIC THINKING AND POLICY 53–56 (1986); FRIEDRICH A. HAYEK, THE ROAD TO SERFDOM 43–46 (1944).

50. It is worth noting here that Hayek himself recognized that planning was an important response to some of the problems and complexities generated by modern industrial society, including public utilities. *See* HAYEK, *supra* note 49, at 48 (noting that problems associated with town planning and "public utilities" were of the type "not adequately solved by competition").

51. In some respects, the move to deregulate and restructure various industries cut against the basic tenets of public choice theory, given the incumbents' preference to maintain the status quo.

52. *See, e.g.*, Elizabeth E. Bailey & William J. Baumol, *Deregulation and the Theory of Contestable Markets*, 1 YALE J. ON REG. 111, 123–24 (1984) (discussing implications of theory of contestable markets for deregulation). Much of the basic theory of contestable markets was developed during the first half of the 1980s, in part as a reflection of and rationale for the broad deregulation movement that was already underway. *But see also* PAUL L. JOSKOW & RICHARD SCHMALENSEE, MARKETS FOR POWER: AN ANALYSIS OF ELECTRIC UTILITY DEREGULATION 211–21 (1983) (arguing against the simple application of models of deregulation to electricity and in favor of a more measured, long-term approach to regulatory and structural reform of the industry).

53. Bailey & Baumol, *supra* note 52, at 137 ("If particular markets are readily contested, there may be no need for continued intervention in these markets.").

could be expected to track those one would expect to see in a competitive market.[54] Thus, instead of focusing on the number of firms and the structure of the market, contestable market theory directed attention to barriers to entry and, even more importantly, barriers to exit, which together determined whether a particular market, even one marked by only a few firms, was contestable.[55] And the key to understanding barriers to exit, the proponents argued, was sunk costs.[56] Even if a firm could enter the market easily, if it had to make large investments that could not be easily recouped, it would be far less likely to enter in the first place.[57]

These insights were powerful and well-timed, providing further grounds on which to indict various forms of economic regulation and state ownership while also offering clear guidance for restructuring.[58] For starters, contestable market theory highlighted the fact that regulation often made things worse precisely because it erected new or additional barriers to entry.[59] Here the monopoly franchise for public utilities in the United States was often held out as Exhibit A.[60] More generally, contestable market theory suggested that vertically integrated industries—whether regulated or state owned—could be unbundled, allowing certain segments to be subjected to competition. Finally, for those segments that did entail high sunk costs—pipeline infrastructure, transmission systems, and local distribution networks—moving toward an open access, common carrier model that would maintain regulation but require all firms to have access to the basic infrastructure on the same rates, terms, and conditions would avoid some of the problems of regulation while further enhancing the contestability of linked markets.[61] Taken together, these elements provided the blueprint for unbundling generation from transmission and distribution, imposing new

54. *Id.* at 113 (noting that in contestable markets, efforts to raise prices and capture monopoly rents will be undermined by new entrants).

55. *Id.* ("[F]reedom of entry and exit are the key requirements of contestability.").

56. *Id.* (discussing barriers to exit); *see also* Richard E. Caves & Michael E. Porter, *Barriers to Exit*, *in* ESSAYS ON INDUSTRIAL ORGANIZATION IN HONOR OF JOE S. BAIN 39, 39 (Robert T. Masson & P. David Qualls eds., 1976) (proposing consideration of barriers to exit "as an element of market structure and ex ante determinant of market conduct and (thereby) performance"). In effect, barriers to exit operate as implicit barriers to entry in that they increase the risks associated with entry.

57. Bailey & Baumol, *supra* note 52, at 113–14 (discussing impact of sunk costs on entry and exit decisions of firms and the resulting degree of market contestability).

58. *See, e.g.*, HERBERT HOVENKAMP, THE OPENING OF AMERICAN LAW: NEOCLASSICAL LEGAL THOUGHT, 1870–1970 (2014) ("Deregulation gathered momentum because new theories about the nature of competition and industry structure combined with the lessons from experience and a terrible economy to convince policymakers that deregulation was worth a try.").

59. Bailey & Baumol, *supra* note 52, at 123 ("Direct regulatory attempts to impede entry or exit or to interfere with the timing or manner of entry must, at the very least, be questioned severely.").

60. *Id.*; Demsetz, *supra* note 45; *see also* Joshua C. Macey, *Zombie Energy Laws*, 73 VAND. L. REV. 1077, 1093 (2020).

61. Bailey & Baumol, *supra* note 52, at 124.

open-access requirements on transmission, and opening up the wholesale generation market to competition.[62] The working assumption was that the new wholesale power markets would be sufficiently contestable to ensure competitive prices, an assumption that, as we will see, proved overly optimistic.

2. Marginal Cost Pricing

Any effort to create new markets for electricity, however, also had to sort out complex issues of price formation. Given the engineering complexities of electric power systems (namely, the fact that the system operated as one big machine that had to be perfectly balanced in real time), highly inelastic demand, and the inability to store electricity, the transactional and pricing aspects of any new market would need to be carefully orchestrated.[63] Realizing the efficiencies that markets promised, in other words, required a solution to the problem of marginal cost pricing that had preoccupied economists, engineers, and regulators for more than a century.

The idea of marginal cost pricing for public infrastructure is often traced back to the mid-nineteenth-century work of Jules Dupuit and other French engineer-economists working in the French civil service.[64] Among other things, Dupuit and his colleagues were looking for ways to assess the relative value of different infrastructure investments—roads, bridges, canals, railroads—so as to better allocate resources and maximize welfare.[65] In the process, they identified some of the key challenges confronting efforts to develop efficient pricing for large infrastructure and public utilities.[66]

62. In the U.S., restructuring of wholesale markets was accomplished mainly through Orders 636 for natural gas and Order 888 for electricity. *See* Pipeline Service Obligations and Revisions to Regulations Governing Self-Implementing Transportation & Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol, 59 FERC 61,030 (1992) (unbundling natural gas pipeline business and imposing open-access regime for interstate transportation of natural gas); Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities and Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 75 FERC 61,080 (1996) (summarizing final rules requiring unbundling and open-access nondiscriminatory transmission services in order to promote competitive wholesale power markets).

63. *See* PHILIP F. SCHWEW, 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.") Boyd, *supra* note 36, at 1626–28 (discussing the distinctive features of electric power systems).

64. *See* ROBERT B. EKELUND & ROBERT F. HEBERT, SECRET ORIGINS OF MODERN MICROECONOMICS: DUPUIT AND THE ENGINEERS 178 (1999). *See generally* Robert B. Ekelund, *Jules Dupuit and the Early Theory of Marginal Cost Pricing*, 76 J. POL. ECON. 462 (1968).

65. EKELUND & HEBERT, *supr*a note 64, at 181. Ekelund and Hebert argue that Dupuit did not explicitly endorse marginal cost pricing for large infrastructure and so-called public works as many have suggested. *See id.*

66. *Id.*

Among the most important issues raised by this work involved setting prices for industries marked by declining costs. If prices were set at short-run marginal costs in these industries, firms would be unable to recover their fixed costs.[67] In an important 1938 article, Harold Hotelling took this problem head-on arguing that the best way to maximize "the general welfare" with respect to infrastructure investments marked by declining costs was for the government to use taxes on income, inheritances, and land to pay for the fixed (overhead) costs of the physical assets and to charge the public a price that was set at marginal cost, which in the case of most infrastructure would be very low or even zero.[68] According to Hotelling, two groups would be likely to object to such a scheme: the wealthy and land speculators.[69] But any losses they incurred would be more than offset by the benefits accruing to the public at large.[70]

Hotelling's intervention, which explicitly invoked Dupuit's earlier work, gave rise to a vigorous debate among economists during the 1940s and 1950s about the merits of marginal cost pricing in industries with declining costs—an episode that Ronald Coase referred to as "the marginal cost controversy."[71] In Coase's view, Hotelling's proposed solution of using tax revenues to pay for the fixed costs of infrastructure and public utility was misguided because it would create a "maldistribution of the factors of production" across the economy, an unwelcome "redistribution of income" among different classes, and "other harmful effects."[72] Most fundamentally, tax-based subsidies would deny the possibility of any sort of "market test" to determine whether the proposed investment was "worthwhile."[73] A better

67. *See, e.g.*, J.M. Clark, *Toward a Concept of Workable Competition*, 30 AM. ECON. REV. 241, 250 (1940) ("A price which at all times covers only short-run marginal cost would lead to large operating deficits whenever demand is short of capacity, and would bankrupt most industries, no matter how shock-proof their capital structures.").

68. *See generally* Harold Hotelling, *The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates*, 6 ECONOMETRICA 242 (1938). Hotelling was a lifelong admirer of Henry George and much of his proposal can be read as an application of Georgist rent theory.

69. *Id.* at 259.

70. *Id.* at 257–60.

71. *Id.* at 242 (characterizing his argument as an effort to update Dupuit's earlier arguments that "the optimum of the general welfare corresponds to the sale of everything at marginal cost"). EKELUND & HEBERT, *supra* note 64, at 182–83, argue that Hotelling was mistaken in his suggestion that Dupuit's analysis was an early example of marginal cost pricing. *See generally* R.H. Coase, *The Marginal Cost Controversy*, 13 ECONOMICA 169 (1946); Brett M. Frischmann & Christiann Hogendorn, *Retrospectives: The Marginal Cost Controversy*, 29 J. ECON. PERSPS. 193 (2015).

72. Coase, *supra* note 71, at 174. Coase returned to many of these criticisms in a 1970 article on public utility pricing. *See generally* R.H. Coase, *The Theory of Public Utility Pricing and Its Application*, 1 BELL J. ECON. & MGMT. SCI. 113 (1970).

73. *See* William Vickrey, *Some Objections to Marginal-Cost Pricing*, 56 J. POL. ECON. 218, 218 (1948) ("One of the leading objections to the marginal-cost pricing policy for decreasing-cost industries is that the admitted necessity for a subsidy leaves no simple and obvious test of whether or not the project is worth while as a whole."). Vickrey goes on to argue that this objection is less salient than many suggest

solution, Coase argued, was to use a multipart pricing scheme that included separate charges for the marginal cost of producing the good or service and for the cost of delivering it—an approach that was already well developed in public utility pricing.[74]

At roughly the same time that Coase and others were debating the merits of marginal cost pricing, another group of French engineer-economists working at Electricité de France ("EDF") (the most prominent of whom was Marcel Boiteux) were developing their own version of marginal cost pricing in their effort to rebuild the French electricity system after World War II.[75] In particular, Boiteux and his colleagues were interested in incorporating marginal costs into the rates charged for electricity in a manner that would allow them to build a national electricity system that contained an appropriate mix of thermal and hydroelectric power plants in the face of rapidly growing demand.[76] According to Boiteux, prices were not simply signals but rather tools to realize an investment policy.[77] Peak-load prices that reflected the system's marginal cost could thus be used to help mold and shape the "load curve" (a term of art for electricity demand over the course of the day or the year), thereby allowing for the efficient investment of capital into certain kinds of physical assets as determined by system

and that the alternatives are rarely better. *See id.* at 219; *see also* Frischmann & Hogendorn, *supra* note 71, at 198 ("Subsidized marginal cost pricing . . . eliminates or at least truncates signals about demand for infrastructure, significantly reducing the information available for investment decisions about how much infrastructure to build, where to build it, when to add capacity, and so on.").

74. Coase, *supra* note 71, at 173–74. As Coase noted, this type of multi-part pricing was "well known to students of public utilities." *Id.* For early discussions of multipart pricing, see generally C.L. Paine, *Some Aspects of Discrimination by Public Utilities*, 4 ECONOMICA 425 (1937); W. Arthur Lewis, *The Two-Part Tariff*, 8 ECONOMICA 249 (1941). *But see* Vickrey, *supra* note 73, at 237 (pointing to various challenges facing efforts to implement multi-part pricing and noting that such schemes were often inferior in practice to a scheme of marginal cost pricing combined with tax-based subsidies). With respect to Coase's proposed scheme of multipart pricing, in particular, Vickrey concluded:

> [T]his device [multi-part pricing] can achieve the desired result in but a limited number of cases, and, in many of these cases, success in achieving the optimum allocation of resources may require information of the same order as that required to determine whether or not the project as a whole is worthwhile under a policy of uniform marginal-cost prices.

Id. at 219.

75. *See generally* Guillaume Yon, *Building a National Machine: The Pricing of Electricity in Postwar France*, 52 HIST. POL. ECON. 245 (2020).

76. *See* Marcel Boiteux, *Electrical Energy: Facts, Problems, and Prospects*, *in* MARGINAL COST PRICING IN PRACTICE 3, 6–7 (James R. Nelson ed., 1964) (discussing EDF's "hydro-thermal problem" as a problem of investment and pricing).

77. *Id.*; *see also* Yon, *supra* note 75, at 251 ("[L]ong-term marginal costs, and the prices deduced from these costs, would be defined as a response to an investment plan, a dispatch (the movements of energy through the grid), and a concerted forecast of the future load profile. Prices were to be designed to trigger the users' behaviors that would support and be adapted to the realization of an equipment plan (the construction of new plants). Long-term marginal cost pricing considered consumers central components of a machine under development, to whom instructions were transmitted through prices."); Paul L. Joskow, *Contributions to the Theory of Marginal Cost Pricing*, 7 BELL J. ECON. 197, 199 (1976) ("The French are especially cognizant of the relationship between pricing policy and investment policy in the context of efficient operation of a public enterprise.").

planners.[78] The price system, in other words, was subordinated to, and made to work on behalf of, the need for infrastructure to support the national objective of building an electric power system based on a particular mix of assets.[79]

Notwithstanding Boiteux's efforts to ground the discussion of marginal cost pricing in the context of national planning and investment policy, however, the concept of marginal cost pricing came to be viewed over time in a more detached, generic sense as the basis for maximizing allocative efficiency in state-owned and rate-regulated public utilities.[80] The goal, as William Vickrey put it in the early 1970s, was "responsive pricing," which would allow prices to track costs and thereby lead to more efficient allocation of capital across the industry.[81] Vickrey did recognize that the move to "responsive pricing" of public utility services was ultimately a political choice that "would constitute a fairly radical departure from current practices in utility pricing," at least in the United States.[82] But in his view, it would be "well worth the considerable effort that [would] be needed to put it into practice" given "the very substantial improvements in economic efficiency" that would be gained.[83] Indeed, responsive pricing was as close as one could

78. *See* Boiteux, *supra* note 76, at 28 ("This new rate structure for high-voltage sales, which will soon be followed by a reform of low-voltage tariffs, is designed to direct the free choices of users toward the types and methods of use which are most advantageous to the country.").

79. Marcel Boiteux, *Peak-Load Pricing*, *in* MARGINAL COST PRICING IN PRACTICE 59, 84 (James R. Nelson ed., 1964) ("[T]he very fact of making peak consumers pay what their consumption actually costs has led subscribers to revise their behavior in a way that can only be beneficial. This open incentive to help to improve the productivity of the nation as a whole is not one of the least merits of price mechanisms; it would be wrong to fail to use its possibilities to the full."); Yon, *supra* note 75, at 250–51 ("Their aim was not just to signal, correctly and without distortion, existing and transparent costs of production to consumers. . . . Instead, EDF's engineers deployed economic calculations to make politically informed decisions on the design of technologies of production and on the future strategic uses of electricity . . . .").

80. As Ralph Turvey put it in an important elaboration of Boiteux's work, "Marginal cost pricing in electricity means a tariff structure such that the cost to any consumer of changing the level or pattern of his consumption equals the cost to the electricity supply industry of his doing so. This can be achieved more or less closely according to whether the tariff structure is more or less complicated." RALPH TURVEY, OPTIMAL PRICING AND INVESTMENT IN ELECTRICITY SUPPLY: AN ESSAY IN APPLIED WELFARE ECONOMICS 86 (1968). There is a general assumption throughout this literature that demand response (or load management) is a critical part of system optimization in the short term and that high prices are the best way to bring load into alignment with available capacity. *Id.* at 91 (observing that "rationing by price is preferred to rationing by power cuts").

81. *See generally* William Vickrey, *Responsive Pricing of Public Utility Services*, 2 BELL J. ECON. & MGMT. SCI. 337 (1971).

82. *See id.* at 346 ("Indeed the main difficulty with responsive pricing is likely to be not mechanical or economic, but political. The medieval notion of the just price as an ethical norm, with its implication that the price of a commodity or service that is nominally in some sense the same should not vary according to the circumstances of the moment, has a strong appeal even today.").

83. *Id.*

hope to get to the virtues of a "free market" in industries marked by "heavy fixed costs and economies of scale."[84]

During the early 1970s, as electricity rates increased across the United States for the first time in decades, several public utility commissions began to explore the possible use of marginal cost pricing as a basis for retail rates.[85] Environmental groups also began to push PUCs in this direction based on their conviction that the prevailing practice of declining block rates (that is, the more you use the less it costs) undermined efforts to promote conservation and efficiency and that marginal cost pricing would reduce the amount of new generation that needed to be built by shaving peaks and possibly even reducing overall demand.[86] In 1974, the Wisconsin Public Service Commission issued a landmark order that embraced marginal cost pricing as a key principle in rate design.[87] In New York, Alfred Kahn, who had just become chair of the New York Public Service Commission, opened a "generic" rate investigation to develop principles and methods for marginal cost pricing.[88] After thirty-five days of hearings, the New York Commission

84. *Id.* ("The free market has often enough been condemned as a snare and a delusion, but if indeed prices have failed to perform their function in the context of modern industrial society, it may not be because that free market will not work, but because it has not been effectively tried. Responsive pricing may not be the same thing as the free market, but it is the closest approach that can be devised in a context of heavy fixed costs and economies of scale.").

85. *See* Joskow, *supra* note 77, at 197 (noting increased interest among state public utility commissions in the application of marginal cost pricing principles to electricity rates); Samuel Huntington, *The Rapid Emergence of Marginal Cost Pricing in the Regulation of Electric Utility Rate Structures*, 55 B.U. L. REV. 689, 691 (1975) ("If implemented by peak load or time-of-day rates, marginal cost pricing will provide economic incentives for customers to make more efficient use of utility capacity and fuel resources. This will in turn contribute toward an economically efficient allocation of all resources."). Much of this was driven by the exhaustion of economies of scale in thermal power generation by the late 1960s and the price shocks associated with the 1973 oil embargo, which together translated into significant increases in electricity rates. The overall goal was to find new rate designs that would promote more load shifting among customers (what was often called "load management") to avoid additional expenditures for new capacity. Joskow, *supra* note 77, at 197.

86. The Environmental Defense Fund, for example, intervened in proceedings in Wisconsin and New York. Peak-load pricing was designed to flatten the load curve (shave the peaks) and thus avoid the need to invest in new capacity to meet such peaks. *See* DOUGLAS D. ANDERSON, REGULATORY POLITICS AND ELECTRIC UTILITIES: A CASE STUDY IN POLITICAL ECONOMY 110–13 (1981) (discussing Environmental Defense Fund's interventions in rate reform proceedings in Wisconsin, New York, and other states during the 1970s to advocate for marginal cost pricing).

87. *See* Application of Madison Gas and Electric Company for Authority to Increase its Electric and Gas Rates, No. 2-U-7423, Wis. Pub. Serv. Comm'n, at 80 (Aug. 8, 1974) [hereinafter Madison Gas] ("The principle of marginal cost pricing is an appropriate guide for the purpose of the design of rates of Madison Gas and Electric Company and other Wisconsin Energy utilities. Such a principle has been shown to be the most effective way to obtain efficient allocation of resources and to prevent wasteful use of electric energy.").

88. *See* N.Y. Pub. Serv. Comm'n, *Order Instituting Proceeding*, No. 26806 (Jan. 29, 1975) ("Rapidly increasing costs of new generating facilities and the rising cost of fuel both make it urgent, in the interest of energy conservation and the efficient use of resources, that the structure of energy prices reflect, to the greatest extent feasible, the variations in the incremental costs of service because of differences in the time of consumption, as well as in all other cost-influencing factors.").

issued an order concluding that marginal costs provided a "reasonable basis for electric rate structures," and directed the state's electric utilities to consider how "to translate marginal cost analyses into rates."[89] These efforts received a further boost in 1978 with passage of the Public Utility Regulatory Policy Act ("PURPA"), which implicitly endorsed the concept of marginal cost pricing and directed state PUCs to consider new rate designs based on time-of-use.[90]

Despite enthusiastic support from economists and other utility reform advocates, however, none of these efforts made much of an impact on existing residential rate structures across the country.[91] Aside from some modest experiments with time-of-use rates and peak-load pricing in a handful of states, most residential customers continued to pay flat rates based on historical average costs.[92] Part of the reason for this was because of the complexity of trying to design rate structures that would reflect marginal costs while also meeting revenue requirements for utilities.[93] Part of it also

89. *See* Opinion and Order Determining Relevance of Marginal Costs to Electric Rate Structures, Case 26806, Opinion No. 76-15, N.Y. Pub. Serv. Comm'n, at 31, 33–34 (Aug. 10, 1976) [hereinafter N.Y. Pub. Serv. Comm'n 1976 Order]. In a section of the Order on "marginal cost theory," the Commission quoted extensively from Paul Joskow to illustrate the merits of marginal cost pricing for electricity and other commodities:

> Prices act as signals to consumers indicating the cost to them of additional consumption of various commodities. To the extent that commodity prices are equal to the marginal social costs of production, these pricing signals indicate simultaneously the cost of commodities to individual consumers and the cost of producing such commodities from the viewpoint of society as a whole. With prices set equal to marginal cost, consumers' decisions regarding the trade-offs associated with the consumption of different commodities are guided by signals which reflect the actual production of commodities. . . . There is, I submit, no real argument about whether marginal cost pricing is right or wrong. If our goal is economic efficiency, it is almost definitional that the prices of commodities must reflect the marginal social cost of supplying these commodities.

Id. at 7–8 (quoting Paul Joskow). In his academic writing, Kahn had also long been an advocate for marginal cost pricing. *See, e.g.*, ALFRED E. KAHN, THE ECONOMICS OF REGULATION VOL. I 65 (1970) ("The central policy prescription of microeconomics is the equation of price and marginal cost. If economic theory is to have any relevance to public utility pricing, that is the point at which the inquiry must begin.").

90. Public Utility Regulatory Policies Act, Pub. L. No. 95–617, 92 Stat. 3117 (1978).

91. Many industrial and commercial customers, on the other hand, did take advantage of time-variant rates. *See* Tim Schittekatte, Dharik Mallapragada, Paul L. Joskow & Richard Schmalensee, *Electricity Retail Rate Design in a Decarbonizing Economy: An Analysis of Time-of-Use and Critical Peak Pricing* 2 (Mass. Inst. of Tech. Ctr. for Energy & Env't Pol'y Rsch., Working Paper No. 2022-015, 2022) (noting that most residential and small commercial customers in the United States continue to pay flat per kilowatt-hour rates whereas some large industrial and commercial customers have been able to take advantage of time-variant rates).

92. *See* ANDERSON, *supra* note 86, at 128–32.

93. *See, e.g.*, KAHN, *supra* note 89, at 182 ("The task of translating these principles [of marginal cost pricing] into actual price schedules is so extraordinarily difficult that it is entirely possible to accept their validity while at the same time concluding that the task of following them is an impossible one. . . . [E]ven the most sophisticated and conscientious effort to apply these principles inevitably involves large doses of subjective judgment and, at the very best, can achieve only the roughest possible approximation of the desired results.").

stemmed from older commitments to using historical average costs, which were easier to calculate and verify based on uniform accounting.[94]

But the concept of marginal cost pricing did have an important impact on the whole approach to public utility pricing that fed into larger concerns about the sector and the need for restructuring.[95] By elevating efficiency concerns, particularly during a moment when prices were rising and regulators were struggling to make sense of a new macroeconomic environment, marginal cost pricing worked to displace and discredit some of the longstanding redistributive aims of public utility.[96] In particular, it made visible the cross-subsidies that had long operated in the shadows of flat rates based on historical average costs.[97] It also provided a foil to the efforts by consumer groups and others during the 1970s to adopt "lifeline rates" for poor customers, a topic that we will return to in Part III below.[98] Alfred Kahn, in fact, was notable in his hostility to the whole idea of lifeline rates, which he dismissed as "social ratemaking" and antithetical to any economically responsible approach to setting rates.[99]

94. *See* JAMES C. BONBRIGHT, ALBERT L. DANIELSEN & DAVID R. KAMERSCHEN, PRINCIPLES OF PUBLIC UTILITY RATES 414 (2d ed., 1988) (observing that despite the enthusiasm for marginal cost pricing among economists and others, the actual application of marginal cost pricing in the utility industry was quite limited and noting that for most electric utilities rate design continued to be based on average system costs).

95. *See, e.g.*, Madison Gas, *supra* note 87, at 90 (Richard D. Cudahy, concurring) ("Electricity has become a very much more precious commodity than it was previously believed to be. Conservation and a strict accounting of costs—both pecuniary and environmental—have become the order of the day. For these reasons primarily it seems clearly justified to explore much more exacting systems of cost determination than were previously thought appropriate. It is, perhaps, belaboring the obvious to recite that, because electricity cannot be stored, the cost characteristics of kilowatt-hours delivered at different hours of the day and during different seasons of the year may be quite different. . . . Only, I think, by seeking to change the system to provide rate incentives or penalties, as the case may be, to those who can and will change their usage to improve the overall economics and social impacts of the system can we make really significant progress. . . . The hour is late and the system cries out for better methods of control. The emphasis should no longer be entirely on an adequate supply of electricity whenever demanded, but also on a structuring of demand to call forth a more orderly and economic supply.").

96. *See* BONBRIGHT ET AL., *supra* note 94, at 179–82 (discussing the tradeoffs between fairness and efficiency in ratemaking).

97. *Id.* at 525–26 (discussing the inevitability of discriminatory pricing in ratemaking based on average cost); *see also* KAHN, *supra* note 89, at 102–03 (discussing problem of internal subsidization in rate designs that are not based on true marginal cost pricing).

98. *See infra* Section III.B.

99. *See* ANDERSON, *supra* note 86, at 118 (quoting Kahn's 1975 reference to lifeline rates as "social ratemaking" in a statement before the New York Assembly's Committee on Corporations, Authorities and Commissions); *see also* N.Y. Pub. Serv. Comm'n 1976 Order, *supra* note 89 at 16 (observing in the proceeding on marginal cost pricing for electricity that "there is at the very least implicit agreement among almost all the parties, with the principal exception of some of the advocates of so-called Lifeline rates, that customers should, to the maximum extent feasible, pay rates based upon the differing costs they impose upon the system, however those costs are defined").

Finally, although much of the discussion of marginal cost pricing had taken place in the context of state-owned and regulated systems (and was largely directed at establishing more efficient rate structures within these systems), there was an important sense in which it reinforced the case for markets. In fact, if designed correctly, competitive spot markets for electricity might provide a solution to the challenge of translating marginal costs into rates precisely because the new markets would provide a robust, granular price signal that reflected the changing costs of generation across time as well as the specific physical constraints of the transmission system.[100] Making this work in practice turned out to be an enormously complicated technical and computational problem given the peculiar nature of electricity networks and their variability over space and time.[101] In the U.S., a system of locational marginal pricing ("LMP") was developed during the 1990s to translate the theory of short-term spot pricing into a workable approach that could capture both the changing cost of supply at particular locations and the additional costs of transmission congestion on the network.[102] LMP has subsequently been adopted by all of the wholesale

100. *See* JOSKOW & SCHMALENSEE, *supra* note 52, at 80–81 ("[A]n ideal pricing system for electricity would set prices equal to short-run marginal cost of providing electricity at different voltage levels. Complications arise, however, because marginal costs in real power systems vary from minute to minute, from day to day, and from season to season."); *see also* Stephen C. Littlechild, *Spot Pricing of Electricity: Arguments and Prospects*, 16(4) ENERGY POL'Y 398, 398 (1988) ("Spot pricing of electricity, whereby prices change from moment to moment according to the changing balance of supply and demand, is often attributed to a proposal by Vickrey.") (citing Vickrey's 1971 article, *Responsive Pricing of Public Utility Services*, *supra* note 81). Littlechild was the chief architect of the UK experiment in privatization and liberalization of electricity. *See infra* Section I.C.2.

101. The solution here came not from market theorists but rather from a group of power system engineers at MIT working on the theory and practice of spot pricing for electricity, with prices varying across both space and time. *See generally* FRED C. SCHWEPPE, MICHAEL C. CARAMANIS, RICHARD D. TABORS & ROGER E. BOHN, SPOT PRICING OF ELECTRICITY (1988). As Fred Schweppe and his colleagues observed at the beginning of their landmark book on spot pricing: "There is a need for fundamental changes in the ways society views electric energy. Electric energy must be treated as a commodity which can be bought, sold, and traded, taking into account its time- and space-varying values and costs." *Id.* at xvii. And in a sweeping assertion of the natural teleology of markets, they observed that "[s]pot pricing is the natural evolution of existing techniques for power system operation, planning, load management and the economic theory of marginal cost pricing." *Id.* at xviii; *see also* Daniel Breslau, *Redistributing Agency: The Control Roots of Spot Pricing of Electricity*, 52 HIST. POL. ECON. 221, 234–39 (2020).

102. The seminal paper that provided the basis for the development of locational marginal pricing ("LMP") is William W. Hogan, *Contract Networks for Electric Power Transmission*, 4 J. REGUL. ECON. 211 (1992). Hogan and others worked closely with utilities in the New York Power Pool and the Pennsylvania-New Jersey-Maryland Interconnection ("PJM") during the early 1990s to develop the LMP concept. As the organized electricity markets in PJM and New York took shape in the mid to late 1990s, the challenges of managing congestion in a decentralized market became acute. In 1997, the Federal Energy Regulatory Commission ("FERC") approved PJM's proposed LMP market design and in 1999 it approved an LMP design for the New York Independent System Operator ("NYISO"). *See, e.g.*, Order Conditionally Accepting Open Access Transmission Tariff and Power Pool Agreements, Establishment of an Independent System Operator and Control Over Jurisdictional Facilities, FERC No. ER97-3189, EC97-38 (Nov. 25, 1997); FERC Order, No. ER-97-1523, ER97-4234, 86 FERC ¶ 61,062 (Jan. 27, 1999); *see also* THOMAS-OLIVIER LEAUTIER, IMPERFECT MARKETS AND IMPERFECT REGULATION: AN INTRODUCTION TO THE MICROECONOMICS AND POLITICAL ECONOMY OF POWER MARKETS 182 (2019)

markets in the U.S. as well as several foreign markets. Translating these short-term wholesale spot market prices into dynamic, real-time prices for retail customers, however, has not been widely adopted in the United States, in part because states still retain jurisdiction over retail prices and in part because of lack of interest from customers. As discussed in Part II, this has significantly limited the ability of supply and demand to mutually adjust in real time and undermined the ability of electricity markets to deliver the full benefits of marginal cost pricing.

B. MARKET DEVICES

Translating these broad commitments to competition and marginal cost pricing into an actual market in the real world was, of course, easier said than done. The main challenge involved creating a package of rules, devices, and institutions capable of formatting the interaction of supply and demand in a manner that would consistently generate prices that reflected marginal costs.[103] Because electricity networks operate as a single integrated machine, where supply and demand must be balanced in real time, this required centralized systems operations that would embed any sort of market arrangement within the basic engineering requirements of the grid.[104]

Here again the basic approach grew out of the experience with vertically integrated systems. Indeed, grid managers in the regulated and state-owned utilities had long used a system of least cost economic dispatch to ensure that the entire system was run as efficiently as possible subject to the basic engineering constraints of the grid.[105] Generating units were ranked in merit order depending on their costs and dispatched from low cost to high until demand was satisfied. In these vertically integrated systems, the fixed and variable costs of each generating unit were known and could be used as a basis for dispatch decisions. Control of the system thus proceeded based on extensive knowledge of how all the parts fit together.[106]

(discussing Hogan's contributions to the development of locational marginal pricing).

103. *Cf.* Marion Fourcade, *Price and Prejudice: On Economics and the Enchantment (and Disenchantment) of Nature*, *in* THE WORTH OF GOODS 42, 45 (Jens Beckert & Patrik Aspers eds., 2011) ("Many pricing technologies, then, are tools (complex, highly sophisticated economic tools) that bring markets into existence. That is, they are technologies whose purpose is to construct a space of 'tradability.' "); Michel Callon & Fabian Muniesa, *Economic Markets as Calculative Collective Devices*, 26 ORG. STUD. 1229, 1240 (2005) (noting "the existence of a multiplicity of practical forms of confrontation between supply and demand" across different markets); *see also* Boyd, *supra* note 21, at 756–57 (discussing role of rules, devices, and techniques in constituting markets).

104. See Boyd, *supra* note 21, at 784, for a discussion.

105. The basic approach was known as "security constrained economic dispatch." *See* FED. ENERGY REGUL. COMM'N, SECURITY CONSTRAINED ECONOMIC DISPATCH: DEFINITION, PRACTICES, ISSUES AND RECOMMENDATIONS 5–6 (2006) (describing basic concept of security constrained economic dispatch).

106. *See, e.g.*, JOSKOW & SCHMALENSEE, *supra* note 52, at 25–26 (discussing benefits of vertical

Finding a "market device" that could replicate this across a fleet of competitive generators where the costs were not known was no small task.[107] Two main challenges confronted the effort. First, the basic design of these markets and their associated activity rules needed to ensure that generators would not be rewarded for offering to sell at inflated prices. Put another way, generator bidding needed to be constrained by a set of rules that would encourage them to submit bids at their actual marginal cost. This was not, as we will see, a simple question of market structure, and the effort to ensure a consistent pattern of honest bidding across these markets has proved to be quite challenging. Second, generators needed sufficient revenues to cover their total costs (that is, both fixed and variable costs) and needed to have sufficient confidence that they would be able to do so going forward to make new investments. Any new market arrangements thus needed to produce sufficient economic rents to maintain enough capacity to meet peak demand and to stimulate enough new investment so that the system would be able to satisfy future demand. This too would prove to be quite challenging.

1. Honest Bidding

For spot markets, the challenge was to create a market mechanism that could consistently generate prices that reflected marginal costs and to avoid gaming by generators. Put another way, the challenge was to make generators behave like honest bidders. As it turned out, economists working in the fields of auction theory had been thinking about a related set of problems since the early 1960s. In 1961, a decade after his initial interventions in the area of public utility pricing, William Vickrey demonstrated that the "incentive properties" of specific auction designs could be used to elicit truthful information from bidders in their bidding strategies.[108] In effect, by separating the price-as-bid from the price received (the clearing price), bidders in a sufficiently competitive market had no

integration in power systems).

107. *See, e.g.*, Fabian Muniesa, Yuval Millo & Michel Callon, *An Introduction to Market Devices*, *in* MARKET DEVICES 1, 2 (Michel Callon et al. eds., 2007) (describing the notion of a market device "as a simple way of referring to the material and discursive assemblages that intervene in the construction of markets"); *see also* DONALD MACKENZIE, AN ENGINE, NOT A CAMERA: HOW FINANCIAL MODELS SHAPE MARKETS 275 (2006) (directing attention to the "infrastructures of markets: . . . the material devices, procedures, routines, rules, and design features that make markets what they are").

108. *See, e.g.*, William Vickrey, *Counterspeculation, Auctions, and Competitive Sealed Tenders*, 16 J. FIN. 8, 9–10 (1961). Laurence Ausubel and Paul Milgrom observed that Vickrey's article

> marked the first serious attempt by an economist to analyze the details of market rules and to design new rules to achieve superior performance. He demonstrated that a particular pricing rule makes it a dominant strategy for bidders to report their values truthfully, even when they know that their reported values will be used to allocate goods efficiently.

Lawrence M. Ausubel & Paul Milgrom, *The Lovely but Lonely Vickrey Auction*, *in* COMBINATORIAL AUCTIONS 17, 17 (Peter Cramton et al. eds., 2006).

incentive to make inflated bids.[109] Although Vickrey's paper was ignored for the better part of a decade, its key insight would become central to efforts in coming decades to adopt specific auction formats to encourage certain forms of behavior.[110]

More generally, as the field of mechanism design gained traction within economics, a new generation of market designers worked to translate the insights of Vickrey and others into the design of actual markets.[111] In the UK, economist Sally Hunt and her colleagues convinced the government to use a single-price auction format for the UK's mandatory short-term electricity market.[112] In California, Robert Wilson made use of Vickrey's insights to explain how different auction designs and activity rules could be used to create what he called a "mode of competition" for electricity markets that would suppress gaming and force market participants to reveal truthful information in their bidding strategies.[113] As one of the key architects of the new California market, Wilson recognized that a uniform or single-price auction design wrapped in detailed activity rules would provide the honest bidding outcome that Vickrey had hypothesized decades earlier.[114]

The basic design of the single-clearing price auction was quite simple. Generator bids would be stacked in ascending order from lowest price to

109. Vickrey, *supra* note 108, at 26 (noting that the uniform price auction design "has the more material advantage of reducing the probability that a bidder's own bid will affect the price he receives, thus inducing bids closer to the full value to the bidder, improving the chances of obtaining or approaching the optimum allocation of resources, and reducing effort and expense devoted to socially superfluous investigation of the general market situation").

110. *See* PHILIP MIROWSKI & EDWARD NIK-KHAH, THE KNOWLEDGE WE HAVE LOST IN INFORMATION: THE HISTORY OF INFORMATION IN MODERN ECONOMICS 170–72 (2017) (discussing Vickrey's contributions to auction theory and the development of what they refer to as the Bayes-Nash school of market design).

111. *See id.* at 171–78 (discussing Robert Wilson's contributions to auction theory and mechanism design as well as his involvement in the design of electricity markets). Wilson had worked under the decision theorist Howard Raiffa at Harvard Business School and was part of an early group of academics seeking to bring insights from operations research and decision theory into economics departments and business schools. *Id.* at 171–72. In 2020, Wilson received the Nobel prize, along with Paul Milgrom, for his work on auction theory. Press Release, The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2020 (Oct. 12, 2020), https://www.nobelprize.org/prizes/economic-sciences/2020/press-release [https://perma.cc/3ARS-BFHC].

112. *See* RONAN BOLTON, MAKING ENERGY MARKETS: THE ORIGINS OF ELECTRICITY LIBERALISATION IN EUROPE 102–03 (2021).

113. *See* Robert Wilson, *Design Principles*, *in* DESIGNING COMPETITIVE ELECTRICITY MARKETS 159, 161 (Hung-Po Chao & Hillard G. Huntington eds., 1998) ("[M]y aim is to construct a design that suppresses gaming or renders it ineffective in favor of greater efficiency. The principle, however, is to treat the market design as establishing a mode of competition among the traders. The key is to select a mode of competition that is most effective in realizing the potential gains from trade.").

114. *See id.* at 182 n.16 ("The activity rules for the California PX are adapted from the FCC's auctions of spectrum licenses, which have been notably successful and are now used worldwide. The PX rules were tested in laboratory experiments at Caltech with good results, but they will not be implemented in the PX until late 1998, so there is presently no factual evidence on their performance in practice.").

highest. Load serving entities would likewise submit offers to buy at various prices, arranged from lowest to highest, although because of the highly inelastic nature of electricity demand the demand curve was essentially fixed. The last increment of generation needed to meet demand would set the clearing price. All generators that submitted bids below that price would receive the clearing price. All load serving entities that submitted offers above the clearing price would pay the clearing price. As long as there was no market power and as long as individual bidders did not know the bidding strategies of their competitors, they had no incentive to bid above marginal cost. By submitting bids at their short-run marginal costs, they maximized their chances of being dispatched without losing money in the short term.[115] And if the clearing price ended up being higher than their marginal costs, they would receive the difference as inframarginal rents.

It was a brilliant solution to a vexing problem that illustrated the significant changes underway in economics as a discipline and the vast new domains opened up by mechanism design. Rather than trying to understand how markets work or why economic agents behave in certain ways, the proponents of mechanism design sought to intervene directly in the economy and build specific kinds of markets with specific rules and institutions that would then elicit the behavior of market participants that theory indicated was optimal.[116]

115. *See* JEREMY LIN & FERNANDO H. MAGNAGO, ELECTRICITY MARKETS: THEORIES AND APPLICATIONS 224–25 (2017) (discussing general features of uniform clearing-price design); *see also id.* at 225 ("In such a pricing scheme, generators are more truthful in revealing their true marginal costs by bidding as close as possible or equal to their marginal costs."). The alternative design, known as "pay-as-bid" or discriminatory pricing, stacks submitted bids and offers in the same manner as the uniform clearing-price design, but generators that clear the market receive the price at which they offered to sell their power rather than the clearing price. Likewise, load-serving entities with bids that cleared the market will pay the price at which they bid rather than the clearing price. As various observers have argued, this creates incentives for generators to "guess the clearing price" rather than submit offers at their marginal costs. *See id.* at 225 (observing that "pay-as-bid" pricing creates incentives for generators to "submit offers that reflected their best guess at what the cleared price will be for the most expensive needed resource, instead of bidding their actual costs as they do in a uniform-price auction"). Although there was some debate in the U.S. about the merits of pay-as-bid after the California electricity crisis, all of the U.S. markets have continued to use the uniform clearing-price design. *See* ALFRED E. KAHN, PETER C. CRAMTON, ROBERT H. PORTER & RICHARD D. TABORS, CAL. POWER EXCH., PRICING IN THE CALIFORNIA POWER EXCHANGE ELECTRICITY MARKET: SHOULD CALIFORNIA SWITCH FROM UNIFORM PRICING TO PAY-AS-BID PRICING? 16 (2001) (concluding that a shift from uniform pricing to pay-as-bid pricing would be a mistake and would likely do more harm than good to consumers).

116. Robert C. McDiarmid, Lisa G. Dowden & Daniel I. Davidson, *A Modest Proposal: Revoke the Nobel Prize? Recognize the Limitations of Theory? Or Grant a License to Steal?*, 14 ELEC. J. 11, 13. (2001) ("At the level at which most regulators understand economic theory, the concept of eliciting a truthful bid through market design is so self-evidently correct that this key piece of the structure has become almost scriptural; that is, it is assumed to be correct and not to be questioned."). *See* MIROWSKI & NIK-KHAH, *supra* note 110, at 148 ("[S]ince roughly 1980, the [economics] profession converged upon a more 'constructivist' approach to markets in the sense that it has become possible, for the first time, to acknowledge that market formats do indeed differ in significant ways; furthermore, it might be possible for economists to intervene in the setup and maintenance of these diverse structures. Where economists

2. Rent Machines

The other challenge facing electricity market design was how to ensure that generators received sufficient revenues to maintain enough generating capacity over time. This was particularly challenging in capital-intensive industries where prices needed to cover fixed costs and provide sufficient incentive for future investment. In the electricity sector, moreover, the problem was further compounded by the inability to store electricity at scale, highly inelastic demand, and the need to balance the system in real time—all of which created special vulnerabilities to market power during conditions of scarcity.

The uniform or single-price auction design offered a possible solution here as well. In effect, the inframarginal rents available to lower cost (inframarginal) generators would cover at least some of their fixed costs and, if consistently high enough, would signal the need for new investment. By operating as rent machines, in other words, the auctions would drive investment toward the lowest cost generation technologies while solving the revenue problem. This had two components: the modest inframarginal rents available to lower cost generators during normal operating periods and the very large rents available during periods of peak demand (perhaps only a few days per year) when prices were very high. The latter scarcity pricing effect was generally viewed as the major source of profits to encourage longer term investment.

But given highly inelastic demand and the fact that electricity is a necessity, market operators were uncomfortable with the extremely high prices that might occur during periods of peak demand when the system is operating at capacity. Allowing prices to go as high as they could during these periods would effectively destroy the market.[117] The solution here was to adopt price caps that would kick in during periods of scarcity. Currently, these range from $1,000 MWh in most of the organized electricity markets in the U.S. to $9,000 in the Electric Reliability Council of Texas ("ERCOT") market (a cap that was reduced to $5,000 per MWh after Winter Storm Uri and has since been thrown into doubt by a 2023 court decision).[118] For

once placidly contemplated markets from without, situated in a space detached from their subject matter, so to speak, now they are much less disciplined about their doctrines concerning the nature of economic agency, and much more inclined to be found down in the trenches with other participants, engaged in making markets."); Boyd, *supra* note 21, at 787–90 (discussing application of mechanism design and experimental economics to electricity markets).

117. *See* Borenstein, *supra* note 26, at 207 ("In reality, price caps are, and will continue to be, a critical element of virtually all wholesale electricity markets. The extreme inelasticity of both supply and demand means that supply shortages, whether real or due to market power, can potentially drive prices many thousands of times higher than their normal level. Such outcomes would destroy the market.").

118. Luminant Energy Co. v. Pub. Util. Comm'n of Texas, 665 S.W.3d 166, 191 (Tex. App. 2023)

comparison, the average annual wholesale prices in many of these markets have historically been around $40 to $50 per MWh.[119]

Opponents of price caps have argued that the effort to limit the extraordinary rents available during periods of scarcity has undermined incentives for future investment. This is sometimes referred to as the "missing money problem," which in turn has led generators to push for all manner of additional out-of-market payments, capacity remuneration mechanisms, and new products intended to provide additional compensation to ensure adequate investment and maintain enough capacity to meet peak demand.[120] As discussed in more detail below, it is fair to say that none of these markets have solved the capacity problem, and it is a problem that becomes significantly harder in a system dominated by intermittent, non-dispatchable renewable energy.

* * *

The intellectual case for electricity markets and the technical aspects of their design were necessary but not sufficient by themselves to deliver actual electricity markets in the real world. In effect, they provided crucial building blocks for the larger political effort to abandon the state-owned and heavily regulated electricity systems that had prevailed for most of the twentieth century. This political effort was, as noted, part of a global project that was deeply rooted in the broader rise of neoliberalism on both sides of the Atlantic and grew directly out of the crisis of the 1970s.

C. POLITICAL HISTORIES

The mutually reinforcing energy and economic crises of the 1970s provided fertile ground for the neoliberal critique of regulation and state ownership. Within electricity, the exhaustion of economies of scale in thermal power generation by the late 1960s combined with high fuel prices

("While the extraordinary circumstances of Winter Storm Uri may have required extraordinary modifications to the SPM [scarcity pricing mechanism] to send appropriate price signals to prompt the necessary market response, the Commission here exceeded the Legislature's limits on its power. Setting a single price at the rule-based maximum price violated the Legislature's requirement in the Utilities Code Section 39.001(d) that the Commission use competitive methods to the greatest extent feasible and impose the least impact on competition.").

119. *See* Energy Information Administration, *Wholesale Electricity and Natural Gas Market Data*, ELECTRICITY: ANALYSIS & PROTECTIONS (2023), https://www.eia.gov/electricity/wholesale [https://perma.cc/7Y8S-QT7V].

120. *See* Paul L. Joskow, *Challenges for Wholesale Electricity Markets with Intermittent Renewable Generation at Scale: The US Experience*, 35 OXFORD REV. ECON. POL'Y 291, 303 (2019) (discussing the "revenue inadequacy" or "missing money" problem that comes from over-reliance on short-run marginal cost pricing in the electricity markets); David Newbery, *Missing Money and Missing Markets: Reliability Capacity Auctions and Interconnectors*, 94 ENERGY POL'Y 401, 402 (2016) (discussing price caps and the "missing money" problem in electricity markets).

stemming from the oil shocks of the 1970s strained the system and undermined support for regulation.[121] In the U.S., declining real prices abruptly gave way to significant price increases as PUCs were inundated with new rate cases brought by utilities seeking higher rates.[122] These facts, combined with a Keynesian welfare state that seemed exhausted and inadequate in the face of high inflation and low growth, prepared the ground for a series of experiments around the world to privatize and restructure the electricity sector—a set of developments that we turn to now.

1. Chile

As with most things neoliberal, the first efforts to privatize electricity and subject it to market competition took place in Chile under the Pinochet dictatorship during the early 1980s.[123] With its potent mix of Chicago economics and authoritarianism, Chile provided an ideal laboratory for neoliberal experiments.[124] The power sector was an obvious target, as it had been under state ownership for decades and was viewed as strategic for the development of other industries.[125]

121. *See* Boyd, *supra* note 36, at 1658–61 (discussing the crisis of the 1970s and impacts on utility regulation in the U.S.).

122. Up until the late 1960s, there were very few rate cases across the United States; only a few a year for the entire country. By the mid-1970s, there were dozens of new rate cases being filed every year. Public Utility Commissions ("PUCs") were not prepared. *See* Joskow, *supra* note 120, at 299.

123. *See, e.g.*, Ricardo Raineri, *Chile: Where it All Started*, *in* ELECTRICITY MARKET REFORM: AN INTERNATIONAL PERSPECTIVE 77, 81–82 (Fereidoon P. Sioshansi & Wolfgang Pfaffenberger eds., 2006). *See generally, e.g.*, Hugh Rudnick, *Chile: Pioneer in Deregulation of the Electric Power Sector*, 14 IEEE POWER ENG'G REV. 28 (1994); Pablo Serra, *Chile's Electricity Markets: Four Decades on From Their Original Design*, 39 ENERGY STRATEGY REVS. 1 (2022). Paul Joskow has argued that while Chile is often identified as the first country to adopt "the textbook electricity sector reform model . . . the Chilean system has involved less restructuring, less competition and more regulation than first meets the eye." Paul L. Joskow, *Lessons Learned from Electricity Market Liberalization*, ENERGY J. 9, 17–18 (2008) (citation omitted).

124. *See* Karin Fischer, *The Influence of Neoliberals in Chile Before, During, and After Pinochet*, *in* THE ROAD FROM MOUNT PÈLERIN: THE MAKING OF THE NEOLIBERAL THOUGHT COLLECTIVE 35 (Phillip Mirowski & Dieter Plehwe eds., 2009). *See generally* JUAN GABRIEL VALDES, PINOCHET'S ECONOMISTS: THE CHICAGO SCHOOL IN CHILE (1995). For a more sympathetic account, see generally SEBASTIAN EDWARDS, THE CHILE PROJECT: THE STORY OF THE CHICAGO BOYS AND THE DOWNFALL OF NEOLIBERALISM (2023). See also Friedrich Hayek's praise of Pinochet and his infamous 1978 statement in a letter to *The Times of London*: "In modern times, there have of course been many instances of authoritarian governments under which personal liberty was safer than under many democracies." In the letter, Hayek goes on to observe that he had "not been able to find a single person even in much maligned Chile who did not agree that personal freedom was much greater under Pinochet than it had been under Allende." F.A. Hayek, Letter to the Editor, *Freedom of Choice*, TIMES (London), Aug. 3, 1978, *reprinted in* THE COLLECTED WORKS OF F.A. HAYEK: ESSAYS ON LIBERALISM AND THE ECONOMY 497, 497–98 (Paul Lewis ed., 2022).

125. The Chilean electricity sector was brought under state control in the 1940s. In the early 1970s, the Allende regime pursued full nationalization of most public service companies. *See* Carlos Batlle, Luiz A. Barroso & Ignacio J. Pérez-Arriaga, *The Changing Role of the State in the Expansion of Electricity Supply in Latin America*, 38 ENERGY POL'Y 7152, 7153–54 (2010) (discussing state electricity monopolies in Latin America during the middle decades of the twentieth century).

One of the main architects of the Chilean experiment, Sebastian Bernstein, had spent time in France studying the theory and practice of marginal cost pricing developed by Marcel Boiteux and others. Rather than use marginal cost pricing as a tool for improving efficiency within a state-owned system, however, Bernstein and his colleagues recognized that marginal cost pricing could also be used in a market context.[126] Two overarching goals animated the basic approach: the use of markets to ensure "the correct allocation of resources" and the assignment of the state to a "subsidiary role."[127] This required, in Bernstein's view, "deconcentrating, decentralizing, and privatizing the activities and property of the energy companies" previously owned by the state, combined with "state support to the more deprived sectors of the population through direct subsidies, without distorting the prices of goods and services," and a strict prohibition on state performance of any "entrepreneurial activities" unless they "cannot or will not be carried out by the private sector."[128] In the reformed electricity sector, "pricing" provided the "mechanism to attain the objectives of global efficiency and state subsidiarity."[129]

Enacted in 1982, the Chilean Electricity Law unbundled and privatized state-owned generation, created new distribution companies, and explicitly required the use of marginal cost pricing: "[T]ransfers of energy between electric power generating companies operating in synchronism with an electric system . . . shall be priced according to the short-term marginal costs of the electric system."[130] These prices would be calculated through an "economic load dispatching centre" that was structured as a "generators' club" with minimal government oversight and involvement.[131]

The two large state-owned electricity companies, Chilectra and Endesa, which generated 13.4% and 64.1% respectively of Chile's electricity, were unbundled into seven generation companies and eight distribution companies.[132] The hope was that more private companies would enter the

126. *See* Sebastian Bernstein, *Competition, Marginal Cost Tariffs and Spot Pricing in the Chilean Electric Power Sector*, ENERGY POL'Y 369, 373–75 (1988); s*ee also* Michael Pollitt, *Electricity Reform in Chile: Lessons for Developing Countries*, 5 J. NETWORK INDUS. 221, 224 (2004) (observing that Chilean officials visited the UK, France, and Belgium to understand various components of restructured electricity markets, including a dispatch system based on marginal cost pricing as developed by engineer-economists at Electricite de France).

127. Bernstein, *supra* note 126, at 369.

128. *Id.* at 369–70.

129. *Id.* at 370–71 ("This price system must be based necessarily on objective technical and economic criteria and on precise calculation mechanisms.").

130. *General Law of Electric Services*, Decree-Law No. 1 of 1982 from the Ministry of Mines (DFL No. 1); *see also* Raineri, *supra* note 123, at 88–89 n.14 (discussing use of marginal cost pricing model for power plant dispatch based on the work of Marcel Boiteux).

131. *See* Bernstein, *supra* note 126, at 374.

132. *See* Serra, *supra* note 123, at 1.

market and enhance competition. In fact, just the opposite occurred. During the late 1980s, Endesa purchased three of its former spin-offs and by 1990 was supplying 52.1% of Chile's electricity generation.[133] By 1995, Chile's leading distribution holding company, Enersis, had acquired a controlling ownership share in Endesa.[134] Four years later, Spain's largest electricity company, also named Endesa, acquired a controlling interest in Enersis.[135] Spanish Endesa then used its control over Enersis to fight off an effort by Duke Energy to acquire a majority stake in Chilean Endesa.[136] Spanish Endesa, moreover, was controlled by the Spanish government through a so-called golden share arrangement until 2005, when the European Court of Justice forced it to relinquish control in accordance with EU competition law.[137]

By the early 2000s, then, two decades after it launched its experiment to privatize and liberalize its electricity sector, Chile faced a highly concentrated sector with its largest companies controlled by a foreign company that was itself controlled by the government of Spain.[138] It seems unlikely that this was the result that Sebastian Bernstein and other architects of the Chilean experiment anticipated in the early 1980s, but it is not, as we will see in the UK case, a story that was unique to Chile.

More important, the overall performance of the Chilean electricity sector over the last forty years has been uneven at best. In effect, privatization led to significant concentration in the ownership of generation assets and very limited gains for consumers, while the new market actors captured large profits.[139] Over the course of the 1990s and early 2000s, Chile's electricity sector underwent several major crises resulting in extremely high prices, forcing the Government to intervene to address the problems.[140] The most extensive reforms came in 2015, when the

133. *Id.* at 2. Serra notes that by 1990, three companies (including Endesa) accounted for 97.2% of total generation. *Id.*

134. *Id.*

135. See Francesc Trillas, *The Takeover of Enersis: The Control of Privatized Utilities*, 10 UTILS. POL'Y 25, 27 (2001). Spanish Endesa viewed Enersis as a platform for it to extend its interests across South America.

136. *Id.* at 30.

137. *See* Leslie Crawford & Daniel Dombey, *Spain Scraps Golden Shares*, FIN. TIMES (Nov. 25, 2005), https://www.ft.com/content/4e24a442-5def-11da-be9c-0000779e2340 [https://perma.cc/QR99-WF9Z].

138. In addition to Endesa, two other major companies in the electricity sector were also controlled by foreign companies. *See* Pollitt, *supra* note 126, at 228 (describing foreign ownership of Chilean electricity system).

139. Serra, *supra* note 123, at 2.

140. *See* Raineri, *supra* note 123, at 96–105 (discussing the series of crises affecting the Chilean electricity sector); Carla Alvial-Palavicino & Sebastián Ureta, *Economizing Justice: Turning Equity Claims into Lower Energy Tariffs in Chile*, 105 ENERGY POL'Y 642, 644 (2017) (noting that energy prices

Government introduced a new "tariff equity law" for retail consumers and embraced a series of reforms that sought to integrate concerns about sustainability and affordability into the dominant market-based approach.[141] Four years later, in response to the widespread social unrest that focused directly on Chile's staggering levels of inequality and a deepening cost-of-living crisis for many Chileans, the Government canceled a proposed 9.2% price increase and froze retail prices for most consumers.[142] Since that time, local electricity distribution companies have faced mounting debts and a growing liquidity crisis.[143] In 2022, the price freeze was extended under a new law that creates a tariff stabilization fund managed by the Government that will be used to reimburse generating companies for the difference between the amounts charged by the distribution companies to retail customers and the amount payable to the generating companies for electricity supply under existing regulated power purchase agreements.[144]

Chile's liberalized electricity markets have also struggled to promote renewable energy—despite the country's vast solar, wind, and hydropower resources. Indeed, although hydropower had long provided a substantial share of Chile's electricity, by the early 2000s, electricity produced from fossil fuels (coal, oil, and natural gas) accounted for the majority of generation.[145] Protests over several large hydropower projects and growing concerns over climate change led to a renewed focus on so-called non-conventional renewable energy (wind, solar, biofuels, and geothermal).[146] In

increased significantly starting in the mid 1990s, with substantial impacts on low-income and rural populations, leading to a movement for "equidad" or equity in electricity prices).

141. *See* Alvial-Palavicino & Ureta, *supra* note 140, at 644–46 (discussing Chile's new "tariff equity law").

142. *See* Humberto Verdejo Fredes, Benjamin Acosta, Mauricio Olivares, Fernando García-Muñoz, Francisco Tobar, Vannia Toro, Cesar Smith & Cristhian Becker, *Impact of Energy Price Stabilization Mechanism on Regulated Clients' Tariffs: The Case of Chile*, 13 SUSTAINABILITY 1, 3 (2021) (discussing government decision in response to the protests of 2019 to freeze energy prices for retail customers).

143. *Id.* at 13–14 (discussing accumulated debt resulting from the 2019 price freeze).

144. Reimbursement will be in the form of a monthly payment certificate from the Chilean Treasury denominated in USD with an explicit guarantee from the government. *See Guidelines May Ease Power Rate Freeze Pressure on Chilean Generators*, FITCHRATINGS (Mar. 27, 2023, 11:35 AM), https://www.fitchratings.com/research/corporate-finance/guidelines-may-ease-power-rate-freeze-pressure-on-chilean-generators-27-03-2023 [https://perma.cc/J8U8-WBAW].

145. *See* Michal Natorski & Israel Solorio, *Policy Failures and Energy Transitions: The Regulatory Bricolage for the Promotion of Renewable Energy in Mexico and Chile*, 2 NPJ CLIMATE ACTION 1, 7 fig.5 (2023) (showing significant increase in fossil fuel generation in Chilean electricity sector starting in the late 1990s).

146. *See, e.g.*, David Hill, *Chilean Patagonia Spared from US$10 Billion Mega-Dam Project*, GUARDIAN (June 11, 2014), https://www.theguardian.com/environment/andes-to-the-amazon/2014/jun/11/chilean-patagonia-spared-10-billion-mega-dam-project [https://perma.cc/TYH3-4QKT] (discussing protests over massive dam projects in southern Chile and the government's ultimate decision to abandon the projects).

2008, the Government adopted a new Law of Renewable Energy, which it amended in 2013 and further amplified in 2015 as part of a broader energy policy agenda for 2050.[147] In essence, these laws established a new framework for renewable energy built around quotas for distribution companies and public and private auctions for long-term power purchase agreements.[148] The overall effect was substantial growth in Chile's renewable energy, particularly solar energy, up through the early 2020s.[149] By 2023, however, the system was in crisis, with multiple renewables developers canceling contracts or exiting projects because of insufficient revenues.[150] Several factors contributed to the crisis, including the general inflation and supply chain constraints that affected the renewables industry everywhere. But much of this was also a product of the increasing dysfunction of the Chilean electricity market, given the imbalances created by the retail price freeze despite rising wholesale costs, a lack of transmission capacity that has led to increased congestion and curtailments of renewables, and the inability of the electricity auctions to deliver sufficient revenues to renewables projects—all of which has led to a growing chorus of calls for bailouts in the short term and a fundamental redesign of Chile's electricity markets over the longer term.[151]

147. *See* Introduce modificaciones a la Ley General de Servicios Eléctricos respecto de la generación de energía eléctrica con fuentes de energías renovables no convencionales, Law No. 20.257, Marzo 20, 2008, Diario Oficial [D.O.] (Chile); Propicia la ampliación de la matriz energética, mediante fuentes renovables no convencionales, Law No. 20.698, Octubre 14, 2013, Diario Oficial [D.O.] (Chile); MINISTERIO DE ENERGÍA, GOBIERNO DE CHILE, ENERGÍA 2050: POLÍTICA ENERGÉTICA DE CHILE (2015), https://www.energia.gob.cl/sites/default/files/energia_2050_-_politica_energetica_de_chile.pdf [https://perma.cc/G88M-RC44]; *see also* Cristián Flores-Fernández, *The Chilean Energy "Transition": Between Successful Policy and the Assimilation of a Post-Political Energy Condition*, 33 INNOVATION: EUR. J. SOC. SCI. RSCH. 173, 178–81 (2020) (identifying 2014 and the second term of President Michelle Bachelet as the beginning of the Chilean energy transition).

148. INT'L ENERGY AGENCY, CHILE RENEWABLE PPAS AND AUCTIONS 72–73 (2022).

149. *See* Natorski & Solorio, *supra* note 145, at 7–9 (discussing increased solar, wind, and biofuels from 2013 to the early 2020s).

150. *Are Chile's Renewable Energies in Crisis?*, BNAMERICAS (May 27, 2023), https://www.bnamericas.com/en/features/are-chiles-renewable-energies-in-crisis [https://perma.cc/4XPM-APM4]; *Are Chile's Renewable Energies in Crisis? Part II*, BNAMERICAS (June 1, 2023), https://www.bnamericas.com/en/features/are-chiles-renewable-energies-in-crisis-part-ii [https://perma.cc/65Y8-LJCN]; Tom Azzopardi, *Analysis: Golden Decade for Chilean Renewables Becomes 'Perfect Nightmare' as Firms Face Financial Ruin*, WINDPOWER MONTHLY (June 2, 2023), https://www.windpowermonthly.com/article/1824872/analysis-golden-decade-chilean-renewables-becomes-perfect-nightmare-firms-face-financial-ruin [https://perma.cc/D9GJ-7KPY].

151. *See* James Attwood & Valentina Fuentes, *Chile Government Resists Renewable Rescue as Boom Turns to Bust for Some Plants*, BLOOMBERG (May 26, 2023, 4:00 AM), https://www.bloomberg.com/news/articles/2023-05-26/chile-government-resists-renewable-rescue-as-boom-turns-to-bust-for-some-plants [https://perma.cc/Q7ST-BZXM] (noting problems facing renewables projects in Chile and discussing calls for both short-term response and long-term reforms); Tom Azzopardi, *Chile Plans Power Market Reforms to Protect Struggling Renewables Sector*, WINDPOWER MONTHLY (June

2. UK

While Chile was the first country to move toward privatizing and liberalizing its electricity sector, the UK launched the first truly comprehensive experiment and was arguably the most influential.[152] During the second half of the 1980s, Margaret Thatcher's government worked to open up the UK electricity sector as part of a broader effort to reform the energy sector.[153] The goal was to privatize formerly state-owned enterprises and to unbundle generation from transmission and distribution in order to create competitive markets for wholesale electricity. It was, as one observer put it, "[t]he biggest and most radical project" of all in the Thatcher government's efforts to "roll back the state" and remake the British economy.[154]

As in many European countries, electricity supply in the United Kingdom had been provided through state-owned monopolies for most of the post-WWII period.[155] Throughout this time, there was a general consensus across the political spectrum that electricity was a strategic sector and that state ownership was in the national interest.[156] Electricity was also viewed as part of an overall package of public services that played a prominent role in the British welfare state.[157] Over time, coal fired electricity came to dominate the system, in part because of the power of the coal mining

14, 2023), https://www.windpowermonthly.com/article/1826363/chile-plans-power-market-reforms-protect-struggling-renewables-sector [https://perma.cc/S2PA-RJRL] (discussing government proposals for new electricity market design to address the problems with renewables projects).

152. *See* Joskow, *supra* note 10, at 8 (referring to the UK experiment as the "gold standard").

153. For overviews, see generally DIETER HELM, ENERGY, THE STATE, AND THE MARKET: BRITISH ENERGY POLICY SINCE 1979 (rev. ed., 2004); THE BRITISH ELECTRICITY EXPERIMENT: PRIVATIZATION: THE RECORD, THE ISSUES, THE LESSONS (John Surrey ed., 1996).

154. John Surrey, *Introduction*, *in* THE BRITISH ELECTRICITY EXPERIMENT 3 (John Surrey ed., 1996); *see* MARGARET THATCHER, THE DOWNING STREET YEARS 599, 676 (1993) (observing that the privatization effort was "fundamental to improving Britain's economic performance. But for me it was far more that it was one of the central means of reversing the corrosive and corrupting effects of socialism").

155. *See* John Chesshire, *UK Electricity Supply Under Public Ownership*, *in* THE BRITISH ELECTRICITY EXPERIMENT 15 (John Surrey ed., 1996). The UK government nationalized the electricity industry in 1947. *Id.*

156. *See* HELM, *supra* note 153, at 1 ("For most politicians in the post-war period, the importance of energy has naturally translated into the assumption that governments need to control its production and distribution. Until the 1980s, it was conventional wisdom . . . that markets are hopelessly inadequate in providing appropriate energy supplies. State-owned companies were deemed to be so natural that they were made *statutory* monopolies, and it was assumed that regulation was inevitable.").

157. *Id.* at 30–32 (discussing the "distributional ambitions" of nationalized energy, including the commitment to provide universal access as a basic primary social good regardless of ability to pay and regardless of location); *see also* Martin Chick, Le Tarif Vert Retrouve*: The Marginal Cost Concept and the Pricing of Electricity in Britain and France*, *1945-1970*, 23 ENERGY J. 97, 102 (2002) ("In Britain, in contrast, there was . . . much more explicit concern to use cross-subsidisation within the industry so as to spread the costs of supplying electricity to hitherto unconnected rural and low-income areas.").

unions.[158] But the state-owned Central Electricity Generating Board ("CEGB") also built and operated nuclear plants and maintained a large in-house engineering program.[159] The whole set up was boring, dull, and gray—overbuilt in places and overly reliant on coal in the eyes of some—but it was a public system that provided reliable and affordable electricity to everyone.[160]

Debates over the performance and proper management of the state-owned industries occurred throughout the 1960s, culminating in a 1967 government White Paper that set specific economic performance targets and adopted marginal cost pricing as official policy.[161] Over the next decade, a series of assessments pointed with increasing urgency to the inefficiencies of state-owned enterprises and the need for reform as the UK sought to navigate the economic crisis of the 1970s and a challenging macroeconomic environment.[162]

158. *See* John Chesshire, *UK Electricity Supply Under Public Ownership*, *in* THE BRITISH ELECTRICITY EXPERIMENT 14, 31 (John Surrey ed., 1996) (noting heavy dependence of UK electricity industry on coal into the late 1980s, almost all of which came from indigenous sources mined by workers affiliated with the National Union of Mineworkers).

159. *See* HELM, *supra* note 153, at 27–30, 37–38, 89–107 (discussing UK government enthusiasm for nuclear power and role of the Central Electricity Generating Board ("CEGB") in nuclear buildout).

160. *See, e.g.*, JAMES MEEK, PRIVATE ISLAND: WHY BRITAIN NOW BELONGS TO SOMEONE ELSE 124 (2014) (observing that under nationalization, "electricity was produced and distributed by a state organisation with a no-nonsense Attlee-era moniker, redolent of brown paper envelopes and blotched stencils and corridors smelling of disinfectant: the Central Electricity Generating Board, the CEGB"); *see also* HELM, *supra* note 153, at 43 ("The public had been led to expect nationalized industries to take a wide account of the public interest—to include concepts of fairness to their workers and customers, to subsidize worthy causes, and to provide a public service. This meant showrooms in every town in Britain, sponsorship of research and development, and contributing to macro- as well as microeconomic objectives."). But the CEGB, with its heavy dependence on coal, did not always act in the public interest. *See, e.g.*, RACHEL EMMA ROTHSCHILD, POISONOUS SKIES: ACID RAIN AND THE GLOBALIZATION OF POLLUTION 63–66 (2019) (discussing the CEGB's opposition to research on acid rain and desulfurization technologies during the 1970s).

161. *See* C. EXCHEQUER, NATIONALISED INDUSTRIES: A REVIEW OF ECONOMIC AND FINANCIAL OBJECTIVES, 1967, Cm. 3437 (UK) [hereinafter 1967 White Paper]. The 1967 White Paper also proposed that the CEGB use a test discount rate to evaluate potential investment projects. Some questioned whether the CEGB ever really deployed true marginal cost pricing. *See also* TURVEY, OPTIMAL PRICING, *supra* note 80, at 57 (extending the work of Boiteux and others on marginal cost pricing with specific attention to its application in the state-owned electricity sector).

162. *See, e.g*, C. EXCHEQUER, THE NATIONALISED INDUSTRIES, 1978, Cm. 7131 (UK) [hereinafter 1978 White Paper] (establishing a revised system of economic and financial controls for nationalized industries in the UK, including a "required rate of return" as the basis for determining cost of capital for an industry's overall investment program, rather than the project-specific test discount rate introduced by the 1967 White Paper); David Heald, *The Economic and Financial Control of U.K. Nationalised Industries*, 90 ECON. J. 243, 243 (1980) (reviewing the main features of the 1978 White Paper and comparing it to the 1967 White Paper); HELM, *supra* note 153, at 33–34 (discussing the challenging macroeconomic environment of the 1970s and emphasizing focus of the 1978 White Paper on a series of short and medium term financial constraints on the nationalized industries).

In 1979, the incoming Thatcher government signaled a shift in approach, and over the next decade pursued a deliberate strategy to privatize and liberalize natural gas and electricity as part of its broader privatization effort.[163] Nigel Lawson was put in charge of energy and much of the original vision that motivated the effort was summed up by his quip that "the business of Government is not the government of business."[164] In an important 1982 speech on energy, Lawson indicated in no uncertain terms where the conservatives were going:

> I do *not* see the government's task as being to try and plan the future shape of energy production and consumption. It is not even primarily to try to balance UK demand and supply for energy. Our task is rather to set a framework which will ensure that the market operates in the energy sector with a minimum of distortion and energy is produced and consumed efficiently.[165]

Lawson turned to a small group of free market economists inside and outside the government to lead the effort.[166] Chief among them was Stephen Littlechild, an economics professor at Birmingham University and devoted follower of Friedrich Hayek and Austrian economics.[167] Littlechild was also quite familiar with principles of marginal cost pricing; his 1969 Ph.D. dissertation used linear programming and game theory to investigate marginal cost pricing in regulated and state-owned industries.[168] Over the next two decades, Littlechild emerged as an outspoken critic of the failures

163. *But see* HELM, *supra* note 153, at 44 (noting that during the early years of the Thatcher government, "privatization and competition in core utilities were regarded as fanciful academic ideas by all but the most die-hard marketeers").

164. NIGEL LAWSON, THE VIEW FROM NO. 11: MEMOIRS OF A TORY RADICAL 211 (1992).

165. Nigel Lawson, *Energy Policy: Text of a Speech Given in July 1982*, *in* THE MARKET FOR ENERGY 23 (Dieter Helm et al. eds., 1989).

166. *See* BOLTON, *supra* note 112, at 33–35 (detailing Lawson's efforts to maintain momentum for privatization and liberalization via a group of committed civil servants, outside consultants, free market think tanks, and academics during and after his tenure as minister in charge of energy).

167. Littlechild reflected on his life-long admiration of Hayek in a 2022 speech at the Austrian Embassy, in which he noted that he had discovered Hayek in grammar school and worked to educate himself in Austrian economics as an antidote to the Keynesian orthodoxy that prevailed across much of the UK during the 1960s and 1970s. *See* Stephen Littlechild, Speech in Honour of Friedrich Hayek, Austrian Embassy (Mar. 23, 2022), https://www.eprg.group.cam.ac.uk/speech-in-honour-of-friedrich-hayek-by-s-littlechild [https://perma.cc/U6Q3-H4RQ]. Lawson too was quite enamored of Hayek as well as other free market champions such as Milton Friedman. *See, e.g.*, NIGEL LAWSON, THE NEW CONSERVATISM 2–3 (1980) (describing the new conservatism as rejecting the "delusions" and "false trails" of social democracy and the commitment to equality that had dominated British politics during the post-war period and urging a return to older traditional wisdoms by way of "new sages" such as Hayek and Friedman).

168. *See* Stephen Littlechild, Life Before Economic Regulation, Summary of a Presentation at the Conference on the Objectives of Economic Regulation, CCP UEA, Norwich (Sept. 16, 2019), https://www.regulation.org.uk/library/2019-Litlechild-Life_before_Economic_Regulation.pdf [https://perma.cc/KTB4-S7D2].

of state ownership and planning.[169] In 1981, he published a manifesto on "denationalization" urging the Thatcher government to complete the task of privatization that it had begun.[170] "[T]he real task," he noted, "is not to control the industries but to control the government itself."[171] And the way to do that was to sell off as many of the state-owned industries as possible and subject them to market forces.[172] "What the Post Office needs," he argued, "is an imaginative asset stripper."[173]

During the second half of the 1980s, Littlechild and his colleagues worked to develop and pursue a comprehensive overhaul of the electricity industry built around privatization, unbundling, and market competition.[174] A 1988 government White Paper, *Privatizing Electricity*, provided the basic blueprint that was then incorporated into legislation the following year.[175] Although it did not go as far as Littlechild hoped, the new law was quite a radical departure from the past. The old Central Electricity Generating Board would be divided into two private generating companies (National Power and PowerGen), a separate transmission company (National Grid), and a

169. In 1978, for example, Littlechild published a monograph that provided his own Austrian critique of government planning and the mixed economy, with significant attention to the failures of state ownership and planning in the UK. *See generally* LITTLECHILD, *supra* note 49. Littlechild also made extensive use of public choice theory and the critique of economic regulation that was hitting full stride in the United States during the economic crisis of the 1970s. *See generally id.*

170. S.C. Littlechild, *Ten Steps to Denationalisation*, ECON. AFFS., Oct. 1981, at 11, 15 ("The general picture, then, is of a government mostly moving in the right direction, but by no means as far or fast as desirable."). On electricity, Littlechild noted that the "promise to allow private companies to sell electricity has not been kept." *Id.*

171. *Id.* at 12.

172. *Id.*; *see also* Michael Beesley & Stephen Littlechild, *Privatization: Principles, Problems and Priorities*, 149 LLOYDS BANK REV. 1, 1 (1983) ("[T]he underlying idea [of privatization] is to improve industry performance by increasing the role of market forces.").

173. Littlechild, *supra* note 170, at 18.

174. It is not clear how much the ongoing experiment in Chile influenced Littlechild and the other proponents of privatization and restructuring in the UK. Littlechild was clearly aware of Bernstein and his efforts in Chile. *See, e.g.*, S.C. Littlechild, *Spot Pricing of Electricity: Arguments and Prospects*, ENERGY POL'Y, Aug. 1988, at 398, 403 (referencing Bernstein's discussion of efforts in Chile to develop spot pricing as part of a privatized and liberalized electricity sector). But there is no evidence that they looked to Chile for anything more than general support for privatization. Indeed, when it came to the details of the new system, the architects of the UK electricity experiment followed many of the "textbook" recommendations for restructuring that had been proposed by Paul Joskow and Richard Schmalensee in their 1983 book, MARKETS FOR POWER, *supra* note 52. In 2006, Joskow praised the UK experiment for sticking to the key components:

> In my view, the gold standard for electricity sector reform is England and Wales. . . . The reforms followed the basic architecture of the textbook model and have led to significant performance improvements in many dimensions. This is not to say that everything worked perfectly. Clearly, the decision to create only three generating companies, two of which set the clearing price in the wholesale market in almost all hours, led to significant market power problems that persisted for several years.

Joskow, *supra* note 10, at 8.

175. *See* SEC'Y STATE ENERGY, PRIVATISING ELECTRICITY: THE GOVERNMENT'S PROPOSALS FOR THE PRIVATISATION OF THE ELECTRICITY SUPPLY INDUSTRY IN ENGLAND AND WALES, 1988, Cm. 322 (UK). *See generally* Electricity Act 1989, c.29 (UK).

group of twelve regional distribution companies that would together own the holding company that governed National Grid.[176] The two new private generating companies, National Power and PowerGen, together controlled close to 80% of the generating capacity of the country, leading some to worry (correctly) that any new market would be subject to significant market power.[177] The reason for sticking with two large companies was because the government had hoped that the larger of the two would be able to take ownership of the country's nuclear power plants and that the other company needed to be sufficiently large to compete.[178] When the government decided that nuclear was too risky and too expensive to put in the mix, it was apparently too late to go back and create more private generating companies.[179] In effect, the government assumed that the lure of large profits would quickly take care of the problem by encouraging entry, particularly of new combined-cycle natural gas plants.[180] As long as these markets were contestable, in other words, any problems of market power would be short lived.

Thatcher, of course, also recognized that privatization and liberalization of electricity markets gave her a tool to discipline labor and, specifically, to break the powerful coal mining unions' grip on the national economy.[181] Privatization and the so-called dash-for-gas after the discovery of large natural gas fields in the North Sea operated in this respect as a proxy in a larger fight between capital and labor with the state coming down firmly on the side of capital.[182] To that end, neoliberal electricity proved to be

176. Electricity Act 1989, c.29, §§ 65–95 (UK) (providing for the transfer of property from the CEGB, area boards, and other state-owned entities to private companies nominated by the Secretary of State and for the subsequent governance and capitalization of the new companies).

177. *See* Richard J. Green & David M. Newbery, *Competition in the British Electricity Spot Market*, 100 J. POL. ECON. 929, 930 (1992).

178. *See* Richard Green, *Failing Electricity Markets: Should We Shoot the Pools?*, 11 UTILS. POL'Y 155, 158 (2003) (noting that the larger generating company, National Power, "was created in the hope that [it] could absorb the risks of the nuclear stations' future performance").

179. *Id.*

180. Green & Newbery, *supra* note 177, at 930 (noting assumptions among the architects of privatization that the availability of new high-efficiency combined-cycle gas turbines made "entry at modest scales (300–600 megawatts [MW]) simple and quick").

181. *See* HELM, *supra* note 153, at 73–88 (discussing the battle between the Thatcher government and the powerful coal miners union during the 1980s, and observing that the move to private ownership and competition in electricity consummated Thatcher's victory over the unions); Mike Parker, *Effects on Demands for Fossil Fuels*, *in* THE BRITISH ELECTRICITY EXPERIMENT 122–23 (John Surrey ed., 1996) (discussing general hostility of Thatcher, Nigel Lawson, and Cecil Parkinson to the National Union of Mineworkers); *see also id.* at 123 (quoting Thatcher's statement that "by the 1970s the coal mining industry had come to symbolise everything that was wrong with Britain" and that defeat of the union in the mid-1980s made clear "the Britain could not be made ungovernable by the Fascist Left").

182. *See* Parker, *supra* note 181, at 127–28 (discussing the "dash-for-gas" and the growth of combined-cycle natural gas power plants and noting the significant impact on coal).

singularly effective, decimating the coal mining labor force as new combined-cycle gas-fired generation replaced older coal burning plants.[183] By 1990, the number of coal miners had fallen from nearly 200,000 in 1985 to about 70,000.[184] Eight years later, the total stood at less than 10,000.[185]

In an effort to ensure marginal cost pricing, the UK market design also established a new mandatory Electricity Pool that would operate as a centralized day-ahead market (priced on half-hour increments) that would determine the merit order for dispatching generation and the wholesale spot price of electricity.[186] The Pool used the basic single-clearing price auction format with the last increment of generation needed to meet load setting the System Marginal Price.[187] The basic approach (and software) used to rank generators as a basis for economic dispatch was the same as had been used previously by the CEGB, except that the generators were now free to submit bids made up of various "price components" as opposed to actual cost information.[188]

From the beginning, however, the Pool struggled with problems of market power.[189] With two big generators controlling the vast majority of generating capacity, clearing prices tended to be much higher than marginal cost pricing would suggest.[190] According to one early study, the proponents

183. *See* U.K. DEP'T FOR BUS., ENERGY & INDUS. STRATEGY, COAL GENERATION IN GREAT BRITAIN: THE PATHWAY TO A LOW-CARBON FUTURE, CONSULTATION DOCUMENT 9 fig.1 (2016) (showing significant displacement of coal-fired generation by natural gas generation during the 1990s).

184. *See* David Newbery, *Electricity Liberalization in Britain and the Evolution of Market Design*, *in* ELECTRICITY MARKET REFORM: AN INTERNATIONAL PERSPECTIVE 109, 118 (Fereidoon P. Sioshansi & Wolgang Pfaffenberger eds., 2005).

185. *Id.*

186. *Id.* at 113.

187. *Id.* at 113–14; *see also* HELM, *supra* note 153, at 133. The basic design of the Pool came from Sally Hunt, a consultant with NERA, and a team at Price Waterhouse. *See* BOLTON, *supra* note 112, at 105; *see also* SALLY HUNT & GRAHAM SHUTTLEWORTH, COMPETITION AND CHOICE IN ELECTRICITY 167–80 (1996) (describing basic design of the UK electricity Pool).

188. *See* Green, *supra* note 178, at 156 ("[T]he Electricity Pool of England and Wales basically replicated the CEGB's procedures for scheduling generation. In the past, a computer algorithm had taken vectors of cost information and operating parameters for each generating set, and calculated the least-cost schedule that would meet the demand forecast for the following day. The Pool used the same computer program, but the companies could submit five price components in place of the vector of cost information. An extra program was written to average these price components and obtain the cost of power from each station—the System Marginal Price (SMP) was based upon the bid of the most expensive station in normal operation in each half-hour."). Additional payments for capacity tied to the value of lost load during peak periods were also provided with the intention of ensuring a sufficient reserve margin and to provide a signal for new investment. Uplift payments were also added to the final price during periods of high demand in order to cover additional costs associated with reserve, availability, and ancillary services (reactive power, voltage and frequency control, and so forth). HELM, *supra* note 153, at 133–34.

189. These problems of market power were evident as early as 1992. *See generally* Green & Newbery, *supra* note 177.

190. *See* Green, *supra* note 178, at 160 ("The fact that all stations received the price set by the marginal bidder was also believed to make the Pool more vulnerable to the exercise of market power.");

of privatization had "seriously underestimated" the exercise of market power in the Pool and the impacts on consumers.[191] Thus, over the first three years of the Pool, annual average Pool prices increased by more than 30% in real terms, even as fuel prices declined and the country struggled through a recession.[192]

None of this should have been surprising. The basic design of the Pool allowed two generating companies controlling close to 80% of generation capacity and almost all of the price-setting marginal plants to participate in a new market for electricity based on software that they were intimately familiar with.[193] Instead of using objective facts about the costs of their various generation units to establish the system marginal cost and merit order for dispatch, they were now free to submit prices based on a complex set of factors that were not tied to costs in any transparent or objective way.[194]

To be sure, the new generating companies did have incentives to improve performance, something they delivered on with great success.[195] The problem, however, was that the gains in performance were captured as profits for the generating companies rather than as lower costs for consumers.[196] One study from 1997 found, in fact, that despite the improvements in efficiency UK consumers were worse off than they would have been under the old CEGB regime.[197]

see also Catherine D. Wolfram, *Measuring Duopoly Power in the British Electricity Spot Market*, 89 AM. ECON. REV. 805, 821 (1999) (finding that the privatized generators were "charging prices significantly higher than their observed marginal costs" but noting that they had not taken full advantage of their pricing power as predicted by standard oligopoly models, perhaps to "deter new entrants or stave off substantial regulatory action").

191. Green & Newbery, *supra* note 177, at 952.

192. *See, e.g.*, OFF. OF ELEC. REGUL., REVIEW OF ELECTRICITY TRADING ARRANGEMENTS, BACKGROUND PAPER 1: ELECTRICITY TRADING ARRANGEMENTS IN ENGLAND AND WALES 20 (1998).

193. *See* Richard J. Green, *Electricity Deregulation in England and Wales*, *in* DEREGULATION OF ELECTRIC UTILS. 184 (Georges Zaccour ed., 1998) (observing that National Power and PowerGen "had the ability and incentive to raise Pool prices to undesirable levels, earning large profits in the process. . . . because they own practically all the price-setting plant, and could raise Pool prices by raising these plants' bids, with little risk of being displaced by other generators").

194. *See, e.g.*, David Newbery, *Electricity Liberalization in Britain: The Quest for a Satisfactory Wholesale Market Design*, 26 ENERGY J. 43, 46 (2005) ("The System Operator (National Grid) used the same (rather ancient) software GOAL to dispatch plant as the former CEGB. As the successor companies had copies of GOAL, they could shape the rather complex individual plant bids (start-up, no-load, and three incremental prices plus various technical parameters) to optimise their revenue, rather than bidding the true parameters.").

195. *Id.* at 52 (documenting improvements in performance).

196. *Id.* at 54 ("Privatisation, combined with unbundling and a transparent wholesale market, provided incentives for considerable efficiency improvements, but the concentrated market structure initially allowed the incumbent generators to retain these cost reductions as enhanced profits.").

197. *Id.* (citing a 1997 study finding "that while the overall simple sum of net benefits of privatising the CEGB was nearly £10 billion, consumers lost relative to the counterfactual in which fuel prices fell and the CEGB had set prices as in the past, while the owners of the generation companies gained very substantially").

The new electricity market, in short, was not a contestable market.[198] Even when entry did materialize, moreover, the single-price auction combined with the complexity of price formation provided ample opportunities for the incumbents to exercise market power across a range of different strategies.[199] Put crudely, asset stripping had succeeded in creating exceptional profit opportunities for the new private electricity companies, while delivering little if any value to customers.

During the 1990s, as their profits soared, the new private electricity companies collectively laid off roughly half of their workforce while bestowing massive dividends on their shareholders.[200] With a capital markets environment that was increasingly conducive to corporate acquisitions, the prospect of large profits was not lost on outsiders. Starting in the mid 1990s, various foreign companies, first from America and then from France and Germany, began buying assets and companies to gain a foothold in the lucrative UK electricity market. Politicians and regulators stood by and watched (they "simply let it happen," as Dieter Helm observed), without thinking through the long-term implications.[201]

Meanwhile the government had become thoroughly disenchanted with the single-clearing price design of the Pool in the face of persistently high wholesale prices, publishing an extensive set of reviews in 1998 and announcing that the Pool would be replaced with the so-called New Electricity Trading Arrangements ("NETA").[202] After several years of work, NETA went live in 2001 and was built around a system of decentralized bilateral contracting, an auction-based market for short-term balancing that

198. *See* Green & Newbery, *supra* note 177, at 947 ("The electricity pool is certainly not a contestable market. Incumbents can change their prices every day, whereas CCGT [combined-cycle gas turbines] power stations, the entrants preferred technology, take 2 or 3 years to build and commission.").

199. *See, e.g.*, Green, *supra* note 193, at 184; *see also* OFF. OF ELEC. REGUL., REVIEW OF ELECTRICITY TRADING ARRANGEMENTS: WORKING PAPER ON TRADING INSIDE AND OUTSIDE THE POOL 4–5 (1998) (recounting criticisms that the complexities of price formation and the single-price auction allowed generators to exercise more market power than would have been possible under a more traditional market structure); HELM, *supra* note 153, at 309 ("In the 1990s, the two main generators National Power and PowerGen, set the price most of the time.").

200. *See* Preetum Domah & Michael G. Pollit, *The Restructuring and Privatization of the Regional Electricity Companies in England and Wales: A Social Cost-Benefit Analysis*, 22 FISCAL STUDS. 107, 107 (2001); Robert Jupe, *The Privatization of British Energy: Risk Transfer and the State*, 37 ACCT. ORGS. AND SOC'Y 116, 120 (2012).

201. *See* HELM, *supra* note 153, at 241 ("Thus, by 2002, the British electricity industry had become in large part an adjunct to the European one, in the hands of the Germans and the French. The consequences were not thought through at the time, but were to have radical ramifications for energy policy. The vision of a disaggregated market with many generators and many suppliers competing in a standardized transparent pool, with a supporting futures market absorbing the risk of long-term contracts, had gone. Politicians and regulators had simply let it happen.").

202. *See, e.g.*, OFF. OF ELEC. REGUL., REVIEW OF ELECTRICITY TRADING ARRANGEMENTS: FRAMEWORK DOCUMENT 10–12 (1998) (describing proposal for new electricity trading arrangements).

would be based on a discriminatory "pay-as-bid" format rather than the single- or uniform- clearing price design of the Pool, and heavier reliance on financial instruments for hedging.[203] In many ways, NETA turned out to be even more complex than the Pool and, if anything, pushed companies to further consolidate and, where possible, integrate backwards and forwards in order to hedge against the additional uncertainty.[204]

By the mid-2000s, then, fifteen years into the experiment with privatization, the UK electricity sector was dominated by large, vertically integrated firms, many of them foreign owned (and some state owned).[205]

203. *See* OFF. OF GAS & ELEC. MKTS. ("OFGEM"), THE NEW ELECTRICITY TRADING ARRANGEMENTS: A REVIEW OF THE FIRST THREE MONTHS 3–4 (2001) (providing overview of NETA). The goal of the new trading arrangements, according to Ofgem, was to "operate as far as possible like other commodity markets whilst, at the same time, making provision for the electricity system to be kept in physical balance at all times to maintain security and quality of supplies." *Id.* at 3. For a discussion of the switch from the uniform- or single-clearing price auction design of the Pool to a discriminatory pay-as-bid format, see Catherine D. Wolfram, *Electricity Markets: Should the Rest of the World Adopt the United Kingdom's Reforms*, 22 Regul. 48, 50–52 (1999). As Wolfram points out, and as others have noted in the context of other electricity markets, the pay-as-bid format does not necessarily solve the problems of the single-price auction because it changes the incentives for the generators to guess the clearing price, with the overall result that in concentrated markets, the prices do not change as much as one might expect. *Id.*; *see also* LIN & MAGNAGO, *supra* note 115, at 225 (observing that "pay-as-bid" pricing creates incentives for generators to "submit offers that reflected their best guess at what the cleared price will be for the most expensive needed resource, instead of bidding their actual costs as they do in a uniform-price auction").

204. *See* HELM, *supra* note 153, at 319 (discussing the complexity of NETA and general lack of understanding among regulators); MEEK, *supra* note 160, at 133 ("Neta was fantastically complex. There is no evidence to suggest that any elected politician has ever understood how it worked (any more than they understand its byzantine predecessor the 'Pool'). Some specialists believe that civil servants do not understand it either. How could they? Its arcane codexes are intelligible only to corporate lawyers and accountants. Yet there was one important clue to how Neta worked: the electricity companies were all for it."). Wholesale prices did decline in the run-up to NETA and for a time after it was launched, but these declines did not translate into lower prices for domestic consumers and the factors driving these price declines likely had as much to do with new natural gas generating capacity coming online as the move away from the Pool. *See* COMM. OF PUBLIC ACCOUNTS, THE NEW ELECTRICITY TRADING ARRANGEMENTS IN ENGLAND AND WALES, 2003–4, HC 63, at 4 (UK) ("Electricity prices have fallen, but by much less for domestic customers than for industrial and commercial customers. Wholesale prices have fallen by around 40% since 1998 and reductions for industrial and commercial customers have been consistent with this fall. But domestic reductions have been much smaller and only 1% to 3% since NETA was implemented in 2001.").

205. After divesting some of their generation capacity in response to the Government's legitimate concerns with market power, the generation companies were "free to buy the supply (retailing) businesses originally integrated with distribution in the [Regional Electricity Companies]. The market evolved toward the current Bix Six generators plus retailers." Michael Grubb & David Newbery, *UK Electricity Market Reform and the Energy Transition: Emerging Lessons*, 39 ENERGY J. 1, 4 (2018). NETA reinforced all of this. As Grubb and Newbery observe, "[T]he risk of incentives to manipulate the spot market was replaced by a clear incentive to vertical integration: the merger of retailing and generation companies ensured that they were automatically hedged against electricity price uncertainties, since they would be selling wholesale to themselves. However, this in turn created major barriers to entry, and a perception of the electricity system as an oligopoly of major power companies controlling the entire system from generation to consumptions." *Id.*

Indeed, one of the great ironies of the UK experiment is that the buyers of many of the formerly state-owned power sector assets were large state-owned enterprises from the continent such as Électricité de France.[206] Without question, this was not the result that Margaret Thatcher and her lieutenants imagined when they embarked on privatization in the 1980s. In less than a generation, the UK had transferred a large part of its vital infrastructure, and along with it the right to tax the British public for the use of that infrastructure, to a wholly owned subsidiary of the French government.[207]

Perhaps even more concerning was the fact that the new markets did not seem to be creating sufficient incentives for new investment, especially in renewables. In response, the Government launched another Electricity Market Reform ("EMR") package in 2013 with the goal of ensuring security of supply and ramping up support for renewables.[208] On security of supply, the EMR provided for new capacity payments that would be paid for firm generation, following the pattern in most electricity markets of establishing new capacity remuneration mechanisms to address underinvestment.[209] On renewables, the EMR created a new government-owned entity, the Low Carbon Contracts Company, that would enter into fifteen-year contracts with renewables projects.[210] These new contracts would be based on a "contracts

206. *See* MEEK, *supra* note 160, at 121 ("The most unexpected consequence of selling the country's electric legacy, the consequence that most directly contradicts what the Thatcherites were trying to do, was the gradual absorption of swathes of the industry by EDF. Beginning with the takeover of London Electricity in 1998, exploiting the Thatcherites open-door market structures and their decision to split the electricity industry into small, easy-to-swallow chunks, France in effect renationalised the industry its neighbor had so painstakingly privatised. Renationalised it, that is, for France.").

207. *See, e.g.*, MEEK, *supra* note 160, at 149–50 ("[T]he realities of privatising essential services—that what is being sold is not infrastructure, but bill-paying citizens, and what is being privatized is not electricity but taxation. Effectively, the French and Chinese governments are buying the right to tax British electricity customers through their electricity bills.").

208. *See* U.K. DEP'T OF ENERGY & CLIMATE CHANGE, ELECTRICITY MARKET REFORM: CONSULTATION ON PROPOSALS FOR IMPLEMENTATION, 2013, Cm 8706, at 10 (Oct. 2013) (summarizing key objectives of the EMR, including incentivizing substantial new investment in low-carbon generation while ensuring reliability and affordability). One major goal of the EMR was to ensure an additional £110 billion in capital investment in the sector by 2020. *Id.*; *see also* Grubb & Newbery, *supra* note 205, at 1 ("The proximate causes of Electricity Market Reform were the impending closure of old fossil and nuclear plant with a lack of willingness to invest in new gas-fired generation, and the need to decarbonize the electricity sector without raising consumer costs excessively.").

209. *See* U.K. DEP'T OF ENERGY & CLIMATE CHANGE, *supra* note 208, at 137–44 (describing the overall framework and workings of the new capacity market and its relationship to the existing electricity market).

210. The Low Carbon Contracts Company ("LCCC") is a private company owned by the UK Government's Department of Energy Security and Net Zero. The LCCC is the counterparty for the private law contracts with renewables developers. For more details, see LOW CARBON CONTRACTS COMPANY, https://www.lowcarboncontracts.uk [perma.cc/NK7R-6ETA]. *See also* Dep't for Energy Sec. & Net

for difference" price term that made the renewables projects indifferent to prevailing market prices.[211] This was deemed essential to providing the long-term predictability needed to drive investment in renewables.[212] In effect, renewable energy projects were now operating entirely outside of the formal electricity market and enjoyed the benefit of the state as a counterparty for long-term contracts with guaranteed prices.[213]

Although the EMR represented a retreat from markets as an instrument for achieving the UK's ambitious and legally binding decarbonization targets, it left the struggling retail electricity sector largely untouched. Under the UK's approach to liberalized electricity markets, retail competition in electricity had been phased in over the course of the 1990s, with the residential market opened to competition in 1998.[214] By the 2010s, however, it was clear that most residential customers were not actively engaged in choosing their retail providers, that the retail supplier market was highly concentrated, and that poor and vulnerable customers had fewer choices and typically paid more than wealthier customers.[215] An investigation by the Competition and Markets Authority in 2016, for example, found that the concentrated retail electricity sector (dominated by the so-called Big Six) combined with widespread customer disengagement led to excessive prices and reduced quality of service.[216] Customers on prepayment meters (around

Zero, *Contracts for Difference*, GOV.UK (Nov. 9, 2016), https://www.gov.uk/government/collections/contracts-for-difference [perma.cc/NYF3-7B2C].

211. *See* U.K. DEP'T OF ENERGY & CLIMATE CHANGE, ELECTRICITY MARKET REFORM: DELIVERY PLAN 10 (2013) ("[Contracts for Difference] will support low-carbon generation by giving eligible generators increased price certainty through a long-term contract. A CfD will largely remove exposure to volatile wholesale prices during the CfD period, reducing investment risk. Generators will receive revenue from selling their electricity into the market as usual and will also receive a top-up to a pre agreed 'strike price.' If the market price is over the strike price then the generator must pay back the difference.").

212. *See* U.K. DEP'T OF ENERGY & CLIMATE CHANGE, ELECTRICITY MARKET REFORM: DELIVERING INVESTMENT, 2013, Cm. 8674, at 7 ("The CfD reduces costs to developers of financing a project, by reducing exposure to volatile wholesale prices and reducing project risks. It also provides investors with a familiar legal framework by establishing a CfD as a private law contract, with a single Government-owned counterparty that can raise money from electricity suppliers.").

213. It is important to note here that these renewables contracts are awarded through a competitive bidding process based on regular auctions or "allocation rounds," in which the project owners submit their bids at particular "strike prices" up to a maximum strike price set by the Government. The price bid by the last awarded project need to meet the capacity or pre-established budget constraint set in the auction then establishes the price for the other winning projects in the same category (e.g., off-shore wind). *See* Nicole Watson & Paul Bolton, *Contracts for Difference* 6–7 (House of Commons Library, Research Briefing No. 9871, 2003) (describing how the auction process works).

214. *See* Stephen Littlechild, *The Evolution of Competitive Retail Electricity Markets*, *in* HANDBOOK ON ELECTRICITY MARKETS 111, 112–16 (Jean-Michel Glachant et al. eds., 2021) (describing the evolution of retail competition in electricity in the UK).

215. *See* UK COMPETITION & MKTS. AUTH., ENERGY MARKET INVESTIGATION: FINAL REPORT 549 (2016).

216. *See id.* at 631–33 (finding excessive prices and reduced quality of service for retail customers).

15% of all electricity customers by 2015) also paid higher prices than those on standard tariffs.[217] As wholesale prices continued to rise throughout the 2010s, more and more customers ended up behind on their bills, many of whom were placed on prepayment meters, often installed without their consent.[218] By 2018, the government regulator Ofgem reported that there were 4.4 million residential electricity customers on prepayment meters across the UK and that the cheapest prepayment plans were "significantly more expensive" than the standard plans based on credit (where customers are billed for their use after the fact).[219]

Thus, by the time of the Russian invasion of Ukraine in early 2022, the system was already in crisis, with millions of customers behind on their bills and millions more on prepayment meters struggling to keep the lights on.[220] Chronic underinvestment after years of asset sweating combined with financial engineering attached to dubious takeovers had left the system exhausted and unable to deliver affordable, reliable electricity. As prices spiked to unimaginable levels in the second half of 2022 (after steadily rising for more than a decade), the public backlash forced a succession of Conservative governments to take extraordinary measures to protect households and launch yet another effort to reform the electricity market.[221] For the first time in a generation, grassroots campaigns such as Don't Pay UK focused directly on the cost of energy and its place in a broader cost-of-living crisis, underscoring the failure of neoliberal electricity to deliver stable and affordable electricity for the public.

217. *Id.* at 35–36, 40 (discussing challenges facing customers on prepayment meters), 46 (finding that excessive pricing is "significantly higher" for prepayment customers).

218. *See* David Newbery, *The Evolution of the British Electricity Market and the Role of Policy for the Low-Carbon Future*, *in* EVOLUTION OF GLOBAL ELECTRICITY MARKETS: NEW PARADIGMS, NEW CHALLENGES, NEW APPROACHES 3, 15–16 (Fereidoon Sioshani ed., 2013) (discussing growth of retail competition and move to prepayment meters).

219. *See* OFGEM, VULNERABLE CONSUMERS IN THE ENERGY MARKET: 2019 50 (2019) ("Prepayment meter customers can be limited in the deals they are able to access in comparison to customers on credit meters. The cheapest prepayment tariffs can be significantly more expensive than those available on credit."); *see also id.* at 49 ("There were . . . 4.4 million electricity and 3.4 million gas customers on a [pre-payment meter] in 2018.").

220. *See* OFGEM, CONSUMER PERCEPTIONS OF THE ENERGY MARKET Q4 2022 23 (2023).

221. The Government launched its latest Review of Energy Market Arrangements (REMA) in 2022 which completed a second consultation process in May 2024. *See* DEP'T FOR BUS., ENERGY & INDUS. STRATEGY, *supra* note 9, at 7; DEP'T OF ENERGY SEC. & NET ZERO, REVIEW OF ELECTRICITY MARKET ARRANGEMENTS: SECOND CONSULTATION DOCUMENT 9–14 (2024) (discussing problems with current market structures and proposal for reform and targeting mid-2025 for conclusion of policy development and move to implementation).

3. California and the U.S.

A decade after the Thatcher Government launched their efforts to privatize the UK electricity sector, California took the lead in the United States to restructure and liberalize electricity under Republican Governor Pete Wilson, who was eager to prove his pro-market bona fides as he prepared for a possible Presidential run.[222] Reacting to a growing chorus of concerns about California's deteriorating "business climate," Wilson was apparently intrigued by the idea of unleashing the forces of competition to reduce the price of electricity in a state that had some of the highest prices in the country.[223] These high prices stemmed in part from excessive spending by utilities, including on some very expensive nuclear power plants, but they also reflected California's decision to mandate generous long-term contracts for renewable power under PURPA, which in turn provided a crucial basis for the development of the wind industry in California and beyond.[224]

In the mid-1990s, Wilson appointed UC Davis Law Professor Daniel Fessler as President of the state Public Utilities Commission and charged him with leading the effort.[225] Fessler, who had no background or experience in electricity, was a committed free marketeer and an unabashed anglophile.[226] After a trip to the UK as part of a delegation of electricity

222. *See, e.g.*, Dan Morain, *Deregulation Bill Signed by Wilson*, L.A. TIMES (Sept. 24, 1996, 12:00 A.M.), https://www.latimes.com/archives/la-xpm-1996-09-24-mn-47043-story.html [https://perma.cc/7BV4-WKUE].

223. *Id.* ("[This] landmark legislation is a major step in our efforts to guarantee lower rates, provide consumer choice and offer reliable service, so no one literally is left in the dark. We've pulled the plug on another outdated monopoly and replaced it with the promise of a new era of competition.") (quoting Governor Wilson's statement upon signing the legislation).

224. *See* RICHARD F. HIRSCH, POWER LOSS: THE ORIGINS OF DEREGULATION AND RESTRUCTURING IN THE AMERICAN ELECTRIC UTILITY SYSTEM 93–96 (2002) (discussing California's generous Public Utility Regulatory Policy Act ("PURPA") contracts for renewables). It is worth noting that California's generous PURPA contracts and other supports for renewables provided a critical boost to the renewables industry. By the mid 1990s, for example, a significant share of the world's installed wind capacity was in California. *See Overview of Wind Energy in California*, CAL. ENERGY COMM'N, http://www.energy.ca.gov/wind/overview.html [https://web.archive.org/web/20170118102209/http://www.energy.ca.gov/wind/overview.html] (noting that California wind farms produced 30% of the world's wind energy in 1995).

225. *See* STEVE ISSER, ELECTRICITY RESTRUCTURING IN THE UNITED STATES: MARKETS AND POLICY FROM THE 1978 ENERGY ACT TO THE PRESENT 234 (2015) ("Fessler was a UC Davis contracts law professor who had no particular background in energy issues, but he did boast a conservative ideology and the friendship of the state's First Lady Gale Wilson. That was enough to make him Wilson's choice as president of the CPUC in 1991."). Isser quotes Fessler's reflection on his appointment: "The fact that I had no involvement with, or experience in, the energy, telecommunications, water and transport mandates of that Commission [the PUC] made me the ideal candidate." *Id.* at 234, n.4 (quoting Fessler).

226. *Id.* at 234; *see also* Bill Bradley, *Master of Disaster*, LA WEEKLY (Feb 14, 2001), https://www.laweekly.com/master-of-disaster [https://perma.cc/F8UL-LGA9]; ARTHUR J. O'DONNELL, SOUL OF THE GRID: A CULTURAL BIOGRAPHY OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR 13–14 (2013) (discussing Fessler's background and noting that he was a scholar of the origins of common carrier regulation).

industry leaders and regulators from California, during which they met with Lawson, Littlechild, and Margaret Thatcher, Fessler came back committed to the idea of harnessing the price system to create a new market for electricity in the Golden State.[227] All of which found support from longstanding proponents of deregulation and a growing push by economists to embrace markets for electric power.[228]

The California Public Utilities Commission ("CPUC") took the lead, issuing background documents and instituting a proceeding to develop a blueprint for deregulation.[229] Not to be outdone, the California legislature passed new legislation (A.B. 1890) in 1996 that established the basic legal framework for deregulation.[230] Under the legislation, the state's three large IOUs would divest 50% of their fossil fuel generation and would receive payments for their remaining stranded costs.[231] Going forward, they were prohibited from signing long-term contracts for power and forced to buy all

227. ISSER, *supra* note 225, at 234; *see also* Duncan Campbell, *Thatcher Caught in the Spotlight*, GUARDIAN (Apr. 25, 2001, 7:25 PM), https://www.theguardian.com/world/2001/apr/25/worlddispatch.duncancampbell [https://perma.cc/UGV2-5AZD].

228. *See generally, e.g.*, JOSKOW & SCHMALENSEE, *supra* note 52.

229. *See generally* CAL. PUB. UTILS. COMM'N, DIV. OF STRATEGIC PLANNING, CALIFORNIA'S ELECTRIC SERVICES INDUSTRY: PERSPECTIVES ON THE PAST, STRATEGIES FOR THE FUTURE (1993) [hereinafter The Yellow Book]; Order Instituting Rulemaking on the Commission's Proposed Policies Governing California's Electric Services Industry and Reforming Regulation, R.94-04-031 (Cal. Pub. Utils. Comm'n, Apr. 20, 1994) [hereinafter The Blue Book].

230. A.B. 1890, 1995–96 Leg., Reg. Sess. (Cal. 1996). Much of this was simply a repackaging of the earlier PUC plan.

231. *See* Timothy P. Duane, *Regulation's Rationale: Learning from the California Energy Crisis*, 19 YALE J. ON REG. 471, 501–04 (2002) (discussing divestment and treatment of stranded costs under the state's plan for restructuring). As Duane notes, "AB 1890 required the utilities to sell off half of their oil- and gas-fired facilities, but the utilities went further (with CPUC encouragement) and sold off nearly their entire fossil-fired generation systems. All told, the utilities sold 18,348 MW of generation with a book value of $1.76 billion for $3.33 billion . . . . The ratepayers of the state, therefore, allowed the sale of generation facilities with relatively predictable costs—the capital recovery on $1.76 billion plus fuel and other variable operating costs—in exchange for the possibility of cheaper power to be provided by companies that had just spent nearly twice the book value of the generating assets the ratepayers had just given up. The $3.33 billion earned on the asset sales, meanwhile, went directly to the utilities rather than to ratepayers. The utilities then fed that money to their parent corporations, who fed it either directly to shareholders through dividends and stock repurchases (which decreased dilution and increased the value of remaining shares) or indirectly through investments in unregulated affiliates (whose assets were not subject to regulation or reachable by the utilities' creditors or ratepayers)." *Id.* at 503–04 (footnotes omitted).

of their power needs in the state's new spot market for electricity.[232] Retail electricity rates were also reduced by 10% and frozen for four years or until the utilities had recovered their stranded costs.[233]

Contrary to what some might have expected, the incumbent utilities initially favored restructuring, presumably because they would be free to play a more active role in deregulated electricity markets in the U.S. and abroad and because of the generous treatment they received for their stranded assets and divested generation.[234] Traders such as Enron, of course, were also heavily in favor of restructuring and saw the California market as an opportunity to further dominate the emerging markets for electricity and natural gas across the United States.[235] The state's large industrial and agricultural customers always weighed strongly in favor of restructuring.[236]

The basic market design was similar to the Pool in the UK. A new FERC regulated entity, the California Power Exchange ("Cal PX"), would run the wholesale day-ahead spot market, while the California Independent System Operator ("CAISO") would manage the real-time and ancillary services markets to ensure overall system reliability.[237] As noted, Robert Wilson was one of the key architects of the new markets, all of which used the single-clearing price design.[238]

The market went live in 1998 and for the first couple of years it functioned without major problems.[239] Starting in the summer of 2000,

232 *Id.* at 497–99 (discussing concerns over vertical market power and the decision to force the vast majority (80 to 85%) of electricity sales through the short-term spot market).

233 *Id.* at 501–02 (discussing details of the rate freeze and noting that it actually operated as a rate floor for the first two years of the market allowing the utilities to transfer billions of dollars to their parent corporations and affiliates from April 1998 to April 2000).

234 *See* ISSER, *supra* note 225, at 238 (discussing early role of the major investor-owned utilities ("IOUs") in trying to influence the process). *But see* Matthew W. White, *Power Struggles: Explaining Deregulatory Reforms in Electricity Markets*, 1996 BROOKINGS PAPERS: MICROECONOMICS 201, 209–10 (discussing substantial negative impact of initial restructuring decisions on the valuation of California's three IOUs).

235. *See, e.g.*, GAVIN BENKE, RISK AND RUIN: ENRON AND THE CULTURE OF AMERICAN CAPITALISM 139–40 (2018) (discussing Enron's central role in pushing for electricity deregulation in California); *see also* ISSER, *supra* note 225, at 237 ("Enron was a key supporter of deregulation, constantly drumming the message that deregulation would save billions for California consumers."); *id.* at 194 (discussing Enron's advocacy for deregulation across multiple markets).

236. *See* ISSER, *supra* note 225, at 236–37.

237. *Id.* at 244–25 (discussing basic design of the California Power Exchange ("Cal PX") and California Independent System Operator ("CAISO") markets).

238. *Id.* (noting Wilson's role in the design of the California market and his "triumph" over consumer advocates on the issue of the single-price auction).

239. *See* Borenstein *supra* note 26, at 195 ("Many people were surprised by the market disruption, but in retrospect, the surprise should have been that the market, as it was designed, took two years to self-destruct.").

however, prices in the spot market increased by more than 1,000% and continued at very high levels into the next year.[240] Because of the retail rate freeze, however, the utilities could not pass along their higher costs and there was no real demand response. And without long-term contracts, they were unable to hedge their exposure to spot market prices. Forced to buy high and sell low, the utilities faced deepening credit problems. Pacific Gas & Electric ("PG&E"), the state's largest utility, filed for bankruptcy in April 2001 and Southern California Edison was forced into quasi-receivership with the state's PUC. Rolling blackouts were common, while manipulation of gas and electricity markets reached "epidemic" levels according to FERC.[241] Overall, Californians paid an estimated $40 billion in excess energy costs during the crisis.[242] Litigation to recover these costs is ongoing, more than twenty years later.[243]

Most explanations for the crisis have highlighted bad market design, a naive and ineffective federal regulator, and widespread gaming and manipulation by traders such as Enron.[244] All of that in combination with hot and dry conditions across the western United States, which cut back on imports of power into California, and a general lack of new generation capacity in the state, made for a perfect storm of market dysfunction.

But a big part of that market dysfunction also stemmed from the widespread exercise of market power by new merchant generators who withheld generation during crucial periods of scarcity, allowing them to drive the single-clearing price to very high levels.[245] Under the original restructuring plan, when the IOUs divested the bulk of their generation

240. *See* CHRISTOPHER WEARE, THE CALIFORNIA ELECTRICITY CRISIS: CAUSES AND POLICY OPTIONS 26–27 (2003).

241. FED. ENERGY REGUL. COMM'N, FINAL REPORT ON PRICE MANIPULATION IN WESTERN ENERGY MARKETS I-18 (2003).

242. WEARE, *supra* note 240, at 3–4.

243. *See Energy Unit*, ATT'Y GEN. OFF., https://oag.ca.gov/cfs/energy [https://perma.cc/ED2J-W3XB].

244. There is voluminous literature on the California electricity crisis. *See, e.g.*, WEARE, *supra* note 240, at 1–2 (describing the severe malfunctioning of the California electricity market); Paul L. Joskow, *California's Electricity Crisis*, 17 OXFORD REV. ECON. POL'Y 365, 377–78 (2001) (discussing increases in wholesale electricity prices in California); Duane, *supra* note 231, at 511–17 (discussing major factors leading to the California market meltdown in 2000–01); David B. Spence, *The Politics of Electricity Restructuring: Theory vs. Practice*, 40 WAKE FOREST L. REV. 417, 417 (2005) (discussing California's "disastrous experience" with restructured electricity markets); ISSER, *supra* note 225, at 275–85 (discussing market manipulation and exercise of market power in California electricity crisis).

245. *See, e.g.*, Borenstein, *supra* note 26, at 191; *see also* Duane, *supra* note 231, at 513 ("There was not a single day in the winter and spring of 2001 when total system demand was greater than California-installed generating capacity. Instead, rolling blackouts occurred because generating units were 'unavailable' at a rate four to five times the historic or industry averages, even after accounting for the age of the facilities . . . . The shortages that caused the rolling blackouts were therefore an institutional artifact of California's market structure rather than a physical phenomenon.").

capacity, five main companies each ended up with between six and eight percent of total generation capacity.[246] While that might not sound like much, during periods of peak demand, when essentially all of the available generation capacity was needed to meet load, these generators could wield enormous influence over the clearing price by simply withholding marginal generating units.[247] Here again, an overreliance on the theory of contestable markets, combined with the failure to recognize the intense gaming that the single-clearing price design created, led to major problems.[248]

In the wake of the California crisis, other states that had been actively pursuing deregulation pulled back, leaving the U.S. with a fragmented regulatory landscape with three major regulatory models in use across the country.[249] Nevertheless, the basic model of wholesale electricity markets that was first attempted in California has survived with various adjustments.[250] Today, about two-thirds of U.S. electricity consumers receive their power through organized wholesale power markets run by Independent System Operators ("ISOs") or Regional Transmission Organizations ("RTOs"), although some of these markets, such as the Midcontinent Independent System Operator ("MISO") and the Southwest Power Pool ("SPP"), are still dominated by vertically integrated utilities that self-schedule the bulk of their generation resources through the markets.

246. *See* Borenstein, *supra* note 26, at 195.

247. *Id.* at 200; *see also* ISSER, *supra* note 225, at 250 (discussing evidence of strategic bidding and withholding by gas-fired thermal generation units during the early years of the California wholesale power market).

248. The other important point to note here is that these merchant generators were also able to acquire substantial information on the cost structures of the entire generation fleet serving the California market. Specialized consulting firms compile and provide detailed data on individual plants throughout the western interconnect to merchant generators and energy traders. *See* McDiarmid et al., *supra* note 116, at 14 (noting widespread availability of plant-level data and extensive use of models to combine this data with models on overall operating conditions and transmission constraints to provide a pretty good idea of what every supplier should be bidding for every unit). If everyone knows (or can easily determine) the cost structures and operating conditions of every generating unit in a relevant market, there is no knowledge problem for the markets to solve.

249. *See* Boyd & Carlson, *supra* note 36, at 835–40 (2016) (discussing three models).

250. Proponents of restructuring sometimes framed the choice as an epic battle between markets and Soviet-style central planning. *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.").

4. A Global Project?

Notwithstanding the failures of these early experiments in Chile, the UK, and California, electricity liberalization spread around the world during the 1990s and 2000s, from Australia and New Zealand to Scandinavia, South Africa, and Turkey.[251] In perhaps the biggest experiment of all, moreover, the EU succeeded after almost two decades of work in establishing a single electricity market for the region starting in the late 2010s.[252]

Like other examples of "fast policy" that have become common features of neoliberal globalization, electricity market reform was pushed by a network of academics, experts, consultants, and corporate actors eager to move into new markets.[253] Leading theorists proposed a standard set of "textbook" reforms that, if followed, would deliver competitive wholesale markets and unleash vast gains for energy consumers.[254] The World Bank, along with other development institutions, also pushed power sector reform, sometimes as a condition for loans, as part of a broader effort to get countries in the global south to open up their economies to outside investment.[255]

The overall success of this effort has been mixed at best. While performance and efficiency have improved in some cases, the savings appear to have been captured largely if not entirely by private companies rather than customers.[256] Investment in new capacity has also failed to keep pace with demand, leading to limited reserve capacity in some markets. Poor customers have also been relegated to an inferior status, often stuck with higher cost, strict prepayment plans.[257] And many (if not most) of these markets have struggled in the face of extreme price shocks, in part because of their reliance on the single-price auction design. All of which has led to a growing chorus of calls for an overhaul of the existing market arrangements, especially in the face of the increasing urgency of decarbonization. As noted, reform

251. For an overview, see generally Adib et al., *supra* note 25.

252. *See* Michael G. Pollitt, *The European Single Market in Electricity: An Economic Assessment*, 55 REV. INDUS. ORG. 63, 68–70 (2019).

253. On fast policy, see generally JAMIE PECK & NIK THEODORE, FAST POLICY: EXPERIMENTAL STATECRAFT AT THE THRESHOLDS OF NEOLIBERALISM (2015). For a discussion in the context of climate policy (with a focus on emissions trading), see William Boyd, *The Poverty of Theory: Public Problems, Instrument Choice, and the Climate Emergency*, 46 COLUM. J. ENV'T L. 399, 399 (2021).

254. *See* Joskow, *supra* note 10, at 4–6.

255. *But see* VIVIEN FOSTER & ANSHUL RANA, RETHINKING POWER SECTOR REFORM IN THE DEVELOPING WORLD 57–70 (2020) (noting the challenges and unevenness of implementing power sector reforms around the world).

256. *See* MacKay & Mercadal, *supra* note 29, at 23–26 (finding that prices have increased for consumers in deregulated states compared to those in regulated states).

257. *See, e.g.*, Njabulo Kambule, Kowiyou Yessoufou & Nnamdi Nwulu, *A Review and Identification of Persistent and Emerging Prepaid Electricity Meter Trends*, 43 ENERGY FOR SUSTAINABLE DEV. 173, 176 (2018) (discussing rising global use of prepayment meters over last fifteen years).

efforts are underway in the UK and the EU as well as in Australia, and at least one sitting FERC commissioner and various state regulators are actively pushing market reform in the United States.

D. INVERSIONS

The overarching goal of neoliberal electricity was to subordinate electricity to the magic of the price system. Rather than use prices as tools to drive particular types of investment across the system based on established objectives, the neoliberals believed that an unfettered price mechanism would deliver the system people actually wanted. It was, in essence, an inversion of the relationship between infrastructure and the price system that earlier state-owned and regulated systems had embraced, where rates were set at a level sufficient to recover long-term average costs in order to pay for ongoing investment.

The engineers that built these earlier systems understood that different generating technologies with different characteristics and cost structures allowed them to play different roles in the overall system, and that the system had to be planned accordingly. Prices or rates could be used as tools to drive particular investments and shape load in a manner that would deliver the right mix of assets.

The neoliberals, by contrast, did not seem to care as much about specific technologies or cost structures. In their view, the market would sort all of that out. Neoliberals in fact often took pride in being agnostic about technologies and fuel sources, embracing the mythical notion that market arrangements could somehow be designed to operate in a neutral manner.[258]

258. The failed assumptions of the "technology neutral" position of neoliberal electricity were on full display in June 2022 when Australia was forced to suspend operation of its electricity markets. *See, e.g.*, John Quiggan, *The National Electricity Market is a Failed 1990s Experiment. It's Time the Grid Returned to Public Hands*, CONVERSATION (June 21, 2022), https://theconversation.com/the-national-electricity-market-is-a-failed-1990s-experiment-its-time-the-grid-returned-to-public-hands-185418 [https://perma.cc/CA7H-ELWQ]; Emmet Penney, *Guest Feature: What Killed Australia's Electricity Market?*, GRID BRIEF (June 24, 2022), https://www.gridbrief.com/p/guest-feature-killed-australias-electricity-market [https://perma.cc/GBK7-DHPZ] ("Power system planning engineers historically designed and built our legacy infrastructure [to reflect the fact that different technologies with different characteristics played different roles in the system] . . . . However, the competition economists who directed the transformation of Australia's state-owned power system into a market did not seem to understand this. They took pride in being agnostic about the source of electrons. No attempt was made to design the market framework to allow the various technologies to play to their relative strengths or to combine them in ways that were complementary to a given location. The engineers were locked in the basement. The market framework that was implemented neither differentiated between which technologies nor 'parts' made up the generation system, nor did it comprehend that the performance of the power system would, in time, be significantly dependent on the interactions between these technologies. These defects of analysis and design have, over time, led to an accumulation of increased risks and amplified performance failures.").

The result was a system built around short-term spot markets that created incentives to sweat assets without any sense of how all the pieces fit together.

The new electricity markets also moved decisively away from any sort of redistributive goals. Previous commitments to the idea that electricity was a primary social good or a key system of provisioning in service to the public interest was anathema to the neoliberal vision. With marginal cost pricing, existing cross subsidies were more visible and became much easier to attack. Although never fully realized, the goal of sending real-time price signals to individual consumers endeavored to demolish the idea that electricity should be viewed as a collective undertaking. In the world of neoliberal electricity, everyone would have to pay their own way.

In the wake of multiple crises and market meltdowns, the proponents of neoliberal electricity have sometimes claimed that the real problem has always been the distortions introduced by politics and regulation, as if somehow the design of new markets could be kept pure as it worked its way through the political process.[259] But, of course, there is no basis for ever concluding that market design can be fully insulated from politics and it is naïve and disingenuous—especially coming from those who accept and celebrate the basic insights of public choice theory—to expect that rent seeking behavior either does not apply or can somehow be controlled in the complex and all too often highly opaque world of market design.[260]

259. *See, e.g.*, Frank A. Wolak, *Diagnosing the California Electricity Crisis*, 16 ELEC. J. 11, 11 (2003) ("[T]he California electricity crisis was fundamentally a regulatory crisis rather than an economic crisis.").

260. *See, e.g.*, Oliver E. Williamson, *Why Law, Economics, and Organization?*, 1 ANN. REV. L. & 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 or unanticipated ways that, in large measure, were foreseeable and should have been factored into the calculus.").

II. MARKET CRISES AND STRUGGLES OVER PRICE MAKING

The early 2020s have been brutal for electricity markets. Coming out of the pandemic, markets were already strained by supply chain problems, especially in natural gas. With the Russian invasion of Ukraine, those stresses became extreme as natural gas prices in Europe and the UK spiked to unimaginable levels, up more than 800% at the peak of the crisis.[261] These extreme price shocks rippled around the world and led to a structural realignment of global gas markets, with U.S. suppliers reaping extraordinary profits.[262]

Extreme prices for natural gas translated into very high prices for electricity, particularly in markets built around the single-price auction given that natural gas generation was on the margin setting the price. As consumers and government officials saw this play out in real time, they began asking why low-cost, non-gas generators should be receiving the same price as gas generators when their costs had not changed, triggering deep intuitions about just or fair pricing.[263] As European Commission President Ursula van der Leyen observed, it was clear to everyone that these markets were "no longer doing justice to consumers anymore."[264] In response, those governments with sufficient fiscal capacity took emergency measures to protect households from price shocks and launched a series of longer-term market reform efforts.[265] In some cases, such as Australia, authorities were forced to suspend operation of the electricity market entirely.[266]

What is remarkable about these recent price shocks is that the specific ways of price making operating at the heart of these markets have been made

261. *See* Jamison Cocklin, *European Natural Gas Prices Hit Record, Creating Big Arbitrage Opportunity for U.S. LNG*, NATURAL GAS INTELLIGENCE (Dec. 15, 2021), https://www.naturalgasintel.com/European-natural-gas-prices-hit-record-creating-big-arbitrage-opportunity-for-u-s-lng [https://perma.cc/PLL8-WWEB].

262. *See* INT'L ENERGY AGENCY, GLOBAL GAS SECURITY REVIEW 2023 8 (2023) (noting the structural transformation of natural gas markets in the wake of Russia's invasion of Ukraine).

263. *See generally* Boyd, *supra* note 8 (discussing various social science literatures finding deep, cross-cultural commitments to notions of a just price).

264. von der Leyen, *supra* note 22 ("The current electricity market design—based on merit order—is not doing justice to consumers anymore. They should reap the benefits of low-cost renewables. So, we have to decouple the dominant influence of gas on the price of electricity. This is why we will do a deep and comprehensive reform of the electricity market.").

265. *See supra* notes 12–13 and accompanying text.

266. In June 2022, Australia suspended operation of its electricity market as soaring prices forced the government to intervene. *See* Nathaniel Bullard, *Why Australia's Power Grid Debacle Matters for Global Energy*, BLOOMBERG (June 23, 2022), https://www.bnnbloomberg.ca/why-australia-s-power-grid-debacle-matters-for-global-energy-1.1782786 [https://perma.cc/YM34-5S25]; *see also* AUSTRALIAN COMPETITION & CONSUMER COMM'N, INQUIRY INTO THE NATIONAL ELECTRICITY MARKET 1 (2022); Zhenfei Tan, Hua Geng, Xiaoyuan Xu, Sijie Chen & Zheng Yan, *Suspension of Australian National Electricity Market in 2022 Necessitates Mechanism Evolution Ensuring Power Supply Security*, 11 J. MOD. POWER SYS. & CLEAN ENERGY 674, 674 (2023).

visible to policymakers and publics seemingly for the first time. Instead of simply accepting prices as facts that emerge from markets, the recent crisis has revealed that prices are, as Robert Lee Hale and others emphasized many years ago, relationships, and that those relationships can sometimes be coercive.[267] Viewed in this way, prices and the ways of price making that generate them are never simply facts or technical artefacts, but rather ongoing objects of struggle.[268]

Understanding how these struggles are playing out and the stakes involved requires getting into the details of these markets and the main problems they have confronted since their inception. This Part focuses on four such problems: the pervasive nature of market power, security of supply, price rationing, and decarbonization. Versions of these problems have emerged in virtually all of the electricity markets and have sometimes become acute during moments of crisis. Governments have responded in various ways, all too often adopting piecemeal, ad hoc reforms that tend to operate more as palliative short-term measures rather than as long-term structural solutions. Absent a major overhaul of the basic structure of these markets, these problems will not be resolved. They are, in effect, embedded in the logic of neoliberal electricity and the distinctive ways of price making that allow these markets to function.

267. *See, e.g.*, Robert L. Hale, *The Constitution and the Price System: Some Reflections on Nebbia v. New York*, 34 COLUM. L. REV. 401, 401 (1934) ("[P]rices and price relationships are decisive factors in modern economic life."); ROBERT L. HALE, FREEDOM THROUGH LAW: PUBLIC CONTROL OF PRIVATE GOVERNING POWER 131 (1952) ("[Market prices] result from and register the mutual pressures exerted by buyers and sellers. The amount of pressure which each can exert is very unevenly distributed, with the result that some are economically strong, others economically weak."); JOHN R. COMMONS, INSTITUTIONAL ECONOMICS: ITS PLACE IN POLITICAL ECONOMY 260 (1934) (defining real value as the price obtained in the absence of coercion); Joan Robinson, *Some Reflections on the Philosophy of Prices*, 26 MANCHESTER SCH. ECON. & SOC. STUD. 116, 135 (1958) ("Prices are a social phenomenon and the pricing system in any economy is geared to its social and political system.").

268. *See, e.g.*, MAX WEBER, ECONOMY AND SOCIETY 201 (Keith Tribe ed. & trans., 2019) ("Money prices are the product of contest and compromise, and hence are outcomes of power constellations."); *see also id.* at 183 (describing the price system as a "struggle of man against man" and prices as "expressions of the struggle"). On ways of price making as objects of struggle, see Boyd, *supra* note 21, at 743–44.

A. MARKET POWER

Market power has been a significant and persistent problem in virtually all restructured electricity markets.[269] The assumption that these markets would be contestable once barriers to entry had been removed proved to be overly optimistic and insufficiently attentive to the special challenges facing electricity markets, especially during periods of peak demand.[270] This has resulted in substantial wealth transfers from consumers to producers.[271]

The single-price auction exacerbates the problem of market power for the simple reason that it endows the market clearing price with special significance.[272] When generation capacity is constrained and scarcity pricing prevails, the prospect of windfall profits for inframarginal generators improves dramatically because of the single-price design. This is one reason why these clearing prices become objects of gaming and manipulation by

269. *See, e.g.*, José A. Garcia & James D. Reitzes, *International Perspectives on Electricity Market Monitoring and Market Power Mitigation*, 6 REV. NETWORK ECON. 397, 402 ("[M]arket power concerns arising from market concentration and the inherent conditions affecting electric power markets . . . are a worldwide issue for electricity markets."); Parviz Adib & David Hurlbut, *Market Power and Market Monitoring*, *in* COMPETITIVE ELECTRICITY MARKETS: DESIGN, IMPLEMENTATION, PERFORMANCE 267, 292 (Fereidoon P. Sioshansi ed., 2008) ("Market power is a fundamental problem that affects most electricity markets in transition from a regime of regulated monopolies to competition. Left unaddressed, restructuring will leave consumers at the mercy of unregulated monopolists."); Richard O'Neill & Udi Helman, *Regulatory Reform of the U.S. Wholesale Electricity Markets*, *in* CREATING COMPETITIVE MARKETS: THE POLITICS OF REGULATORY REFORM 128, 141 (Marc Karnis Landy et al. eds., 2007) ("There was not much question that in the transition from the era of monopoly regulation, the new electricity markets could be particularly prone to generation market power.").

270. *See* Severin Borenstein, James Bushnell & Christopher R. Knittel, *Market Power in Electricity Markets: Beyond Concentration Measures*, 20 ENERGY J. 65, 66 (1999) ("One central insight from both theoretical and empirical models of restructured electricity markets is that a single market can at times exhibit very little market power and, at other times, suffer from the exercise of a great deal of market power. The change between these states occurs when demand rises to the point that very few producers have capacity available to compete for the marginal load. This separation is more pronounced in the electricity industry because of the relatively limited production capacities of small producers, the widespread potential for transmission congestion, and the fact that electricity is expensive to store."); *see also* Richard Green, *Market Power Mitigation in the UK Power Market*, 14 UTILS. POL'Y 76, 87 (2006) ("The structure created at privatization [in the UK] is widely acknowledged to have been a mistake. In the early years, the major generators had a lot of market power, and the regulator had a difficult task in preventing its abuse.").

271. *See* Wolak, *supra* note 259, at 14; MacKay & Mercadal, *supra* note 29, at 2–4.

272. Some commentators have suggested that the argument that the single-price auction enhances market power is based on the mistaken assumption that the main alternative auction design (pay-as-bid pricing) would itself not be subject to gaming. *See, e.g.*, Green, *supra* note 270, at 83 ("The most important charge against the Pool, however, was that its uniform price rule enhanced market power. The simplest version of this argument is based upon a fallacy—some stations bid zero, but get the market price, so if they were only paid their own bid, the average price would fall. The fallacy ignores that fact that the stations would promptly change their bidding strategy if the market rules were changed."). But this does not follow and does not acknowledge the fact that, under the single-price auction, the inframarginal generators have a strong incentive to drive the clearing price higher. Moreover, even if there are few if any workable alternative auction designs, that is hardly a reason to dismiss the criticisms directed at the single-clearing price design.

traders and financial institutions.[273] It is also why wholesale generators have employed various strategies to drive clearing prices higher, such as withholding particular generating units during periods of scarcity.[274] This was, as noted, a particular problem during the early years of the UK Pool as well as during the California crisis, and it can be very difficult to police against.[275]

Regulators around the world have generally approached the problem of market power in electricity markets through various *ex ante* mitigation measures, ongoing monitoring and investigation, and *ex post* enforcement.[276] Typically, the U.S. market operators have taken an *ex ante* approach, adopting various structure- and conduct-based approaches that seek to prevent the exercise of market power.[277] The UK, Australian, and EU markets, in contrast, have adopted a more *ex post* approach.[278] The overall trend seems to be toward more elaborate approaches based on a growing recognition that the standard antitrust approach to market structure does not work for electricity markets given their distinctive characteristics.

The evolution of the U.S. approach to market power mitigation is instructive in this regard. In the early years of restructuring, FERC essentially imported the basic approach to market power that it had been

273. *See* Boyd, *supra* note 21, at 798, 801–02; *see also* Gabriel Rauterberg & Andrew Verstein, *Index Theory: The Law, Promise and Failure of Financial Indices*, 30 YALE J. ON REGUL. 1, 31 (2013); Robert C. Hockett & Saule T. Omarova, *Systemically Significant Prices*, 2 J. FIN. REGUL. 1, 11 (2016).

274. *See, e.g.*, ALEXANDRA VON MEIER, ELECTRIC POWER SYSTEMS: A CONCEPTUAL INTRODUCTION 295 (2006) ("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."). There are two main types of withholding: physical and economic. Physical withholding occurs when a generator takes a unit offline through, for example, an unplanned maintenance outage. Economic withholding occurs when a generator knowingly submits a bid at a price that is above the expected clearing price. For a discussion, see Garcia & Reitzes, *supra* note 269, at 402.

275. *See* Frank A. Wolak & Robert H. Patrick, *The Impact of Market Rules and Market Structure on the Price Determination Process in the England and Wales Electricity Market* 7–8 (Nat'l Bureau of Econ. Rsch., Working Paper No. 8248, 1997) (finding that the two dominant generators (National Power and PowerGen) exercised market power by physically and economically withholding capacity from the market); Borenstein, *supra* note 26, at 200-01 (reviewing various studies concluding that sellers exercised significant market power in California's electricity market); *see also* U.S. GEN. ACCT. OFF., RESTRUCTURED ELECTRICITY MARKETS: CALIFORNIA MARKET DESIGN ENABLED EXERCISE OF MARKET POWER 4 (2002) ("[W]holesale electricity suppliers exercised market power by raising prices above competitive levels during the summer of 2000 and at other times after restructuring . . . by withholding electricity from the market"); *id.* at 36–37 (summarizing multiple studies showing extensive withholding of generation from California electricity market during the 2000–01 crisis).

276. *See* Garcia & Reitzes, *supra* note 269, at 408–09 (discussing these approaches).

277. *See* Christoph Graf, Emilio La Pera, Federico Quaglia & Frank A. Wolak, *Market Power Mitigation Mechanisms for Wholesale Electricity Markets: Status Quo and Challenges*, 8–39 (Stanford Freeman Spogli Inst. for Int'l Studies, Working Paper, 2021) (surveying market power mitigation mechanisms in U.S. electricity markets); *see also* Udi Helman, *Market Power Monitoring and Mitigation in the US Wholesale Power Markets*, 31 ENERGY 877, 877 (2006).

278. *See* Garcia & Reitzes *supra* note 269, at 408.

using in experiments with so-called market-based rates for bilateral sales of electricity in the late 1980s and early 1990s.[279] Drawing on antitrust conceptions of market structure, the Commission developed *ex ante* screens to determine whether a firm possessed market power.[280] If the firm passed these screens, the Commission would grant it market-based rate authority—that is, the authority to go out into the market and sell power at market-based rates rather than on the basis of pre-approved tariffs.[281] Various appellate decisions held that FERC's market-based rate program was consistent with the Federal Power Act, on the theory that competition would provide the discipline needed to ensure that rates (prices) would be just and reasonable.[282] Notably, the Supreme Court has never addressed the question of whether market-based rates are consistent with the Federal Power Act.[283]

While the system of market-based rates was designed for a world of bilateral contracts, it took on additional importance with the move to

279. *See* G. William Stafford, *Electric Wholesale Power Sales at Market-Based Rates*, 12 ENERGY L.J. 291, 291–94 (1991) (discussing FERC's early use of market-based rate authority); Helman, *supra* note 277, at 888–93 (discussing evolution of FERC's approach to market power).

280. Use of traditional concentration measures for determining market power in electricity has been criticized on various grounds given the distinctive nature of the electric grid and the possibility of more localized instances of market power that derive from network topographies. *See, e.g.*, Borenstein et al., *supra* note 270, at 86 (1999) ("[Concentration measures] suffer from a number of weaknesses, which are exacerbated when applied to restructured electricity markets."); Carine Staropoli & Céline Jullien, *Using Laboratory Experiments to Design Efficient Market Institutions: The Case of Wholesale Electricity Markets*, 77 ANNALS PUB. & COOP. ECON. 555, 564 (2006) ("Particularly for electricity, market power cannot be assessed based on traditional concentration measures alone. Notably, there is another type of market power, the local market power, which depends essentially on the localization of the network and the temporary topography of the network.").

281. *See* William H. Hieronymus, J. Stephen Henderson & Carolyn A. Berry, *Market Power Analysis of the Electricity Generation Sector*, 23 ENERGY L.J. 1, 36–41 (2002) (describing the history of FERC's use of various market power screens for market-based rate authority). FERC's most significant recent effort to refine its approach to market-based rate authority came in 2016. *See generally* Refinements to Policies and Procedures for Market-Based Rates for Wholesale Sales of Electric Energy, Capacity and Ancillary Services by Public Utilities, 81 Fed. Reg. 33375 (May 26, 2016) (codified as amended at 18 C.F.R. pt. 35). FERC further refined its horizontal market power analysis in 2019. *See generally* Refinements to Horizontal Market Power Analysis for Sellers in Certain Regional Transmission Organization and Independent System Operator Markets, 84 Fed. Reg. 36374 (July 26, 2019) (codified as amended at 18 C.F.R. pt. 35).

282. To date, the Ninth Circuit and the D.C. Circuit have held that market-based rates satisfy the just and reasonable standard. *See, e.g.*, California ex rel. Lockyer v. FERC, 383 F.3d 1006, 1013 (9th Cir. 2004) ("[I]n a competitive market, where neither buyer nor seller has significant market power, it is rational to assume that the terms of their voluntary exchange are reasonable, and specifically to infer that the price is close to marginal cost, such that the seller makes only a normal return on its investment.") (quoting Tejas Power Corp. v. FERC, 908 F.2d 998, 1004 (D.C. Cir. 1990)).

283. *See* Morgan Stanley Capital Grp., Inc. v. Pub. Util. Dist. No. 1 of Snohomish County, 544 U.S. 527, 538 (2008) ("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."); *see also* David B. Spence & Robert Prentice, *The Transformation of American Energy Markets and the Problem of Market Power*, 53 B.C. L. REV 131, 197–200 (surveying the doctrinal landscape regarding the question whether market based rates satisfy the just and reasonable standard).

restructure wholesale markets in the late 1990s and early 2000s.[284] Merchant generators and electricity traders such as Enron were all required to secure market-based rate authority before they could participate in the new wholesale power auctions.[285] Needless to say, FERC's general assumption that this would ensure that these markets would be competitive proved to be mistaken.[286]

Over time, the RTO and ISO markets themselves have also adopted increasingly elaborate mechanisms to mitigate and remedy the exercise of market power. These include automatic "structural" approaches, where the offer prices of large generators deemed to have potential market power are automatically replaced with default reference prices, as well as behavioral approaches (sometimes called conduct and impact approaches), where the market monitor reviews and replaces offer prices found to be non-competitive with default reference prices.[287] FERC also has substantial civil penalty authority that it can use to enforce against market manipulation and conduct that produces prices that are unjust and unreasonable.[288]

In contrast to the U.S. approach, other markets around the world have taken a less proactive approach to market power and tend to rely more on *ex post* monitoring and enforcement as well as referrals to competition authorities.[289] In some cases, such as the UK in the late 1990s, this led to a new round of mandatory divestments by large generators as well as various

284. *See* Market-Based Rates for Wholesale Sales of Electric Energy, Capacity, and Ancillary Services by Public Utilities, 72 Fed. Reg. 39904 (July 20, 2007) (codified as amended at 18 C.F.R. pt. 35) (establishing system of market-based rates for wholesale sales of electricity).

285. *See* Enron Power Marketing, Inc., Order Accepting Rate Schedule as Modified, and Granting and Denying Waivers, 65 FERC ¶ 61,305 (Dec. 2, 1993); Enron Energy Services Power, Inc., Order Conditionally Accepting for Filing Proposed Market-Based Rates, 81 FERC ¶ 61,267 (Nov. 26, 1997). In the wake of the California electricity crisis and evidence of Enron's efforts to manipulate the market, FERC revoked Enron's market-based rate authority in 2003. *See* Enron Energy Services, Inc., Order Revoking Market-Based Rate Authorities and Terminating Blanket Marketing Certificates, 103 FERC ¶ 61,343 (June 25, 2003).

286. *See* Borenstein et. al., *supra* note 270, at 67 ("The market power analysis supporting the approval by FERC of market based rates for electrical energy in both California and the PJM pool . . . was dominated by concentration measures.").

287. *See* Garcia & Reitzes, s*upra* note 269, at 409–10. The default reference prices used under these approaches are the market operators' estimate of the price that the generator would offer if it faced effective competition. One would be forgiven for asking how much of a departure this is from traditional cost-of-service regulation.

288. Partly in response to the California electricity crisis of 2000–01, Congress gave FERC significantly enhanced civil penalty authority in the Energy Policy Act of 2005, which allows FERC to impose penalties of up to $1 million per day per violation for violations of the Natural Gas Act or the Federal Power Act. *See* Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594, 691, 980 (2005) (establishing enhanced civil penalty authority under the Natural Gas Act and the Federal Power Act).

289. *See* Garcia & Reitizes, *supra* note 269, at 409.

market reform initiatives.[290] In others, it led to prohibitions on certain acquisitions and ongoing investigations.[291]

The bottom line here is that restructured electricity markets have never been sufficiently contestable to control the exercise of market power. Given the capital intensity of new generation combined with long lead times and general uncertainty regarding consistent dispatch in the markets (uncertainty that increases as the share of intermittent, non-dispatchable generation increases), there are significant barriers to entry and exit that undermine contestability. And because privatization and restructuring often failed to create a sufficiently competitive market structure at the outset, in part because of an overreliance on the theory of contestable markets, the problem of market power has turned out to be pervasive.[292] In electricity, as many observers have noted, extreme inelasticity of demand combined with the lack of storage and the need to balance the system in real time creates opportunities for individual firms with limited market share to set prices above marginal costs.

These problems with market power have been borne out repeatedly in the experience of electricity markets, particularly during periods of scarcity. Indeed, because scarcity pricing delivers very large rents to inframarginal generators, incumbent generators have a strong incentive to maintain the system as close to the edge as possible. When compounded by larger structural crises or extreme events, the basic mechanism of scarcity pricing in these markets can result in extremely high prices and very large windfalls for inframarginal generators. During the recent price shocks in Europe, for example, one scholar estimated that non-gas generators received some 400 billion EURs in windfall profits as a result of the very high clearing prices for natural gas generators.[293] To mitigate this, EU member states considered several responses, including windfall taxes on generator profits, a new lower reference price for natural gas that would set the marginal electricity price,

290. *See* Green, *supra* note 270, at 87–88 (discussing divestitures, possible reference to competition authorities, and more general market reform initiatives as responses to continued exercise of market power in UK electricity markets).

291. *See* Tomaso Duso, Jo Seldeslachts & Florian Szücs, *The Impact of Competition Policy Enforcement on the Functioning of EU Energy Markets*, 40 ENERGY J. 97, 97 (2019) ("[Since 2002, the European Commission has used] the full range of enforcement tools at its disposal, including merger control, antitrust legislation, and state aid control [to protect competition in gas and electricity markets.]").

292. *See, e.g.*, Borenstein, *supra* note 26, at 200 ("This focus on market share analysis ignores the reality that in a market with no demand elasticity and strict production constraints, a firm with even a small percentage of the market could exercise extreme market power when demand is high. On a hot summer afternoon, when the system operator needs 97 percent of all generators running to meet demand, a firm that owns 6 percent of capacity can exercise a great deal of market power.").

293. *See* Natalia Fabra, *Electricity Markets in Transition: A Proposal for Reforming European Electricity Markets* 6 (Ctr. Econ. Pol'y Rsch., Discussion Paper DP17689, 2022).

and permission to member states to introduce price caps for inframarginal generators.[294]

But it would be a mistake to conclude that market power only exists during periods of scarcity and that short-term measures directed at limiting or clawing back some of the windfalls constitutes an adequate response . In fact, experience in the UK and recent studies investigating market power in the United States indicate that price markups have been far more pervasive across time, even as costs have declined, and that these price markups affect both short-term auctions and the long-term bilateral contracts that are increasingly common in all of these markets.[295] Moreover, it is also important to recognize that most of the generators and traders in most of the markets actually have very specific, detailed information on the cost structures all of the other generators in the market as well as a very good understanding of overall demand and system constraints.[296] Needless to say, this complicates the Hayekian premise that these markets are necessary to aggregate knowledge from a diffuse set of actors, much less that there is sufficient competition to allow prices to play their proper coordinating function.

B. SECURITY OF SUPPLY

Notwithstanding the pervasive fact of market power (and the additional profits that accrue to those with market power), all of these markets have also struggled to produce sufficient incentives for new investment. This might seem paradoxical if there are in fact substantial rents available in these markets for generators able to exercise market power. Part of this goes back to the challenges of entry (and exit) in these markets—the capital intensity of new generation, the long lead times, the volatility of spot market prices, and regulatory uncertainty—all of which have worked against contestability. Part of it also likely stems from specific mechanisms, such as price caps, that have been adopted by market operators to mitigate against market power and protect consumers. This has created what some economists have referred to as a "missing money" problem in the markets, which refers to the limits on inframarginal rents available during periods of scarcity that, if available to inframarginal generators, would in theory be sufficient to encourage new investment.[297] More generally, the entire purpose of privatization and

294. Council Regulation 2022/1854, 2022 O.J. (L 261) 1. *See generally* European Commission, *Policy Options to Mitigate the Impact of Natural Gas Prices on Electricity Bills*, Non-Paper (2022).

295. *See, e.g.*, MacKay & Mercadal *supra* note 29, at 26–27.

296. *See* McDiarmid et al., *supra* note 116, at 12.

297. On the missing money problem, see generally David Newbery, *Missing Money and Missing Markets: Reliability, Capacity Auctions, and Interconnectors*, 94 ENERGY POL. 401 (2016). Some economists view price caps as the primary cause of the missing money problem. Others have pointed to

restructuring was to correct for the overbuilding that was supposedly endemic under state-owned and regulated cost-of-service systems. In fact, the new electricity markets have never been oriented toward promoting investment, but rather were focused from the start on "sweating" existing assets.[298] The whole point of shifting the risk of investment from ratepayers to investors was to mitigate against overinvestment and waste and improve performance of existing assets, something that the markets have clearly delivered upon.[299]

The irony (and the tragedy) here is that underinvestment is actually a much more serious problem than overinvestment when it comes to systems of provisioning for necessities. When electricity grids do not have sufficient reserve capacity to meet peak demand, significant disruptions can result. These problems can become acute during extreme events, with very serious consequences. During Winter Storm Uri in Texas, when temperatures in South Texas were lower than they were in Alaska in February, close to half of the state's generation capacity was offline because of a lack of investment in winterization and insufficient reserve capacity.[300] This was true across all sources of generation, and the system came very close to total collapse as a result.[301] More than two hundred people died during that crisis.[302]

the inability of the markets to properly value and price the benefits of capacity and reliability. For a discussion, see Jan Horst Keppler, Simon Quemin & Marcelo Saguan, *Why the Sustainable Provision of Low-Carbon Electricity Needs Hybrid Market*s, 171 ENERGY POL. 1, 2–3 (2022). Of course, as Severin Bornstein has pointed out, none of these markets would be viable as a political matter without price caps, irrespective of what theory instructs. *See* Borenstein, *supra* note 26, at 207 ("In reality, price caps are, and will continue to be, a critical element of virtually all wholesale electricity markets. The extreme inelasticity of both supply and demand means that supply shortages, whether real or due to market power, can potentially drive prices many thousands of times higher than their normal level. Such outcomes would destroy the market."). In sum, the problem that the notion of "missing money" seeks to capture suggests deep structural tensions in these markets and the ongoing distributional struggle over the ways of price making that operate in these markets. Indeed, the term itself is yet another telling example of how the language of economic theory tends to naturalize and depoliticize these distributional struggles.

298. *See, e.g.*, HELM *supra* note 153, at 423 ("It was a lucky coincidence that the market approach of the 1980s and 1990s was applied in the context of mature and well-invested electricity and gas networks. The assets could be sweated without worrying too much about the cost of capital or supply security. That luxury is no longer available, and hence the regulatory priority, and the appropriate instruments, need to shift towards investment.").

299. *Cf.* David M. Newbery, *Power Markets and Market Power*, 16 ENERGY J. 39, 42 (1995) ("The effects of privatization on performance have been impressive in terms of labor productivity, profitability, and share prices . . . . The question to be addressed here is whether these gains were at the expense of consumers through the exercise of market power by the privatized generators or through increased productive efficiency.").

300. *See generally* FED. ENERGY REGUL. COMM'N, THE FEBRUARY 2021 COLD WEATHER OUTAGES IN TEXAS AND THE SOUTH CENTRAL UNITED STATES (2021) (providing detailed discussion of the outages during Winter Storm Uri).

301. *Id.* at 10–15.

302. Patrick Svitek, *Texas Puts Final Estimate of Winter Storm Death Toll at 246*, TEX. TRIBUNE (Jan. 2, 2022), https://www.texastribune.org/2022/01/02/texas-winter-storm-final-death-toll-246 [https://

To be sure, market regulators have long recognized the problem of underinvestment and have gone to great lengths to encourage new investment.[303] The so-called missing money problem has been a near constant refrain among market boosters.[304] This has led to all manner of contrivances such as capacity markets, capacity payments, reliability must-run contracts, and outright mandates and subsidies for new generation. While some of these efforts have succeeded in driving new investment, it would be hard to describe the current mix of policies and programs to promote investment in new capacity as rational or well designed. Much of it in fact looks like bad cost-of-service regulation that has created ample opportunities for new rent seeking behavior.[305]

The larger lesson here is that an overbuilt system is actually much better for consumers than a system that is slightly underbuilt or even one that is operating right on the edge of full capacity. When it comes to vital infrastructure, asset sweating is generally not a good strategy. And even if there was a time when asset sweating made sense for the electricity sector, this is decidedly not the case today as the sector enters a new phase of substantial investment.

C. PRICE RATIONING

The neoliberal vision of competitive electricity markets depended ultimately upon the ability to transmit real-time prices in the wholesale markets all the way through to consumers in the retail markets. If consumers could see and respond to the actual wholesale cost of electricity as it fluctuated in real time, they would be able to adjust their demand accordingly

perma.cc/NUG3-WJZU].

303. The failure of deregulated electricity markets to provide adequate revenues for investment in generation capacity in Europe is well documented. *See, e.g.*, Dominique Finon & Virginie Pignon, *Electricity and Long-Term Capacity Adequacy: The Quest for Regulatory Mechanism Compatible with Electricity Market*, 16 UTILS. POL'Y 143, 143 (2008); Jan Horst Keppler, *Rationales for Capacity Remuneration Mechanisms: Security of Supply Externalities and Asymmetric Investment Incentives*, 105 ENERGY POL'Y 562, 562 (2017); Natalia Fabra, *A Primer on Capacity Mechanisms*, 1 (Univ. of Cambridge Energy Pol'y Rsch. Grp. Working Paper No. 1806, 2018). For the United States, see Peter Cramton, Axel Ockenfels & Steven Stoft, *Capacity Market Fundamentals*, 2 ECON. ENERGY & ENV'T POL'Y 27, 27 (2013). *See also* Paul L. Joskow, *Capacity Payments in Imperfect Electricity Markets: Need and Design*, 16 UTILS. POL'Y 159, 159 (2008).

304. *See, e.g.*, William W. Hogan, *Electricity Market Design and Zero Marginal Cost Generation*, 9 CURR. SUSTAINABLE/RENEWABLE ENERGY RPTS. 15, 23 (2022).

305. *See* Boyd, *supra* note 21, at 809–12 (discussing problems with rent seeking and capacity market design in various RTO/ISO markets in the U.S.). Recent legislation introduced in Texas would provide guaranteed returns of 10% funded by taxpayers for 10 GW of new natural gas plants that would provide back-up reserve power in the event of future crises. The total cost is estimated at some $18 billion. *See* Emily Foxhall, *Bills Aimed at Adding More Natural Gas Power to Texas Grid Clear Senate*, TEX. TRIBUNE (Apr. 5, 2023), https://www.texastribune.org/2023/04/05/texas-senate-grid-natural-gas-energy-legislature [https://perma.cc/V927-DKDM].

and the system would be optimized. This form of price rationing provided a way to manage load, as Boiteux and others recognized in the 1950s, and was the only way to fully realize the allocative efficiency that comes with marginal cost pricing.[306]

The problem is that most retail customers in most markets do not want to take service on these terms. When given the choice, most residential customers in most markets seem to prefer stable, flat rates as evidenced by the general lack of switching in retail markets that allow it.[307] This is especially true for the elderly and others who spend a lot of time at home and have limited options for shifting their demand over time.[308] To be sure, an increasing (but still quite small) number of residential retail customers in the U.S. and elsewhere have started to take service under a system of time-varying rates—an option that is much easier with new advanced metering infrastructure.[309] And commercial and industrial customers have long opted for time-varying rates because of their sensitivity to costs and ability to shift load.[310] In some states such as California and Massachusetts, moreover, certain classes of residential customers are being defaulted into time-varying rates.[311]

There are a range of options here—from simple time-of-use block rates to various forms of peak pricing to fully-dynamic real-time pricing, and there is a large and growing literature evaluating the relative advantages of each.[312] The catch is that the more closely retail prices track wholesale prices, the more volatile and unpredictable customers' bills become. This is, of course,

306. Boiteux, *supra* note 79, at 83–84.

307. *See* MATHEW J. MOREY & LAURENCE D. KIRSCH, ELEC. MKTS RES. FOUND., RETAIL CHOICE IN ELECTRICITY: WHAT HAVE WE LEARNED IN 20 YEARS? v (2016) (noting that less than one tenth of eligible residential customers in U.S. markets have switched providers); *see also id.* at 62 ("In summary, there is evidence that retail choice decisions require business savvy that many consumers lack, and that less educated or low-income consumers are more likely than other consumers to make poor retail supplier choices."). For a review of U.S. and international experiences with retail choice in electricity, see generally Littlechild *supra* note 214.

308. *See* Lee V. White & Nicole D. Sintov, *Health and Financial Impacts of Demand-Side Response Measures Differ Across Sociodemographic Groups*, 5 NAT. ENERGY 50, 50 (2020) (noting that time-varying rates and other forms of responsive pricing can have detrimental effects on the poor and elderly).

309. *See, e.g.*, Shan Zhou, *The Effect of Smart Meter Penetration on Dynamic Electricity Pricing: Evidence from the United States*, 34 ELECTR. J. 1, 6 (2021) ("[The growing penetration of smart meters in the United States] is positively and significantly associated with the share of customers participating in dynamic pricing.").

310. *See* Nasim Nezamoddini & Yong Wang, *Real-Time Electricity Pricing for Industrial Customers: Survey and Case Studies in the United States*, 195 APPLIED ENERGY 1023, 1023 (2017).

311. *See* Boyd & Carlson, *supra* note 36, at 873.

312. *Id.* at 869–77 (discussing the different forms of time-varying rates). *See generally* Jacob Mays & Diego Klabjan, *Optimization of Time-Varying Electricity Rates*, 38 ENERGY J. 67 (2017) (discussing debates on different types of time-varying rates).

also the basis for the opportunities that such pricing programs entail—allowing customers to adjust their demand in response to price signals over the course of a day, month, or season. But the assumptions about consumer behavior that underwrite much of the thinking about these policies seem to be rather crude and unrealistic. How many people actually want to be energy day traders for a few dollars a day (at most)?

More importantly, dynamic retail pricing can also turn out to be a disaster when wholesale prices reach extreme levels. To take a rather dramatic recent example, in Texas during Winter Storm Uri, many of the customers who ended up with extremely high bills used a retail provider called Griddy to procure their power. For a monthly fee of $9.99, Griddy provided its customers with retail electricity at a price that mirrored the wholesale cost of electricity established by the auctions in the Texas electricity market.[313] As one of the purest forms of dynamic marginal cost pricing of electricity that one could find, Griddy sought to put into practice what Alfred Kahn and other proponents of marginal cost pricing had long sought—a system where supply and demand could mutually adjust based on real-time price signals.

In February 2021, however, the Texas grid was pushed to the breaking point and wholesale prices were allowed to rise to the market operator's $9,000/MWh price cap for several days.[314] Given the arctic conditions across the state, of course, most customers had little choice but to keep using their electricity as long as it was available. This left thousands of customers facing astronomical bills and financial distress (one Griddy customer reported a bill of $16,752).[315] Griddy, of course, went out of business (after urging its customers to switch suppliers) and the government had to come to the rescue.[316] The Texas Public Utility Commission issued orders blocking retail providers from sending bills or disconnecting customers, while the Texas Legislature promptly banned the use of dynamic real-time pricing plans like

313. William Boyd, *Getting Down to the Nitty Griddy*, LEGALPLANET (Feb. 24, 2021), https://legal-planet.org/2021/02/24/getting-down-to-the-nitty-griddy [https://perma.cc/4QPQ-ZJJR].

314. *See* Luminant Energy Co. v. Pub. Util. Comm'n of Texas, 665 S.W.3d 166 (Tex. App. 2023) (discussing scarcity pricing mechanism in ERCOT market and two Texas PUC orders during Uri directing ERCOT to set market clearing price at $9,000 per MWh); *see also* Stephen Littlechild & Lynne Kiesling, *Hayek and the Texas Blackout*, 34 ELECTR. J. 1, 6 (2021) (describing decision by the Texas PUC to direct ERCOT to set wholesale prices at the $9,000 per MWh cap given the dramatic scarcity of supply, much of which was offline because of a lack of weatherization). The price cap stayed in effect for four days. *Id.* at 7.

315. *See* Giulia McDonnell Nieto del Rio, Nicholas Bogel-Burroughs & Ivan Penn, *His Lights Stayed on During Texas' Storm. Now He Owes $16,752*, N.Y. TIMES (Feb. 20, 2021), https://www.nytimes.com/2021/02/20/us/texas-storm-electric-bills.html [https://perma.cc/T4FR-FGKT].

316. *See* Littlechild & Kiesling, *supra* note 314, at 5 (describing Griddy's "Hayekian" approach to residential electricity pricing and its demise during Winter Storm Uri).

the one offered by Griddy.[317] Some Texas politicians even called for federal relief for Texan's utility bills.[318]

Various commentators have also argued that real time pricing would have helped avert the California electricity crisis in 2000–01, given that the retail rate freeze instituted as part of the restructuring legislation undermined any possibility of demand response and forced utilities to buy high and sell low.[319] There is surely some truth to this, but it is difficult to gauge how much of a difference it would have made. In fact, widespread use of responsive pricing during the California crisis would likely have transferred the costs of market power and market manipulation to rate payers in the short term rather than over the longer term. And it would surely have hurt those most dependent on electricity, such as the elderly and the infirm.

The key lesson here is that an overreliance on responsive pricing for necessities can quickly become coercive during periods of great need, raising important political and ethical questions about the overall governance of key systems of provisioning. Even the proponents of responsive pricing have recognized this. As William Vickrey put it more than fifty years ago, "the main difficulty with responsive pricing is likely to be not mechanical or economic, but political. The medieval notion of the just price as an ethical norm, with its implication that the price of a commodity or service that is nominally in some sense the same and should not vary according to the circumstances of the moment, has a strong appeal even today."[320] Indeed it does.

But perhaps the most extreme manifestation of price rationing in electricity is the widespread use of prepayment meters that have been such a prominent part of retail electricity in the UK and other markets around the world over the last decade.[321] Retail providers, not surprisingly, strongly

317. *See* Order Directing Certain Actions and Granting Exceptions to Certain Rules, Proj. No. 5182, Pub. Util. Comm'n of Tex. (Feb. 21, 2021) (prohibiting disconnections and requiring deferred payment plans for customers); An Act Relating to the Regulation of Certain Retail Electric Products, H.B. 16, 87th Sess. (Tex. 2021) (prohibiting electricity providers from offering "wholesale indexed products" to residential and small commercial customers and defining a "wholesale indexed product" as a "retail electric product in which the price a customer pays for electricity includes a direct pass-through of real-time settlement point prices" from the wholesale ERCOT market).

318. *See* Martin Pengelly, *Republicans Eye Federal Funds to Help Pay Texans' Exorbitant Energy Bills*, GUARDIAN (Feb. 21, 2021, 3:10 PM), https://www.theguardian.com/us-news/2021/feb/21/texas-republicans-federal-funds-energy-bills [https://perma.cc/8LAR-M3DN].

319. *See, e.g.*, WEARE, *supra* note 240 at 26–27.

320. Vickrey, *supra* note 81, at 346; *see also* Boyd, *supra* note 8, at 721 (discussing history of the concept of just price and its influence on public utility law).

321. *See* Steve Thomas, *Allowing British Electricity Consumers to Choose Their Supplier*, IEEE POWER & ENERGY MAG., July/Aug. 2023, at 18, 21 ("The widespread use of prepayment meters is a particular feature of the British reforms. In 2016, about 16% of consumers used them. Their use dates to 1993, when policy became that consumers struggling to pay their energy bills had little choice but to

favor the use of prepayment meters precisely because they put responsibility on individual households and provide a means to extract additional fees from the poor.[322] Indeed, various government reports have found that customers on prepayment meters typically pay higher prices than those on standard tariffs and have fewer options to switch among providers.[323] The widespread use of prepayment meters in the midst of the recent energy crisis, as noted, became one of the major points of contention for grassroots campaigns such as Don't Pay UK.[324]

What seems to be increasingly clear from these developments is that many customers do not view electricity as a commodity. Rather, they (we) tend to view it as part of the basic infrastructure of everyday life and many of us prefer a stable, predictable monthly bill. This is especially true for older customers, low-income customers, and others who are confined to their homes because of illness or, say, a pandemic. So, while it may be true that more price-mediated demand response can make the power grid more responsive and help to balance supply and demand, we need to think long and hard about safeguards and protections during extreme events for certain classes of customers and should proceed carefully as we start defaulting customers into systems of variable rates as California, Massachusetts, and other states are doing.[325] Prices for electricity, like the prices for other essential services, are more than just signals, and the ways in which we decide to make prices for these essential services (that is, the ways in which we design and use regulation and markets to generate prices) have serious implications for people and their ability to get on with their lives.

As we enter the age of electricity, moreover, price rationing makes even less sense than in the past. Going forward, we actually want people to use *more* electricity, not less; that is, we want them to replace their gas-fired cooking and heating and their internal combustion vehicles with electricity. That means we need to find ways to make electricity cheaper and more stable over time so that we can accelerate the process of decarbonization through electrification. Although well-designed time-varying rates clearly have an important role to play in shifting load and balancing the system as we ramp

switch to prepayment meters. In some cases, retail suppliers break into consumers' premises to replace the standard meter with a prepayment meter . . . . From an industry point of view, prepayment meters were an ideal solution to the issue of consumer debt. With a prepayment meter, consumers that could not afford to buy energy cut themselves off, so there was no possibility of further debt.").

322. *Id.*

323. *See, e.g.*, UK COMPETITION & MKTS. AUTH., *supra* note 215, at 546 (noting that customers on prepayment meters often paid higher prices).

324. *See supra* text accompanying note 7 (describing Don't Pay UK demand to end use of prepayment meters).

325. *See* Boyd & Carlson, *supra* note 36, at 873.

up electrification, it seems unlikely that most customers will be able to constantly adjust their demand in response to constantly changing price signals. Any viable decarbonization strategy will need to include rate designs that spread costs over time and across customers while ensuring access to affordable electricity for everyone.

D. DECARBONIZATION

There has long been an implicit assumption in much of the energy policy literature that because wind and solar are now the cheapest sources of electricity generation, investment will inevitably flow to these technologies relative to others. Subsidies and supports have been and will continue to be important, the argument goes, but now that renewables have won the war on costs, markets are the best way to translate these cost advantages into deployment at scale. The rapid growth of renewables in general and solar energy in particular are often taken as evidence of this.

As Brett Christophers reminds us, however, this assumption rests on a basic misconception about how capitalism works.[326] Simply put, capital flows not to the lowest cost option but to the one with the highest expected profits.[327] This is part of the reason why large fossil fuel companies continue to invest heavily in fossil fuels rather than renewables. They simply cannot make the same profits in renewables that they make with fossil hydrocarbons.[328] Thus, to assume that renewables will beat gas and coal just because they are cheaper is to ignore the all-important question of whether they are actually more profitable. Without question, cost and profit are sometimes aligned, but that is always an artefact of the system of price making that has been devised rather than some sort of natural fact about markets.

The assumption that low-cost renewables will beat fossil fuels simply because they are cheaper also ignores the distinctive cost structures and capital requirements of the new renewable energy technologies. Because renewables are essentially all capital costs and no variable costs, the cost of financing is all important.[329] It is in the capital markets, therefore, that much of the future cost of renewable energy will be determined.[330]

326. *See* CHRISTOPHERS, *supra* note 27 at xii-xiii (arguing that one should focus on profit rather than relative prices when analyzing the prospects for investment in clean energy).

327. *Id*.

328. *See id.* at xxv. *See generally* Brett Christophers, *Fossilised Capital: Price and Profit in the Energy Transition*, 27 NEW POL. ECON. 146 (2022).

329. *See* Keppler et. al., *supra* note 297, at 6 (noting that capital costs dominate the investment challenge for renewables and concluding that the inability of markets to ensure cost recovery causes financing costs to rise considerably).

330. *See, e.g.*, Malcolm Keay, John Rhys & David Robinson, *Electricity Market Reform in Britain:*

The need for large upfront financing and stable revenues is also why, in virtually all electricity markets, renewable energy is almost always compensated through long-term contracts at fixed prices that make these projects largely indifferent to the prices that emerge from the spot markets.[331] Simply put, the inframarginal rents available in the electricity markets have not provided sufficiently reliable revenues to compensate new investment, leading governments to intervene in various ways. In the UK, as noted, since 2013 the government itself has stepped in to act as the counterparty on long-term renewables contracts precisely in order to promote investment and lower the cost of capital.[332] In the EU, member states are also moving toward a system of contracts-for-differences, building on their longstanding use of feed-in-tariffs and other mechanisms to de-risk investment in renewables.[333] Other countries, including Brazil, Chile, Colombia, and Argentina have adopted similar approaches.[334] And, in the United States, aggressive state Renewable Portfolio Standards, which were adopted initially to protect and promote renewables during the transition to restructured electricity markets, often mandate the use of long-term power purchase agreements, and virtually all renewable energy projects are financed on the basis of such long-term contracts.[335] In important respects, this can be seen as a move back to a form of vertical integration—another sign that short-term spot markets cannot provide the compensation these resources require.[336]

Central Planning Versus Free Markets, *in* EVOLUTION OF GLOBAL ELECTRICITY MARKETS: NEW PARADIGMS, NEW CHALLENGES, NEW APPROACHES 31, 34–35 (Fereidoon P. Sioshani ed., 2013) (discussing distinctive financing and investment challenges for renewables and the inadequacy of current market structures); Joskow, *supra* note 27, at 325 (discussing preference for long-term contracts for renewables as a means to lower the cost of capital for renewable energy projects).

331. *See* Roques & Finon *supra* note 27, at 590 ("The experience with policies that aim to support RES-E [Renewable Energy Sources for Electricity] in liberalized markets shows an evolution across countries in favour of mechanisms based on long-term arrangements to guarantee revenues."); Graham Weale, *Can an Energy-Only Market Fully Remunerate Investment? Empirical Evidence Since 2005*, 177 ENERGY POL'Y 1, 3 (2023) (finding that wholesale power prices in France and Germany from 2005 to 2019 were not sufficient to cover full costs).

332. *See supra* Section I.C.2.

333. Joskow, *supra* note 27, at 325; Roques & Finon, *supra* note 27, at 584.

334. Joskow, *supra* note 27, at 324 ("At least 50 countries have relied to some extent on long-term PPAs mediated through competitive procurement programs to acquire some or all of the wind, solar, nuclear, green natural gas, storage, etc. that they forecast they need to meet their decarbonization goals.").

335. *See* Roques & Finon *supra* note 27, at 590 (discussing use of long-term PPAs for renewables projects driven by Renewable Portfolio Standards in the US).

336. *See, e.g.*, Joskow, *supra* note 27, at 316 ("I expect to see this [clean electricity] transition lead to more government intervention in long-term planning of investments ('integrated resource planning' or IRP) in wind, solar, storage, and other carbon-free technologies, more reliance on long-term contracts ('purchased power agreements' or PPAs), more government-mandated competitive procurements of generation by long-term PPAs and, as a result, a partial return to government planning and vertical integration by contract rather than ownership."); Boyd, *supra* note 36, at 1683–96 (discussing need for planning and investment outside of current electricity markets to facilitate decarbonization).

Finally, the inability of organized the electricity markets to promote renewables becomes even more acute as the overall share of renewables increases. This is because in a single-price auction built around short-run marginal costs, large-scale presence of renewables will compress and ultimately destroy the clearing price.[337] While this may be viewed as a positive development for those who want to accelerate the retirement of coal, gas, and even nuclear, it also makes it impossible for renewables (or storage for that matter) to receive sufficient compensation through these markets, which then simply reinforces the preference for other forms of long-term remuneration and support.[338]

III. DECOMMODIFYING ELECTRICITY

In 2022, for the first time, global investment in clean energy exceeded $1 trillion and matched, also for the first time, global investment in fossil hydrocarbons.[339] Notwithstanding the headwinds of supply chain disruptions, higher interest rates, and geopolitical uncertainty, clean energy investment looks likely to continue growing and will soon be the main driver of global energy investment.[340] While there is much to celebrate in these developments, the problem is that current investment levels are still only a fraction of what the world needs to hit its climate targets. In fact, the world needs to be investing at least $4 trillion dollars every year starting now to have a reasonable chance of hitting those targets.[341] And, needless to say, every dollar invested in new fossil fuel assets creates that much more inertia in a global energy system that is still dominated by fossil fuels.

The continuing shortfall in current levels of investment are often taken as evidence that we need additional interventions by governments to de-risk and turbocharge private sector investment. This was, in part, the thinking behind the Inflation Reduction Act ("IRA"), and it has become an article of faith for many policymakers around the world. The politics of these sorts of subsidies are, of course, much easier than interventions focused on imposing additional costs on emissions, whether through pricing mechanisms or direct regulation. As the EU and the UK ramp up their own subsidies for the green transition, moreover, the existing "rules-based" trading system is being challenged by a newfound faith in industrial policy. But while economists

337. *See* Joskow, *supra* note 27, at 315 (observing that wind and solar are not suitable for "traditional short-run auction-based 'economic dispatch' protocols and associated market mechanisms").

338. *Id.* at 319.

339. BLOOMBERG NEW ENERGY FIN., ENERGY TRANSITION INVESTMENT TRENDS 2023: TRACKING GLOBAL INVESTMENT IN THE LOW-CARBON ENERGY TRANSITION 8–11 (2023).

340. *Id.*

341. *Id.* at 12; *see generally* INT'L ENERGY AGENCY, WORLD ENERGY INVESTMENT REPORT 2022 (2022).

and others might bemoan the inefficiencies of a "subsidy race" among larger emitters, it is not at all clear that a system built around sticks rather than carrots could ever be sufficient to build whole new industries (much less survive politically).

If we focus specifically on the power sector, which, as noted, is the backbone of broader decarbonization efforts, there are two main challenges going forward: (1) how to substantially increase capital investment in clean energy assets and (2) how to ensure access, affordability, and security of supply. The first is an investment challenge and the second is a provisioning challenge. And these two challenges have to be addressed together. Put another way, if we solve the investment problem without also simultaneously solving the access and affordability problem, efforts to accelerate the electrification of everyday life will stall in the face of high prices. This will in turn undermine overall democratic support for the effort, which will then undercut the support for more investment.

As this Article has sought to demonstrate, electricity markets as currently designed cannot deliver on these goals. While the forty-plus year experiment with liberalized electricity markets may have been good at sweating assets, these markets are not capable of driving new investment in the sector at the scale and pace necessary to achieve decarbonization targets while also ensuring access and affordability. In important respects, and as documented above, the move away from markets is already underway. But the process has been largely ad hoc and piecemeal and too many continue to cling to the idea that existing market designs can be tweaked and adjusted to deal with the challenges they face.[342] While short-term balancing markets will continue to play an important role in electricity, it is past time to acknowledge the larger shortcomings of neoliberal electricity and embrace new institutional arrangements capable of driving massive new investment while expanding access and affordability.

There are three main components of this. First, instead of focusing on using competition between generators to discipline prices and maximize efficiency, we should focus on tools to secure a low cost of capital for the trillions of dollars of financing for zero emissions electricity generation, storage, and transmission infrastructure that is needed. This requires a fundamental shift in the relationship between capital and infrastructure that has marked the last forty years of neoliberal electricity. That means de-

342. *See, e.g.*, William W. Hogan, *Electricity Market Design and Zero-Marginal Cost Generation*, 9 CURRENT SUSTAINABLE/RENEWABLE ENERGY REPS. 15, 15 (2022) (arguing that the expansion of zero-marginal cost generation does not change the fundamentals of efficient electricity market design). *But see* Joskow, *supra* note 27, at 315 (concluding that current markets are not suitable for zero-marginal cost resources).

emphasizing competition and the price system to focus more on the best ways to channel large flows of low-cost capital into long-lived physical assets. Second, we need to explicitly embrace new forms of "social ratemaking" that depart from the principles of market pricing to support stable and affordable rates going forward.[343] That will inevitably require new approaches to spreading different components of costs among and between different classes of customers, a task that is made more challenging by the ongoing adoption of distributed generation, distributed storage, and electric vehicles. Third, we need to rethink our approach to balancing—both on the bulk power supply side and on the demand side in favor of a more cooperative approach that recognizes the fact of intermittency and prioritizes arrangements to share reserve capacity and load management responsibilities as we transition to a renewables-dominated future.

A. CAPITAL AND INFRASTRUCTURE

The old idea of public utility in the United States was built in part around efforts to devise a framework that could channel large amounts of capital into new infrastructure based on specific mechanisms of cost recovery. The objective was to make sure that the investments were prudent when made and that the investors would receive a fair return on their capital—a moving target that was tied to the more general conditions in the capital markets.[344] Historians have documented that one of the reasons IOUs favored rate regulation through state PUCs was in order to secure a lower cost of capital, which the evidence suggests was at least partly realized.[345]

During the first three quarters of the twentieth century, this system succeeded in driving substantial capital investment in new infrastructure.[346] As utilities built larger and larger plants together with extensive transmission and distribution systems, economies of scale translated into declining real prices for ratepayers. The concern, as noted, was overbuilding and overinvestment in the physical assets that constituted a utility's rate base—a problem that was compounded by the threat of regulatory capture.[347] By the

343. *Cf.* Alexandra B. Klass & Gabriel Chan, *Regulating for Energy Justice*, 97 N.Y.U. L. REV. 1426, 1462 (2022) (noting that all ratemaking is "social ratemaking" and discussing various efforts to use ratemaking to ensure access and affordability).

344. *See* Fed. Power Comm'n v. Hope Nat. Gas Co., 320 U.S. 591, 602 (1944); Bluefield Water Works v. Pub. Serv. Comm'n, 262 U.S. 679, 681 (1923); Missouri ex rel. Southwestern Bell Tel. Co. v. Pub. Serv. Comm'n, 262 U.S. 276, 289–92 (1923) (Brandeis, J., concurring).

345. *See* William J. Hausman & John L. Neufield, *The Market for Capital and the Origins of Electric Utilities in the United States*, 62 J. ECON. HIST. 1050, 1058 (2002).

346. *See generally* THOMAS HUGHES, NETWORKS OF POWER: ELECTRIFICATION IN WESTERN SOCIETY (1983).

347. *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

1970s, with economies of scale in thermal power generation exhausted and in the face of major increases in fuel prices and slowing demand, utilities and their regulators were suddenly confronted with a very different macroeconomic environment that entailed a significantly higher cost of capital.[348] This was the beginning of the end of the so-called "public utility consensus," and the emergence of a new emphasis on deregulation and markets that would go into high gear during the 1980s and 1990s.[349]

A big part of the move to markets, in fact, was premised on the idea that investment would be disciplined by the forces of competition and the price system rather than the judgments of regulators. Gold plating would be replaced by a focus on performance and efficiency. Assets would be squeezed and sweated, made to work harder, while the risk of new investment would be transferred from ratepayers to investors.

Today, however, the electricity sector is transitioning once again to a phase of high investment. Moreover, the dominant generating technologies and underlying cost structures that mark the current phase put even more of a premium on cost of capital than in the past. As the clean energy transition accelerates, the focus will once again need to be on institutional arrangements that can secure a low cost of capital for long-lived assets.[350] Spreading those financing costs over a longer time frame and a larger customer base will in turn provide a critical part of the effort to ensure stable and affordable electricity for customers.

This requires patient capital willing to support high upfront investments in exchange for long-term, stable returns. Doing that, as noted above, means shifting our attention from the remuneration possible in the electricity

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 actual empirical evidence for the Averch-Johnson effect is mixed, but despite that it has become accepted as gospel by the critics of rate regulation. In any event, it is not clear what this looks like in a world of zero-marginal cost resources where there are no other factors of production other than capital.

348. *See* Boyd, *supra* note 36, at 1658–59 (discussing crisis of the 1970s and factors affecting electric utilities).

349. *See* HIRSCH, *supra* note 224, at 205.

350. *Cf.* Hung-Po Chao, Shmuel Oren & Robert Wilson, *Reevaluation of Vertical Integration and Unbundling in Restructured Electricity Markets*, *in* COMPETITIVE ELECTRICITY MARKETS: DESIGN, IMPLEMENTATION, PERFORMANCE 27, 61 (Fereidoon P. Sioshansi ed., 2008) ("Cost-of-service regulation is inherently a kind of insurance for utilities, since it guarantees to a utility that its costs accepted as prudent and accepted into its rate base are eventually recovered in full from retail rates on an amortized basis that includes the cost of capital. Insuring utilities' cost recovery was very effective in reducing the cost of capital, since their bonds and shares carried negligible risks of default and provided steady payments of interest and dividends."); *see also* Grubb & Newbery, *supra* note 205, at 10 (finding that the UK's contracts-for-differences approach to renewables, which looks a lot like cost-of-service, succeeded in significantly reducing the cost of capital for renewables projects).

markets to the capital markets and to the role of government in promoting capital investment in long-lived assets. In the United States, at least, there are three main options for doing this: (1) the use of tax credits and other subsidies to de-risk private investment in new assets; (2) public investment and public ownership of new assets; and (3) public utility regulation.

The big looming question in all of this is whether the new renewable energy and storage assets that will dominate our electricity systems in the future will be owned and managed by private owners intent on charging what the traffic will bear or whether they will be part of a broader collective project that includes diverse forms of public utility—from outright public ownership to various cooperative and community arrangements to a renewed effort to leverage public utility cost-of-service regulation to harness the power of private enterprise and direct it toward public ends.[351] For the last thirty years, the U.S. has made a very deliberate choice to pursue a privatized and financialized approach to renewable energy, with generous tax credits driving project finance structures that were dominated by banks and financial institutions. The IRA continues this trend, but it also begins to move away from the heavily financialized arrangements of the past through the direct pay and transferability provisions. While it is too early to tell how popular and effective these provisions will be, they do point up the importance of creating a system with a diversity of ownership structures for renewable power that maintain strong public and regulated components. Given the long lead times and financing challenges associated with renewables, especially under current market structures, there is a danger (and a growing body of supporting evidence) that large private equity firms, asset managers, and large clean energy multinationals are increasingly in a position to own the lion's share of renewable energy generation. While this may be a welcome development for those who are eager to see more private capital flowing into clean energy, we should be careful to remember the painful lessons learned when unregulated private capital takes over vital infrastructure.

But there are alternatives, as Harold Hotelling made clear almost a century ago in his argument in favor of using taxes on land and wealth to pay for the fixed costs of new public infrastructure.[352] Although it seems unrealistic to expect full government financing for new infrastructure along the lines of what Hotelling and some contemporary proponents of the Big Green State have advocated for, it is still important to articulate the details of how these new public enterprises would be structured and governed—a

351. *Cf.* Boyd, *supra* note 36, at 1619 (observing that the IOU model does not exhaust the category of public utility); *see also* Shelley Welton, *Public Energy*, 92 N.Y.U. L. REV. 267, 267 (2017) (arguing for broader reconsideration of more public forms of energy control and ownership).

352. *See* Hotelling, *supra* note 68, at 245.

task that requires attention not only to past experiences with state-owned enterprises, various public power projects, and municipal utilities, but also one that critically evaluates emerging approaches such as the UK's Low Carbon Contract Company and similar efforts around the world. Government-backed financing arrangements can also provide cheap long-term capital to various forms of community and cooperative arrangements. And, of course, recent calls for a new public investment authority and efforts in various states to revive public ownership and control over clean energy assets could also serve as examples of a more robust public role in the clean energy transition.[353]

As for the IRA and the use of tax credits to de-risk private investment, the key question here is whether the public will get anything in return for the use of public money to drive investment in new assets and infrastructure or whether the new private renewable energy asset owners will capture the majority of the benefits of public support. As noted, the new direct pay provisions under the IRA could be used to support various forms of public ownership of renewable energy, but it seems unlikely that this will scale quickly.

A third option that offers a middle path between public ownership and the pure de-risking approach is U.S. style public utility regulation, which has long served to channel large amounts of low-cost capital into long-lived physical assets.[354] Under this approach, public utilities are allowed a guaranteed rate of return on their prudent investments that covers their costs including the cost of capital. The certainty of cost recovery through rates has historically translated into a lower cost of capital. Moreover, under the basic model (which, to be sure, does not always work as intended), once the costs are recovered in rates and the assets are depreciated, they are no longer charging costs to the ratepayers beyond whatever it takes to keep them running, which is very little in the case of wind and solar. Critics will surely rehearse all of the problems and perverse incentives that are embedded in public utility regulation, all of which ultimately depend on how well regulators do their jobs. At the very least, though, it seems important to acknowledge the promise that public utility regulation holds for more public

353. *See, e.g.*, SAULE OMAROVA, BERGGRUEN INST., THE NATIONAL INVESTMENT AUTHORITY: AN INSTITUTIONAL BLUEPRINT 62 (2024); Robert C. Hockett & Saule T. Omarova, *Private Wealth and Public Goods: The Case for a National Investment Authority*, 43 J. CORP. LAW 437, 437 (2018).

354. *See* Boyd, *supra* note 36, at 1683–99 (discussing need for planning and investment in clean energy transition and role of public utility cost-of-service rate regulation as a mechanism for securing capital on favorable terms and directing it toward large investments in generation, transmission, and distribution); Boyd & Carlson, *supra* note 36, at 844–61 (discussing the role of public utility cost-of-service rate making in financing large low-carbon generation assets such as nuclear power and carbon capture and storage as well as in various grid modernization efforts).

control over the direction of private capital investment and the mechanisms of cost recovery. This seems particularly important for renewable energy, which in many ways is a perfect fit for cost-of-service regulation given the fact that these projects are almost all capital costs, which should make financing and cost-recovery much more straightforward than traditional fossil fuel assets.

The key takeaway in all of this is that we have returned, it seems, to many of the fundamental questions regarding capital and infrastructure that Hotelling and others raised during the middle decades of the 20th century.[355] In Hotelling's view, the "general welfare," as he called it, was best served when the fixed costs of infrastructure investments were paid from taxes on income, inheritances, and land, which would then allow the public to pay only the short-run marginal costs of using the asset, which in many cases was zero.[356] In effect, Hotelling was arguing for using taxes on the wealthy to support public infrastructure, which promised to deliver enormous benefits to the public that far outweighed the costs imposed.[357]

In some ways, the IRA tax credit provisions could be read as a partial realization of Hotelling's argument. Substantial tax revenues (albeit in the form of foregone taxes or so-called tax expenditures) are being used to build part of the infrastructure we need for the clean energy transition. The only problem is that we have allowed private financial institutions and large corporations to take the tax credits and own the assets. If anything, then, the current use of public money to de-risk private investment looks like a neoliberal inversion of Hotelling's argument. In this view, it is a mistake to suggest that the ultimate ownership of the assets does not matter. As the great clean energy buildout proceeds, the critical question is how much rent these asset owners will be able to extract from the public for the use of those assets. Put another way, once these projects are paid off, the owners will continue to extract rents for the use of resources that are essentially free and have been partially financed by public expenditures in the form of tax credits. But only if we let them.

Hotelling, of course, was writing against the backdrop of massive government spending on infrastructure, particularly for large public power projects, and a concerted government effort through initiatives such as the Tennessee Valley Authority and the Rural Electrification Administration (among others) to ensure near-universal access to affordable electricity. To be sure, our world is quite different than the one Hotelling was writing about,

355. *See* Hotelling, *supra* note 68, at 257–60; *see also* discussion *supra* Section I.A.2.
356. *See* Hotelling, *supra* note 68, at 242.
357. *Id.* at 257–60.

but we are clearly at the beginning of another substantial buildout of new infrastructure, where questions of cost recovery, cost of capital, access, and affordability will be front and center. One of the major claims of this Article is that the market-based approach to electricity of the last forty years—that is, the effort to make electricity into a commodity—will not get the job done. Policymakers, market regulators, and even some economists have started to recognize this. But the question of what comes next is still unresolved, notwithstanding the strong tendencies pushing toward a financialized and privatized version of the clean energy future. While there is surely no one right way to decommodify electricity, in all cases it seems critical to think of the new assets being built (and, perhaps, the capital being invested in those assets) as part of a common infrastructure and key system of provisioning for basic needs. In this vision, renewable energy and storage, which will likely be the dominant sources of electricity in a decarbonized future, should be essentially free once the capital costs have been paid. And that should open up a range of possibilities for making electricity widely available at low and stable prices.[358]

B. SOCIAL RATEMAKING

A fundamental commitment of Don't Pay UK was that electricity is too important to be left to a system of markets and price rationing. Their demands for an end to prepayment meters and for a social tariff that would provide a stable, affordable rate structure for all customers reflected a view that electricity is a primary social good (an "essential service," as Felix Frankfurter once put it) that needs to be made available to everyone on reasonable terms.[359] This was, as noted, a basic commitment of many of the nationalized systems of the past, which, despite all of their problems, were directed at providing reliable and affordable electricity to everyone and often explicitly conceived as part of a broader redistributive welfare state.

In the U.S., the older regulated public utility model incorporated some of these commitments, but all too often fell short of the goal of universal access. Expansive federal support for rural electrification, regional experiments such as the Tennessee Valley Authority, and large public power projects were also based on strong public commitments to providing cheap

358. *Cf.* BENKLER, *supra* note 40, at 103 ("A critical goal of any post-neoliberal order would be moving toward meaningful, if partial, decommodification of the basic necessities of life so that more people have a chance to live decently without being forced to sell their labor or maximize their earnings.").

359. *See* FELIX FRANKFURTER, THE PUBLIC AND ITS GOVERNMENT 81 (1930) ("No 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.").

and reliable electricity to all households.[360] That work is still not done, despite its increasing urgency.[361]

Access and affordability are important on their own terms, given that electricity is a necessity and increasingly important to everyday life.[362] But, they are also critical to a clean energy transition that is built around electrification. As noted, the whole strategy of decarbonization through electrification requires that people use more electricity, not just for the normal activities of the past but also for cooking, heating, and mobility. And one way to get people to use more electricity, especially people with limited budgets, is to make it cheaper for them to do so. Social ratemaking, to use Alfred Kahn's dismissive phrase, will thus need to be a key feature of the clean energy transition.[363]

There is a history here that is worth recalling briefly.[364] During the 1970s, at the same time that state PUCs were considering marginal cost pricing as a way of improving efficiency and promoting conservation, consumer and ratepayer advocacy groups were also pushing state PUCs to adopt new rate structures that would cushion the impact of high and rising prices on low-income customers.[365] In 1974, the Colorado PUC was the first in the country to adopt a system of "lifeline" rates establishing a minimum block of service at below average costs.[366] The California PUC followed in 1975 with a rate case for PG&E that adopted a similar system of lifeline rates

360. *See* Shelley Welton, *Clean Electrification*, 88 UNIV. COLO. L. REV. 571, 613–17 (2016) (discussing role of public power projects such as the Tennessee Valley Authority and the Rural Electrification Administration in ensuring access and affordability); Welton, *supra* note 351, at 267 (discussing different forms of "public energy" and their role in the clean energy transition).

361. *See, e.g.*, *Tribal Energy Development*, U.S. DEP'T ENERGY (Mar. 29, 2023), https://www.doi.gov/ocl/tribal-energy-development [https://perma.cc/48PY-TGNP] ("21% of Navajo Nation homes and 35% of Hopi Indian Tribe homes are unelectrified.").

362. *See* Welton, *supra* note 360, at 580 (highlighting the importance of access to affordable electricity as a means of enabling broad participation in the economy and civil society).

363. *See* Klass & Chan, *supra* note 343, at 1462 ("All ratemaking is 'social ratemaking.' "); *see also id.* at 1426 ("Rate setting is and always has been social policy implemented within a legislative framework designed to promote the public interest.").

364. *See id.* at 1463–70 (tracing the history of low-income and lifeline rates).

365. The Utility Reform Network ("TURN") first advocated for the adoption of lifeline rates in a general rate case for Pacific Gas & Electric in 1974. The Vermont Public Interest Research Group was active in pushing for similar reforms before the Vermont legislature. Over the next several years, various consumer groups and ratepayer advocates around the country began to push for similar rate reforms among state legislatures and PUCs. For a review, see generally PAUL RODGERS & J. EDWARD SMITH, JR., NAT'L ASS'N REGUL. UTIL. COMM'RS, LIFELINE RATES (1976).

366. *See* Decision and Order of the Commission Establishing New Rates and Tarrifs, No. 86821, Colo. Pub. Util. Comm'n, at 21 (Sept. 24, 1974) ("Today, the Commission finds and adopts as being in the public interest and consistent with the Public Utilities Law, the concept of 'lifeline' pricing for minimum electric service . . . . It should be recognized that at the outset that as we use the term, 'lifeline' service refers to the level of use and not the economic situation of the user. Thus, a minimum user, regardless of economic status, will be entitled to the lifeline rate which we establish today.").

providing a cheap initial block of electricity for "essential needs."[367] That same year, the state adopted legislation codifying the concept of lifeline rates and stating explicitly that light and heat were "basic human rights [that] must be made available to all people at low cost for basic minimum quantities."[368] As the name suggested, the overall objective of lifeline rates was to ensure that all customers would have access to a sufficient amount of electricity to meet their basic needs.[369] For use beyond that basic amount, rates would increase, following what is known as an inverted rate structure.

Other states followed suit. By the 1980s, more than twenty states in the U.S. had adopted some version of lifeline rates.[370] Although some critics argued that the system of lifeline rates departed from cost-based pricing (given that the rates for the initial lifeline block of electricity were typically below average costs) and that they violated the core public utility commitment to non-discrimination between customers, commissions and legislatures had little trouble finding that a baseline amount of electricity to meet essential needs for all customers was in the public interest and consistent with public utility law.[371] In fact, the inverted rate structure that

367. *See* Application No. 54279 et al. of Pacific Gas and Electric Company, Decision No. 84902, Cal. Pub. Util. Comm'n, at 148 (Sept. 16, 1975) (" . . . [W]e adopt a simplified rate structure which provides no increase in rates for residential customers who use less than a basic, minimum amount of electricity . . . . Our intention is to freeze rates for this minimum amount of usage until these rates are significantly below the average rates in the system."); *see also* STEPHEN MINTZ, DEPT. OF ENERGY, OFF. CONSUMER AFFAIRS/SPECIAL IMPACT, THE LIFELINE RATE CONCEPT 4 (1976) ("A lifeline rate would make available a basic minimum amount of electricity to everyone at a fair and reasonable cost.").

368. *See* Miller-Warren Energy Lifeline Act, 1975 Cal. Stat. 2388, Sec. 1(a). Among other things, the legislation required the PUC to designate a baseline quantity of gas and electricity necessary to supply a significant portion of the reasonable energy needs of the average residential customer at rates below average cost. As initially designed, the California lifeline program struggled with how to define the amount of electricity required to meet "essential needs," and developed a system of "special allowances" to accommodate certain classes of customers as well as variability of energy use across different climatic zones within the state. In 1982, the legislature approved new legislation that established "baseline rates" (essentially another name for lifeline rates) and removed the special allowances and other end-use criteria. Instead, the baseline amount was fixed at 50% to 60% of average residential consumption for most residential customers and 60% to 70% of average residential consumption during the winter for customers with all-electric residences. *See* Michael Hennessy & Dennis M. Keane, *Lifeline Rates in California: Pricing Electricity to Attain Social Goals*, 13 EVAL. REV 123, 123–24 (1989).

369. MINTZ, *supra* note 367, at 27 ("The low-income household and the low fixed-income elderly household are dependent upon electricity to maintain health and home. When the price of electricity rises to a point where it begins to consume an unusually large share of income, lifestyle is threatened. Lifeline would guarantee an amount of electricity which can provide for the basics of life at a reasonable rate . . . . It is a concept designed to distribute energy to people in a fair manner."). *But see* Lenneal J. Henderson Jr., *Public Utility Regulations: The Socioeconomic Dimensions of Reform*, 9 REV. BLACK POL. ECON. 260, 272 (1979) ("Fundamentally, the lifeline concept is an emergency concept which is aimed less at the incorporation of a basic social equity principle in utility pricing than at providing an emergency service to the needy at less than normal cost.").

370. *See* Elliot Taubman & Neal Rauch, *Recent Decisions on Rate Structure Reform: A Survey with Emphasis on Lifeline Rates*, 10 CLEARINGHOUSE REV. 607, 607 (1976); RODGERS & SMITH, *supra* note 365, at 1–2.

371. *See, e.g.*, Ashley C. Schannauer, *Lifeline Electric Rates: Are They Unreasonably*

resulted from the use of lifeline rates, where subsequent blocks of electricity were priced at above average costs to make up for the below average cost of the initial block, corrected for some the cross-subsidies inherent in so-called promotional or declining block rates and were consistent with the energy conservation goals that were increasingly dominating discussions of rate design during and after the energy crisis of the 1970s.[372] One of the great advantages of lifeline rates, moreover, was that they did not require any sort of means testing, making them much easier to administer.

But various means-tested programs have been adopted over the years, including direct assistance, reduced billing and rebates, and targeted weatherization and efficiency programs.[373] Most recently, California enacted legislation in 2022 that calls for a new system of progressive income-based fixed charges for utility customers that seeks to reduce the growing burden of system costs on poor households and redistribute some of these costs to wealthier households.[374] While the measure has generated an enormous amount of controversy and opposition and while there are important questions regarding implementation, including whether the program will further encourage so-called grid defection by the wealthy, the effort represents an important experiment directed at affordability in the face of rising costs.[375]

In the UK and elsewhere, there are ongoing debates over the need for "social tariffs," which provide targeted discount rates for low-income,

Discriminatory?, 83 DICKINSON L. REV. 541, 541 (1979).

372. During the energy crisis of the 1970s, environmental advocates and the federal government embraced inverted rate structures because they promoted conservation. Inverted rates also worked to mitigate some of the cross subsidies that were inherent in the declining block rate system where poor customers often ended up paying more per kilowatt-hour than wealthier customers, who typically used much more electricity than poor customers.

373. *See, e.g.*, Kenneth W. Costello, *Features of Good Utility-Initiated Energy Assistance*, 139 ENERGY POL'y 1, 1 (2020) (discussing various utility programs for low-income households); Leslie W. Baxter, *Electricity Policies for Low-Income Households*, 26 ENERGY POL'Y 247, 247 (1998) (reviewing various energy assistance, consumer protection, and weatherization programs targeted at low-income households); Lenneal J. Henderson, Jr., *Energy Policy and Socio-Economic Growth in Low-Income Communities*, 8 REV. BLACK POL. ECON. 87, 102 (1977) (summarizing a wide range of energy policy issues related to poor households).

374. A.B. 205, Ch. 61, Sec. 10 (Cal. 2022); Cal. Pub. Util. Code § 739.9 (West 2022); *see also* CAL. PUB. UTIL. COMM'N, UTILITY COSTS AND AFFORDABILITY OF THE GRID OF THE FUTURE: AN EVALUATION OF ELECTRIC COSTS, RATES, AND EQUITY ISSUES PURSUANT TO PU CODE SECTION 913.1 7 (2021) (discussing rising rates for California electricity customers and the need "to employ aggressive actions to minimize growth in utility rate base and to protect lower-income ratepayers from cost shifts and bill impacts"); Severin Borenstein, Meredith Fowlie & James Sallee, *Designing Electricity Rates for an Equitable Energy Transition* 4–5 (UC Berkeley Haas Energy Inst., Working Paper No. 314, 2021).

375. *See, e.g.*, Rose Horowitch, *Richer People Pay More: California's Dramatic Change to Electricity Bills*, GUARDIAN (June 6, 2023, 4:48 P.M.), https://www.theguardian.com/us-news/2023/jun/06/california-income-based-electricity-fees-2025 [https://perma.cc/H44J-L46X].

elderly, and other customer groups.[376] As noted in the introduction, this has been one of the main demands of Don't Pay UK and other similar grassroots groups.[377] Various EU member countries have also used a system of cheap initial block rates, similar to lifeline rates in the U.S., as well as rebates, direct transfers, and more holistic approaches such as social housing to ensure affordability.[378]

This kind of social ratemaking represents a major departure from the commitments of neoliberal electricity and reflects a growing recognition that electricity is too important to be treated as a commodity where everyone is expected to pay their own way. By explicitly structuring rates to support low-income customers, these various programs resurrect earlier redistributionist objectives of ratemaking and serve to reinforce the broad commitment to the public interest that motivated much of the early development of public utility law.[379]

Going forward, if we approach electricity as a system of provisioning for necessities rather than as a commodity that should be priced at marginal cost, there is a strong argument for a commitment to some form of social ratemaking, perhaps even universal basic service. In a renewables-dominated world, moreover, where financing of new projects has access to a low cost of capital, we should be able to spread these costs across a stable rate structure over long time frames. One can think of this more like a long-term fixed rate mortgage rather than a series of volatile market transactions tied to unpredictable markets. Customers who wish to opt into time-of-use or other forms of dynamic rates should continue to have that option. And regulators will surely continue to experiment with new pricing schemes that will drive certain kinds of investments. California's new Net Energy Metering framework, for example, shifts the benefits of net metering from distributed generation to distributed storage.[380] Although the rooftop solar

376. *See generally* NICOLE WATSON, PATRICK GRIMES & NIKKI SUTHERLAND, HOUSE OF COMMONS LIBRARY, DEBATE ON ENERGY SOCIAL TARIFFS (2023) (discussing history, background, and key features of proposal for energy social tariff in the UK).

377. *See supra* text accompanying note 7.

378. *See* Philipp Lausberg & Tijn Croon, *Europe Must Fight Energy Poverty More Effectively*, EUROPEAN POL'Y CTR. (Jan. 19, 2023), https://www.epc.eu/en/publications/-Europe-must-fight-energy-poverty-more-effectively~4da8dc [https://perma.cc/S4P5-JVFL].

379. *See* Boyd, *supra* note 8, at 750–61 (tracing the history of just price and the public interest in public utility law).

380. *See* Decision Revising Net Energy Metering Tariffs and Subtariffs, Rulemaking 20-08-020, Cal. Pub. Util. Comm'n, at 2 (Dec. 15, 2022). In simplest terms, the new net metering rules, which govern the rates that rooftop solar customers receive for the electricity they put back on the grid during periods of excess generation, reduce the amounts received during periods of the day when there is substantial excess solar on the system and increase the amounts they would receive during the early evening (after the sun goes down), which operates as an incentive to adopt new distributed storage systems that can store the excess electricity from solar and then export it back to the grid in the evening.

industry has reacted with outrage at the new rules,[381] it is important to recognize this effort for what it is: California is using prices to drive investment in behind-the-meter storage because that is what the system currently needs. This is the Boituex vision of using price signals to drive investment toward a particular mix of assets.

With more electric vehicles and distributed energy resources connecting to the grid, questions about how to price electricity for those customers who are able to take advantage of distributed energy and those who are not and how to allocate system costs across these different customer groups will be increasingly important and connected to broader questions of economic policy and social welfare. For the vast majority of customers, however, it seems that simple, stable rates that allow for predictable household expenditures and budgeting are surely preferable to a world of constantly changing price signals.

As the system settles down and the infrastructure gets built out, moreover, responsive pricing may come to matter less. In a world of zero marginal costs, and especially in a world where storage is able to spread zero marginal cost resources across the entire day, short-run costs will ultimately collapse into long-term financing costs. In that world, stable, affordable rates can serve as a stabilizing mechanism for the clean energy transition and the broader economy.[382]

C. COOPERATIVE BALANCING

A decommodified approach to electricity also entails new thinking about balancing across the system. This is especially important as intermittent renewables such as wind and solar become a larger source of electricity, whether at utility scale or so-called behind-the-meter distributed generation. Because intermittent renewable energy makes everything on the system intermittent, this can make it difficult to finance and recover costs for other assets. In a renewables-dominated world, natural gas plants and

381. *See, e.g.*, Ryan Kennedy, *California Pulls the Plug on Rooftop Solar*, PV MAG. (Dec. 19, 2022), https://pv-magazine-usa.com/2022/12/15/california-pulls-the-plug-on-rooftop-solar [https://perma.cc/95XG-VC4M].

382. This would, of course, have important benefits for macroeconomic stabilization, bringing an end to the energy price shocks and inflation effects of the fossil fuel dominated energy system of the last half century. *See* Enrico Turco, Davide Bazzana, Massimiliano Rizzati, Emanuele Ciola & Sergio Vergalli, *Energy Price Shocks and Stabilization Policies in the MATRIX Model*, 177 ENERGY POL'Y 1, 1 (2023) ("[G]overnment-funded energy tariff reduction is the most effective policy in mitigating GDP losses at relatively low public costs, particularly when coupled with an extra-profit tax on energy firms."); *see also* Anton Korinek & Joseph E. Stiglitz, *Macroeconomic Stabilization for a Post-Pandemic World: Revising the Fiscal-Monetary Policy Mix and Correcting Macroeconomic Externalities* 2 (Brookings Hutchins Ctr. Working Paper No. 78, Aug. 2022).

batteries are essentially on hold waiting to see when the wind stops blowing or the sun stops shining. In effect, renewable power has been pushing the costs of intermittency onto the rest of the system.[383]

There are a variety of solutions here. One obvious approach would be to require all generators to offer firm power all the time.[384] That is happening in some power purchase agreements ("PPAs") and there are proposals to require this in some markets outside of the United States. More transmission providing access to more and different types of renewables across larger geographies can also help. Windy nights in Wyoming and Colorado could be used to complement sunny days in Arizona and California. Storage could also play a major role here, effectively allowing wind and solar to be spread out over the course of the day.

But under any approach, the fact that renewables are intermittent and non-dispatchable will require new approaches to balancing the system. And this needs to happen on both ends of the grid: the bulk power supply side as well as the demand side.

On the bulk power supply side, as intermittent renewables account for a higher and higher portion of supply, broader regional and inter-regional approaches to balancing will become more important. The existing RTO and ISO markets can provide some of this. The Western Energy Imbalance Market and the proposed Southeast Energy Market ("SEEM") are other examples. While we can debate the pros and cons of different approaches (real-time auctions versus bilateral contracts traded over an exchange), the larger question is whether these arrangements should be viewed as competitive or collaborative.

In their original manifestation, balancing markets grew out of the old tight power pools of the middle decades of the twentieth century, where large vertically-integrated utilities developed cooperative arrangements to share reserves and power so that they could deliver reliable power more cheaply than they could acting alone.[385] The entire approach was based on a simple

383. *See* DEITER HELM, COST OF ENERGY REVIEW 19 (2017) (discussing how costs of intermittency are not currently borne by those who cause them).

384. *Id.* at 89.

385. *See* WILLIAM J. BAUMOL, PAUL L. JOSKOW & ALFRED E. KAHN, EDISON ELECTR. INST., THE CHALLENGE FOR FEDERAL AND STATE REGULATORS: TRANSITION FROM REGULATED TO EFFICIENT COMPETITION IN ELECTRIC POWER 42 (Dec. 9, 1994) (Appendix A of Initial Comments of Edison Electric Institute, Docket No. RM94.7.000, FERC) ("The efficiency benefits that the industry achieves today by intercompany coordination are enormous. As we have already pointed out, pooling, which substantially reduces the dispatch cost of generation, mutual backup and enhanced reliability of service, makes a major contribution to reduced costs. Numerous bilateral and multilateral agreements and contracts are in place to effect this coordination and to make it possible to 'move' power from sellers in one area to buyers in another. For the most part these arrangements relate to transactions between interconnected, vertically

"split-savings" arrangement under which the cooperating utilities shared the savings.[386] This system worked because it was built on reciprocity and mutual assistance among similarly situated actors.[387] Such an approach may be more difficult in the current environment, with its mix of different regulatory and ownership structures, but the regional balancing authorities and load serving entities of today do have a strong incentive to find new approaches to cooperative balancing. Regional experimentation will be critical, but one could imagine a world of short-term regional energy imbalance markets constructed around principles of joint dispatch and reserve sharing—where different balancing authorities are cooperating with each other based on an agreed set of protocols and prices. The key point here is that the short-term markets would be deployed as tools to help balance the system rather than as arenas for competition and price discovery.

At the inter-regional scale, there are ongoing efforts, including proposed bipartisan legislation, to promote and even require substantial transfer capacity between the big regional systems that make up the U.S. power grid.[388] Having access to substantial flows of power from outside the Texas market during Winter Storm Uri, for example, would have made a huge difference.[389] As climate disruption intensifies, moreover, more robust transfer capacity across regions can provide crucial resources to make up shortfalls and enhance resilience. Such transfer capacity can also provide much needed assistance during various sorts of market disruptions. Substantial new investments in high voltage transmission connecting key regions across the EU, for example, allowed for large transfers of bulk power across the continent to manage some of the disruptions during the recent

integrated utilities. The cooperation that they entail will inevitably be more willingly undertaken among companies that have franchised monopolies in their assigned retail service areas than it will if they are direct competitors. Devising ways to maintain the very large benefits of coordination in a fully competitive generation market will not be a simple task.").

386. *See* JOSKOW & SCHMALENSEE, *supra* note 52, at 66–77 (discussing inter-utility coordination and pooling).

387. *Id.*

388. Among other things, the Big Wires Act would require 30% transfer capacity between regions. *See* Big Wires Act, S. 2827,118th Cong., at 6 (2023); *see also* Ethan Howland, *FERC Urged to Set Interregional Transfer Capacity Requirements to Boost Reliability, Lower Costs*, UTILITY DIVE (Dec. 6, 2022), https://www.utilitydive.com/news/ferc-interregional-transfer-capacity-reliability-transmission/638066 [https://perma.cc/5UTA-CTWM]; Patrick R. Brown & Audun Botterud, *The Value of Inter-Regional Coordination and Transmission in Decarbonizing the US Electricity System*, 5 JOULE 115, 115 (2020).

389. *See* MICHAEL GOGGIN, GRID STRATEGIES, LLC, TRANSMISSION MAKES THE POWER SYSTEM RESILIENT TO EXTREME WEATHER 2 (2021) (noting that "[e]ach additional 1 GigaWatt (GW) of transmission ties between the Texas power grid (ERCOT) and the Southeastern U.S. could have saved nearly $1 billion, while keeping the heat on for hundreds of thousands of Texans" during Winter Storm Uri (emphasis omitted)).

energy crisis and ultimately kept the lights on for millions of people despite the rapid and dramatic reduction in natural gas supplies because of the Russian invasion of Ukraine.[390] This new transfer capacity was explicitly based on a fundamental commitment to solidarity and mutual assistance among the EU member states that sought to compensate for the significant shortcomings of the market.[391]

On the demand side, ongoing experiments with incentive-based demand-response programs and new rate structures offer promising ways forward for a system that includes demand not simply as a resource to be managed but as an active participant in the balancing of the system. The question here, though, is whether it is possible to think about demand response based on notions of reciprocity and cooperation rather than responsive pricing where each individual customer is left to decide how they will respond to price signals. Given how rapid the demand side is changing amid significant growth of distributed energy resources and electric vehicles, it is impossible to say how this might be organized in practice and whether individuals would ever embrace a more cooperative and collective approach to the electricity system. It is quite possible, maybe even likely, that we are headed in a very different direction where rich households and gated communities can defect entirely from the grid, leaving the rest of us to pay the fees that the owners of the system demand.[392] But there are alternatives and there may well be deeper commitments in play here than we realize. In September 2022, during an intense heat wave that pushed California's electricity system to its limit, the government sent a text message to everyone in the state asking them to step up and reduce their electricity demand over a period of hours.[393] We did it and it worked and for a brief moment we were reminded that the electricity system is in fact a shared, collective infrastructure.

390. *See* Ben McWilliams, Giovanni Sgaravatti, Simone Tagliapietra & Georg Zachmann, *A Grand Bargain to Steer Through the European Union's Energy Crisis*, BRUEGEL POL'Y CONTRIBUTION, Sept. 2022, at 1, 1–2.

391. *Id.*

392. *See* Sharon Jacobs & Dave Owen, *Community Energy Exit*, 73 DUKE L.J. 251, 315 (2023) (discussing challenges posed by distributed generation and community microgrids to existing of electricity regulation); Boyd, *supra* note 36, at 1614 (discussing challenges of distributed generation for the broader "public" commitments of public utility).

393. *See* Grace Toohey & Alexandra E. Petri, *A Text Asked Millions of Californians to Save Energy. They Paid Heed, Averting Blackouts*; L.A. TIMES (Sept. 7, 2022, 8:30 PM), https://www.latimes.com/california/story/2022-09-07/a-text-asked-millions-of-californians-to-save-energy-they-listened-averting-blackouts [https://perma.cc/NR9V-J6S4].

CONCLUSION

The forty-year experiment with electricity markets is coming to an end. Policymakers and regulators around the world now recognize that these markets have been unable to deliver on even the most basic metrics and have launched a series of reform efforts. While there are various reasons for these failures, this Article has demonstrated that they trace back in large part to the basic design of these markets and their distinctive ways of price making. That basic market design, and the broader effort to turn electricity into a commodity, was built around fossil fuel generation and a commitment to harnessing the price system to squeeze as much efficiency out of the system as possible. But that approach no longer makes sense in the face of radical shifts in the goals, underlying technologies, and cost structures of the power sector. It is time to recognize that we are at the beginning of a new age of electricity—one in which electricity is now the chief instrument of decarbonization for most economies around the world and an increasingly critical infrastructure for vast domains of everyday life.

Needless to say, the stakes in all of this are quite high. If we cannot fix electricity, we will surely fail in our effort to fix the climate. Part of that is an investment challenge. But part of it is, as this Article has made clear, a provisioning challenge. Fixing electricity, in other words, means that we also must solve the access and affordability problem at the same time that we dramatically increase investment in new assets and infrastructure. Rapid decarbonization via electrification will not happen unless we can ensure universal access to electricity at stable and affordable rates. Put another way, electricity policy is climate policy. But it is also social policy, and it is no longer possible or prudent to ignore the connections between the two.