

# Allocating Electricity

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## ABSTRACT

*The U.S. electricity system is premised on the ideas that utilities have a duty to serve all customers in their service territories and that electricity supply should always meet demand. Until recently, there has been little reason to question these foundational premises. U.S. electricity demand has remained flat for over a decade, and during earlier periods of growth, new energy generation plants were relatively easy to build. Now, however, electricity experts predict massive load growth—most notably from data centers to power artificial intelligence and cryptocurrency—and building new power plants is no longer easy.*

*Major efforts are underway to increase electricity supply. However, there are also important lessons from legal frameworks developed for other resources—natural gas and water—for which short- or long-term scarcity is or was the norm rather than the exception. This Article uses these lessons to reevaluate electricity law’s foundational principles, like the duty to serve, and to propose new approaches to meeting electricity demand.*

*Based on principles distilled from federal natural gas markets and U.S. Western water law doctrine, this Article proposes a contracts- and trading-based framework for regulating data centers. We call this framework “demand-side connect-and-manage.” This framework can reduce the likelihood of overbuilding energy generation plants, allocate risks to and encourage innovation from major data center companies, and accelerate data center grid interconnection. Moreover, our analysis supports a shift in basic assumptions of electricity law and a reexamination of the roles of regulators and markets in electricity systems.*

## TABLE OF CONTENTS

INTRODUCTION . . . . .	61
I. THE NEW ELECTRICITY ERA? . . . . .	68
A. Projections for Increased U.S. Electricity Consumption . . . . .	69
B. Allocating Risks in a New Electricity Era . . . . .	77

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C. <i>Emerging Contractual Approaches to Allocating Risks</i> . . . . .	82
D. <i>Supply-Side Connect-and-Manage</i> . . . . .	89
II. ANALOGIES AND PRECEDENTS FROM OTHER RESOURCES . . . . .	90
A. <i>Contracting for Energy Scarcity: Natural Gas Regulation and Markets</i> . . . . .	90
1. Overview of Interruptible and Firm Natural Gas Contracts . . . . .	91
2. Natural Gas Industry Expansion and Disfunction: 1950s to Early 1970s . . . . .	92
3. The Curtailment Era: The 1970s . . . . .	94
4. The Natural Gas Policy Act of 1978 and Beyond: A Return to Markets and the Development of a Capacity Release Program . . . . .	97
B. <i>Beyond Energy Scarcity: Allocating Water Rights in the West</i> . . . . .	99
1. The Promise of Prior Appropriation . . . . .	100
2. The Challenges of Prior Appropriation . . . . .	104
a. <i>The Limits of Priority</i> . . . . .	104
b. <i>The Limits of Water Markets</i> . . . . .	106
III. ALLOCATING ELECTRICITY: IMPLICATIONS AND RECOMMENDATIONS . . . . .	109
A. <i>Demand-Side Connect-and-Manage: A Specific Proposal</i> . . . . .	109
B. <i>Advantages of Demand-Side Connect-and-Manage</i> . . . . .	112
C. <i>Cautionary Lessons</i> . . . . .	116
D. <i>Why Not a Federal Supply-Side Solution?</i> . . . . .	118
CONCLUSION . . . . .	120

## INTRODUCTION

After decades of relatively static consumption, U.S. electricity demand is rising.<sup>1</sup> In many parts of the United States, utilities are already seeing increased electricity usage, and their future projections anticipate

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<sup>1</sup> See LALIT BATRA, DEB HARRIS, GEORGE KATSIGIANNAKIS, JUSTIN MACKOVYAK, HIMALI PARMAR & MARIA SCHELLER, RISING CURRENT: AMERICA'S GROWING ELECTRICITY DEMAND 3-5 (2025); Jason Plautz, *How the AI Rush Is Reshaping Electric Utilities*, E&E NEWS: ENERGYWIRE (June 2, 2025, at 06:59 ET), <https://subscriber.politicopro.com/article/eenews/2025/06/02/how-the-ai-rush-is-reshaping-the-utilities-business-00367400> [<https://perma.cc/VAG8-ZUJB>] (describing power companies' efforts to vastly expand their gas plant and nuclear plant fleets, often in joint ventures with data centers' developers).

enormous growth.<sup>2</sup> Some of that growth is due to electrification; as electric cars and heat pumps replace gasoline-powered engines and natural gas furnaces, electricity demand grows, even if overall energy consumption levels remain roughly the same.<sup>3</sup> Industries also are turning to electricity; in some places, even oil and gas drilling rigs are treating electricity as a preferred source of power.<sup>4</sup> But the largest increase in projected demand comes from data centers.<sup>5</sup> Increases in computing capacity, primarily associated with advances in generative artificial intelligence (“AI”), are driving a rapid expansion in the construction of power-hungry data centers.<sup>6</sup>

In many ways, these are exciting developments. Electrifying fossil-fuel-fired vehicle engines, stoves, furnaces, and industrial operations is a crucial step toward reducing or eliminating fossil fuel dependence and, thus, toward an effective response to both climate change and localized air and water pollution.<sup>7</sup> Similarly, the increase in energy demand for data processing is happening because of advances in computing technology, and although there is ongoing controversy over the value of some energy-intensive computing processes,<sup>8</sup>

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<sup>2</sup> See JOHN D. WILSON, SOPHIE MEYER, ZACH ZIMMERMAN & ROB GRAMLICH, POWER DEMAND FORECASTS REVISED UP FOR THIRD YEAR RUNNING, LED BY DATA CENTERS 3 (2025), <https://gridstrategiesllc.com/wp-content/uploads/Grid-Strategies-National-Load-Growth-Report-2025.pdf> [<https://perma.cc/ET48-X83E>]; Kayla Guo, *Data Centers Are Booming in Texas. What Does That Mean for the Grid?*, TEX. TRIB. (Jan. 24, 2025, at 05:00 CT), <https://www.texastribune.org/2025/01/24/texas-data-center-boom-grid/> [<https://perma.cc/8ULM-5U63>].

<sup>3</sup> See Michael Blonsky, Adarsh Nagarajan, Shibani Ghosh, Killian McKenna, Santosh Veda & Benjamin Kroposki, *Potential Impacts of Transportation and Building Electrification on the Grid: A Review of Electrification Projections and Their Effects on Grid Infrastructure, Operation, and Planning*, 6 CURRENT SUSTAINABLE/RENEWABLE ENERGY REPS. 169, 170–71 (2019).

<sup>4</sup> See, e.g., Mella McEwen, *Texas Approves High-Voltage Lines to Meet Permian Basin Power Demand*, MIDLAND REP.-TELEGRAM (Apr. 24, 2025), <https://www.mrt.com/business/oil/article/texas-high-voltage-lines-permian-basin-20292980.php> [<https://perma.cc/Z6CK-7BAH>].

<sup>5</sup> Nilay Manzagol & Tyler Hodge, *Commercial Electricity Demand Grew Fastest in States with Rapid Computing Facility Growth*, U.S. ENERGY INFO. ADMIN. (June 28, 2024), <https://www.eia.gov/todayinenergy/detail.php?id=62409> [<https://perma.cc/UTQ8-JU3R>].

<sup>6</sup> See ARMAN SHEHABI ET AL., 2024 UNITED STATES DATA CENTER ENERGY USAGE REPORT 6 (2024) (describing increased usage and its causes); Marc Levy, *Amazon to Spend \$20B on Data Centers in Pennsylvania, Including One Next to a Nuclear Power Plant*, ASSOCIATED PRESS (June 9, 2025, at 21:04 ET), <https://apnews.com/article/amazon-data-center-nuclear-power-plant-pennsylvania-electricity-grid-31f705d035069279b70fa27a5dc71596> [<https://perma.cc/85RG-83MK>]; WILSON ET AL., *supra* note 2, at 3–4, 8–12.

<sup>7</sup> See Nadja Popovich & Brad Plumer, *How Electrifying Everything Became a Key Climate Solution*, N.Y. TIMES (Apr. 14, 2023), <https://www.nytimes.com/interactive/2023/04/14/climate/electric-car-heater-everything.html> [<https://perma.cc/253U-82PA>].

<sup>8</sup> These debates are most salient with cryptocurrency. See generally Peter Howson & Alex de Vries, *Preying on the Poor? Opportunities and Challenges for Tackling the Social and Environmental Threats of Cryptocurrencies for Vulnerable and Low-Income Communities*, ENERGY RSCH. & Soc. Sci., Feb. 2022, at 1 (summarizing concerns).

computing-technology advances often benefit the economy.<sup>9</sup> The advances also have potential national security implications; experts and regulators have argued that keeping data-processing facilities on American soil is crucially important to maintaining the United States's technological edge and to protecting national security.<sup>10</sup> For these reasons, many legislators and energy officials view accommodating the needs of these new electricity users as an important priority.<sup>11</sup> There also are jobs at stake—or, at least, that is the perception<sup>12</sup>—and for that additional reason, states are using tax breaks and other financial incentives to court the so-called “hyperscalers”<sup>13</sup> behind the new data center construction.<sup>14</sup>

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<sup>9</sup> Some estimates of AI's economic value are enormous. *See, e.g., Generative AI Could Raise Global GDP by 7%*, GOLDMAN SACHS (Apr. 5, 2023), <https://www.goldmansachs.com/insights/articles/generative-ai-could-raise-global-gdp-by-7-percent> [<https://perma.cc/8VUB-DZWP>]. *But see* Daron Acemoglu, *The Simple Macroeconomics of AI*, MASS. INST. TECH. 43 (May 12, 2024), [https://shapingwork.mit.edu/wp-content/uploads/2024/05/Acemoglu\\_Macroeconomics-of-AI\\_May-2024.pdf](https://shapingwork.mit.edu/wp-content/uploads/2024/05/Acemoglu_Macroeconomics-of-AI_May-2024.pdf) [<https://perma.cc/6JDU-BSW9>] (predicting much more modest economic effects).

<sup>10</sup> *See* PJM Interconnection, L.L.C., 189 FERC ¶ 61,078, para. 3 (2024) (Phillips, Chairman, dissenting) (warning that “U.S. leadership in Artificial Intelligence (AI) is necessary to maintaining our national security,” that this will require “a massive and unprecedented investment in . . . data centers,” and that “access to reliable electricity is the lifeblood of those data centers”); LING ZHU, CONG. RSCH. SERV., IF12899, DATA CENTERS AND CLOUD COMPUTING: INFORMATION TECHNOLOGY INFRASTRUCTURE FOR ARTIFICIAL INTELLIGENCE 2 (2025) (stating that AI “implicate[s] national security interests” in multiple ways).

<sup>11</sup> *See* Press Release, House Comm. on Sci., Space, & Tech., House Bipartisan Task Force on Artificial Intelligence Delivers Report (Dec. 17, 2024), <https://science.house.gov/2024/12/house-bipartisan-task-force-on-artificial-intelligence-delivers-report> [<https://perma.cc/N54L-HGFG>] (reporting on the release of a report “explor[ing] how Congress can ensure America continues to lead the world in AI innovation”); Brian Dabbs, Christa Marshall & Carlos Anchondo, *5 Takeaways from Chris Wright's Hill Visit*, E&E NEWS: ENERGYWIRE (May 8, 2025, at 06:34 ET), <https://www.eenews.net/articles/5-takeaways-from-chris-wrights-hill-visit> [<https://perma.cc/SZUC-JWSZ>] (quoting U.S. Secretary of Energy Chris Wright as stating that AI is “the Manhattan Project of our time” and that “[i]f we're behind China in AI, our sovereignty [and] our national defense [are] at risk” (second and third alterations in original)).

<sup>12</sup> *See* Amy L. Stein, *Shifting Structural Power: The Tech Energy Transition*, 101 IND. L.J. 1, 34–35 (2025) (noting that tech centers create few lasting jobs).

<sup>13</sup> BLOOM ENERGY, 2025 DATA CENTER POWER REPORT 2 (2025), <https://www.bloomenergy.com/midyr-2025-data-center-report/> [<https://perma.cc/XE8S-UAM8>]; ZHU, *supra* note 10, at 2 (“According to industry analysts, to be considered a hyperscale data center, a facility must contain at least 5,000 servers and occupy at least 10,000 square feet of physical space, with a power demand exceeding 100 megawatts (MW).”).

<sup>14</sup> *See* Karin Rives, *Some State Lawmakers Question Tax Breaks for Datacenters, Others Roll Out Mat*, S&P GLOB. (Aug. 12, 2024, at 20:25 UTC), <https://www.spglobal.com/commodity-insights/en/news-research/latest-news/electric-power/081224-some-state-lawmakers-question-tax-breaks-for-datacenters-others-roll-out-mat> [<https://perma.cc/MP2Q-NAKK>]; Jake Remington & Rod Carter, *An Overview of State Data Center-Related Tax Incentives*, DEVELOPMENT, Winter 2024/2025, at 13, 14; Jack Vaughn, *U.S. Data Center Tax Incentives: A Special Report*, DATA CTR. KNOWLEDGE (May 21, 2025), <https://www.datacenterknowledge.com/regulations/u-s-data-center-tax-incentives-a-special-report> [<https://perma.cc/J6X5-33JP>].

But the projected expansion in electricity demand will also stress energy systems.<sup>15</sup> Even before generative AI became the hottest new thing in tech, energy experts were worried about the United States's ability to construct the new electricity generation and transmission facilities necessary to accommodate building and vehicle electrification and a clean energy transition.<sup>16</sup> AI has dramatically raised the stakes, along with enhancing worries that heightened demand will mean more burning of fossil fuels.<sup>17</sup> A massive buildout of new electric generating plants also puts consumers at risk.<sup>18</sup> A single new data center can use up all the electricity from a large power plant,<sup>19</sup> and utilities that are eager to attract and supply major new customers might raise prices for, and lower the

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<sup>15</sup> See generally Hannah Wiseman & Matthew McHale, *Governing the Energy Bottleneck*, 50 HARV. ENV'T L. REV. (forthcoming 2026) (discussing challenges); Dylan Baddour & Arcelia Martin, *Data Centers Are Building Their Own Gas Power Plants in Texas*, TEX. TRIB. (June 5, 2025, at 05:00 CT), <https://www.texastribune.org/2025/06/05/texas-data-centers-gas-power-plants-ai/> [<https://perma.cc/WJ2X-HKTW>] (discussing rapidly increasing demands for data-center-driven power in Texas).

<sup>16</sup> See, e.g., J.B. Ruhl & James Salzman, *The Greens' Dilemma: Building Tomorrow's Climate Infrastructure Today*, 73 EMORY L.J. 1, 6–8 (2023) (arguing that legal challenges will make it nearly impossible to build renewable energy infrastructure fast enough); Michael B. Gerrard, *A Time for Triage*, ENV'T F., Jan./Feb. 2022, at 38, 40 (same). But see David E. Adelman, *Permitting Reform's False Choice*, 51 ECOLOGY L.Q. 129, 134–35 (2024) (using empirical data to argue that critics are overstating the role of federal environmental review in slowing renewable energy development); David D. Ayliffe, Elizabeth Haskins & Noelle E. Wooten, *Seven County Infrastructure Coal. v. Eagle Cnty., Colo.—Supreme Court's "Course Correction" on NEPA Already Steering Decisions in Infrastructure Development Cases*, BAKER DONELSON (July 25, 2025), <https://www.bakerdonelson.com/seven-county-infrastructure-coal-v-eagle-nty-colo-supreme-courts-course-correction-on-nepa-already-steering-decisions-in-infrastructure-development-cases> [<https://perma.cc/UTD8-3388>] (arguing that courts are increasingly narrowing the scope of federal environmental review of projects).

<sup>17</sup> See, e.g., David Rotman, *AI Could Keep Us Dependent on Natural Gas for Decades to Come*, MIT TECH. REV. (May 20, 2025), <https://www.technologyreview.com/2025/05/20/1116272/ai-natural-gas-data-centers-energy-power-plants/> [<https://perma.cc/TER9-ECPX>]; Antonio Olivo, *Internet Data Centers Are Fueling Drive to Old Power Source: Coal*, WASH. POST (Apr. 17, 2024, at 06:05 ET), <https://www.washingtonpost.com/business/interactive/2024/data-centers-internet-power-source-coal/> [<https://perma.cc/B3ZF-2PEH>]; Adam Aton, *Texas Prepares for Boom in Gas Plants—and Emissions*, E&E NEWS: CLIMATEWIRE (June 12, 2025, at 06:25 ET), <https://subscriber.politicopro.com/article/eenews/2025/06/12/texas-prepares-for-boom-in-gas-plants-and-emissions-00401000> [<https://perma.cc/XV86-2Z56>].

<sup>18</sup> See generally ELIZA MARTIN & ARI PESKOE, *EXTRACTING PROFITS FROM THE PUBLIC: HOW UTILITY RATEPAYERS ARE PAYING FOR BIG TECH'S POWER* (2025), <https://eelp.law.harvard.edu/wp-content/uploads/2025/03/Harvard-ELI-Extracting-Profits-from-the-Public.pdf> [<https://perma.cc/K99C-HAVK>] (explaining how government-regulated utility rates socialize a utility's costs of providing electricity service to the public, which results in existing ratepayers funding discounted rates for data centers).

<sup>19</sup> See ZHU, *supra* note 10, at 1 (describing hyperscale data centers as having power demands exceeding 100 megawatts (“MW”)); BLOOM ENERGY, *supra* note 13, at 3 (“The median data center size is expected to grow from approximately 175 MW [in 2025] to about 275 MW in 2030 and 375 MW in 2035.”); Baddour & Martin, *supra* note 15 (discussing plans for a new 1,200 MW natural gas plant project to support a single data center in Texas).

quality or reliability of service to, their existing customer base.<sup>20</sup> Perhaps even more problematically, utilities might build new electric generation and transmission infrastructure, only to discover that the anticipated data centers will not be built, will take their equipment somewhere else, or will use much less electricity than anticipated, leaving investors, ratepayers, or both holding the bag.<sup>21</sup> That outcome would be consequential and unfair; electricity prices in many places are rising, and millions of Americans are struggling to pay their electricity bills.<sup>22</sup>

Beneath these threats are challenging legal questions, which electric utilities and state regulators are now attempting to address. The most immediate is whether and how electricity providers should contract with new large-load electricity consumers. Should data centers be treated like other industrial or commercial ratepayers, which could mean paying the same rates as other customers in those ratepayer classes, or should they get individual contracts?<sup>23</sup> If they get their own contracts, should those contracts provide preferential treatment, or should existing consumers be favored?<sup>24</sup> What if new data centers want exclusive relationships with their own dedicated power plants; should that be allowed or even encouraged?<sup>25</sup> Beyond protecting existing utility

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<sup>20</sup> See MARTIN & PESKOE, *supra* note 18, at 1; Brian Martucci, *Affordability a 'Formidable Challenge' as Load Shifts to Tech, Industrial Customers: ICF*, UTIL. DIVE (June 30, 2025), <https://www.utilitydive.com/news/affordability-load-demand-tech-industrial-icf> [<https://perma.cc/ELA9-L6PC>] (discussing cost and reliability impacts associated with the shift toward increased industrial load growth and away from residential load growth).

<sup>21</sup> See Brian Martucci, *A Fraction of Proposed Data Centers Will Get Built. Utilities Are Wising Up.*, UTIL. DIVE (May 15, 2025), <https://www.utilitydive.com/news/a-fraction-of-proposed-data-centers-will-get-built-utilities-are-wising-up> [<https://perma.cc/Y738-S58N>]; see also Robert Walton, *There Aren't Enough AI Chips to Support Data Center Projections, Report Says*, UTIL. DIVE (July 9, 2025), <https://www.utilitydive.com/news/not-enough-ai-chips-to-support-data-center-projections-london-economics> [<https://perma.cc/E3HN-LQC5>] (discussing a report concluding that data center and electricity growth estimates are “almost certainly overstated”); JONATHAN KOOMEY, ZACHARY SCHMIDT & TANYA DAS, *ELECTRICITY DEMAND GROWTH AND DATA CENTERS: A GUIDE FOR THE PERPLEXED 7–10* (2025), <https://bipartisanpolicy.org/report/electricity-demand-growth-and-data-centers/> [<https://perma.cc/LBR3-Q2FE>] (showing that utility company projections of electricity demand growth have far exceeded actual demand since the mid-2000s and urging caution about current projections).

<sup>22</sup> See *Skyrocketing Utility Bills Nationwide Leave American Consumers Feeling Stressed, Powerless*, POWERLINES (Apr. 23, 2025), <https://powerlines.org/skyrocketing-utility-bills-nationwide-leave-american-consumers-feeling-stressed-powerless/> [<https://perma.cc/L7SK-WBAW>].

<sup>23</sup> See *infra* Section I.C (providing examples).

<sup>24</sup> See *infra* Section I.C (discussing existing approaches).

<sup>25</sup> See Marc Levy, *Big Tech Wants to Plug Data Centers Right into Power Plants. Utilities Say It's Not Fair*, ASSOCIATED PRESS (Jan. 25, 2025, at 09:42 ET), <https://apnews.com/article/power-electricity-amazoners-grid-f4763f73bc112425e18f30618dff0039> [<https://perma.cc/YN7T-CKCN>]; Naureen S. Malik, *Texas Regulator Wants Data Centers to Build Power Plants*, BLOOMBERG (Oct. 3, 2024, at 19:04 ET), <https://www.bloomberg.com/news/articles/2024-10-03/texas-regulator-wants-data-centers-to-build-power-plants> [<https://perma.cc/93F2-SMBZ>] (reporting that the Chair of the

customers, can contracts be structured in ways that encourage otherwise desirable things like carbon-free energy and energy efficiency?<sup>26</sup>

More fundamentally, should data centers change basic premises of energy law? Longstanding principles of electricity policy provide that electric utilities have a duty to serve all customers<sup>27</sup> and must maintain sufficient capacity so that even peak demand periods can pass without curtailments or blackouts.<sup>28</sup> Are these still viable or desirable assumptions, particularly as applied to data centers?<sup>29</sup> To put all these issues in broader terms, how should contracts, regulatory systems, and electricity markets be structured to encourage innovation, support economic growth, and provide for a fair and socially beneficial allocation of risk?

These are hard questions, and the peculiarities of electricity provision make them even more challenging. Traditional market- or government-centered solutions can be difficult to graft onto a system that has predominantly relied on regulated monopoly private utilities.<sup>30</sup>

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Public Utility Commission of Texas has told data center developers that “they will need to supply some of their own power if they want to connect to the Texas grid within 12 to 15 months”); BLOOM ENERGY, *supra* note 13, at 3 (stating that by 2030, thirty-eight percent of data centers are expected to have their own onsite power plants, up from thirteen percent in 2024, and that although only one percent of data centers in 2024 were “fully powered by onsite generation,” that percentage is expected to increase to twenty-seven percent by 2030).

<sup>26</sup> See *infra* notes 161–66 and accompanying text (discussing the “Clean Transition Tariff” negotiated by Google and NV Energy).

<sup>27</sup> See Jim Rossi, *The Common Law “Duty to Serve” and Protection of Consumers in an Age of Competitive Retail Public Utility Restructuring*, 51 VAND. L. REV. 1233, 1236 (1998) (“For hundreds of years, public utilities have assumed obligations to extend service to customers within their service territories and to continue providing service once service has commenced.”); see also Heather Payne, *Unservice: Reconceptualizing the Utility Duty to Serve in Light of Climate Change*, 56 U. RICH. L. REV. 603, 606 (2022) (acknowledging that due to climate change, utilities “may have to allow the utility to stop serving some customers, or never start serving them in the first place”).

<sup>28</sup> See *Reliability Explainer*, FED. ENERGY REGUL. COMM’N (Aug. 16, 2023), <https://www.ferc.gov/reliability-explainer> [<https://perma.cc/88RN-V9RL>] (stating that grid reliability is a function of (1) “[a] reliable power grid” that can “withstand sudden . . . disturbances” and (2) resource adequacy, which “means having sufficient generation to meet projected electric demand”); Joshua C. Macey, Shelley Welton & Hannah Wiseman, *Grid Reliability in the Electric Era*, 41 YALE J. ON REGUL. 164, 189–94, 225–26 (2024) (discussing the federal regulators and regional grid entities responsible for ensuring adequate power supplies and setting reliability standards for utilities); Paul Denholm, *Top 10 Things to Know About Power Grid Reliability*, NAT’L LAB’Y OF THE ROCKIES (Jan. 26, 2024), <https://www.nrel.gov/news/detail/program/2024/top-10-things-to-know-about-power-grid-reliability> [<https://perma.cc/2BV2-UKUJ>] (explaining that “[t]he average U.S. customer loses power less than two times per year for a total of less than five hours, which represents 99.95% reliability,” and almost all outages result from problems on the local distribution system rather than insufficient electricity supply).

<sup>29</sup> See, e.g., ANNE FRANCES JOHNSON & KASIA KORNECKI, NAT’L ACADS., *IMPLICATIONS OF ARTIFICIAL INTELLIGENCE–RELATED DATA CENTER ELECTRICITY USE AND EMISSIONS 1* (2025) (considering environmental, health, and social impacts of data centers).

<sup>30</sup> See Aneil Kovvali & Joshua C. Macey, *The Corporate Governance of Public Utilities*, 40 YALE J. ON REGUL. 569, 573–74 (2023) (explaining how investor-owned utilities’ incentive

Nevertheless, the questions are not entirely new; supply challenges for other resources have raised analogous concerns.<sup>31</sup> The legal efforts taken to address such concerns therefore hold lessons for responding to the projected growth in electricity demand—and, probably, for whatever other new energy supply challenges the future brings.

This Article considers the implications of two such examples. First, it addresses natural gas, which also has gone through cycles of boom and bust, and for which foundational assumptions of contracting systems have often been quite different than they have been for electricity.<sup>32</sup> Next, the Article leaves the world of energy and turns to water allocation.<sup>33</sup> In contrast to electricity systems, water law in the Western United States relies on a system known as “prior appropriation,” which assumes that supply often will be insufficient to meet demand.<sup>34</sup> Allocating the burdens of shortage is—at least in theory<sup>35</sup>—foundational to water law systems rather than a challenge to be avoided.<sup>36</sup> Thus, the experience with Western water allocation systems holds potential lessons for electricity law.

Neither of these examples offers a perfect analogy to modern-day electricity systems, and the lessons this Article draws come with predictable caveats. Indeed, some of the mechanisms used to allocate natural gas or water probably should not or could not be adapted to present-day electricity management challenges, either because these mechanisms were addressing very different circumstances or because they just did not work.<sup>37</sup> Nevertheless, important conclusions do emerge. The most important conclusion is that electricity law does not need to remain wedded to a duty-to-serve, excess-capacity model, in

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structures differ from those of traditional companies). *See generally* Harvey Averch & Leland L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1052 (1962) (exploring the economic incentives of a regulated monopoly subject to a “fair rate of return,” a regulatory criterion under which a monopoly may only realize a certain amount of profit).

<sup>31</sup> *See infra* Part II.

<sup>32</sup> *See infra* Section II.A.

<sup>33</sup> *See infra* Section II.B.

<sup>34</sup> *See* BARTON H. THOMPSON, JR., JOHN D. LESHY, ROBERT H. ABRAMS & SANDRA B. ZELLMER, *LEGAL CONTROL OF WATER RESOURCES* 173–88 (6th ed. 2018) (describing basic principles of prior appropriation).

<sup>35</sup> In practice, rules for allocating shortage burdens are sometimes unevenly applied. *See, e.g.*, NELL GREEN NYLEN, DAVE OWEN, JENNIFER HARDER, MICHAEL KIPARSKY & MICHAEL HANEMANN, *MANAGING WATER SCARCITY: A FRAMEWORK FOR FAIR AND EFFECTIVE WATER RIGHT CURTAILMENT IN CALIFORNIA* 8–12 (2023) (describing limitations in California’s system for curtailing water diversions during drought periods); Reed D. Benson, *Alive but Irrelevant: The Prior Appropriation Doctrine in Today’s Western Water Law*, 83 U. COLO. L. REV. 675, 679 (2012) (arguing that prior appropriation’s significance has diminished).

<sup>36</sup> *See* Gregory J. Hobbs, Jr., *Reviving the Public Ownership, Antispeculation, and Beneficial Use Moorings of Prior Appropriation Water Law*, 84 U. COLO. L. REV. 97, 111 (2014) (“The doctrine of prior appropriation is a rule of scarcity, not of plenty.”).

<sup>37</sup> *See infra* Sections II.A.2, II.B.2.

which the response to potential shortages must be the maintenance of sufficient capacity rather than some form of curtailment.<sup>38</sup> The excess-capacity system has produced decidedly mixed results for electricity provision,<sup>39</sup> and alternative systems have worked for natural gas and for water.<sup>40</sup> Those alternative systems also have had their flaws, and their implementation has been politically and legally fraught, particularly when curtailments would fall upon large and politically powerful resource users.<sup>41</sup> But the systems have functioned, and they have protected consumers and spurred innovation.<sup>42</sup> Analogous systems, which this Article calls “demand-side connect-and-manage,” for electricity seem well worth exploring—or continuing to develop in the places where they have begun to emerge.<sup>43</sup>

This Article proceeds as follows. Part I surveys the emerging rise in electricity demand, explaining why it is happening, why it might accelerate or dissipate, how utilities and regulators are responding, and the basic questions they must face in their efforts. Part II discusses the history of interruptible contracts and capacity release markets for natural gas and then turns to legal systems for water allocation in the American West. Finally, Part III returns to present-day electricity allocation, explaining the implications of the examples in Part II for electricity contracting and regulation in the face of rising demand.

## I. THE NEW ELECTRICITY ERA?

Just a few years ago, experts anticipated that future electricity use might decline or at least remain flat.<sup>44</sup> The assumption seemed reasonable. For decades, the United States had decoupled energy consumption from economic growth, largely because of shifts away

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<sup>38</sup> For an argument—which this Article revisits in Part III—that such an approach is technically feasible and would offer significant advantages, see TYLER H. NORRIS, TIM PROFETA, DALIA PATINO-ECHVERRI & ADAM COWIE-HASKELL, *RETHINKING LOAD GROWTH: ASSESSING THE POTENTIAL FOR INTEGRATION OF LARGE FLEXIBLE LOADS IN US POWER SYSTEMS* (2025), <https://dukespace.lib.duke.edu/items/bb350296-d7a1-4d8f-acb0-2fba9b1f03de> [<https://perma.cc/7543-56SL>].

<sup>39</sup> See *infra* Section I.C.

<sup>40</sup> See *infra* Part II.

<sup>41</sup> See *infra* Section II.A.2.

<sup>42</sup> See *infra* Sections II.A.3–4.

<sup>43</sup> See *infra* Sections I.C–D (discussing some of these nascent systems, including the large-load tariffs used in several states and the connect-and-manage approach used in Texas).

<sup>44</sup> See, e.g., Popovich & Plumer, *supra* note 7 (discussing projections for lower overall energy use); JOHN D. WILSON & ZACH ZIMMERMAN, *THE ERA OF FLAT POWER DEMAND IS OVER 4* (2023), <https://gridstrategiesllc.com/wp-content/uploads/2023/12/National-Load-Growth-Report-2023.pdf> [<https://perma.cc/4UC3-9HTG>] (“Over the past decade, grid planners have been forecasting a mere 0.5% annual growth rate, as summarized by NERC.”).

from heavy manufacturing and increases in energy efficiency.<sup>45</sup> But with energy, circumstances can change quickly, and projections of flat demand have aged as quickly as a social media meme.<sup>46</sup> This Part explains how and why demand projections have grown so fast—albeit with large and problematic uncertainties. It also explains how electric utilities and regulators are responding to these changes, and it explores the challenges those responses face.

#### A. *Projections for Increased U.S. Electricity Consumption*

For the fifteen-year period between 2005 and 2020, electricity consumption in the United States grew by an average of only 0.1% per year.<sup>47</sup> As the U.S. Energy Information Administration (“EIA”) has explained, “Electricity demand increases generally associated with population growth and economic growth were offset by efficiency improvements and other structural changes in the economy, such as the transition from manufacturing to service sectors that tend to consume less energy.”<sup>48</sup> But that period of stability appears to have ended. Growth rates have ticked up, with the EIA measuring 1.7% increases in recent years and projecting those trends to continue.<sup>49</sup> Other estimates are higher,<sup>50</sup> with one 2025 report estimating increases close to 3.2% annually, which would mean an overall 25% increase by 2030.<sup>51</sup>

The projections are also changing fast. In 2022, a report based on regional grid planning estimated the nation would need an additional twenty-four gigawatts (“GW”)<sup>52</sup> of power to meet projected peak

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<sup>45</sup> See Namit Sharma, Bram Smeets & Christer Tryggestad, *The Decoupling of GDP and Energy Growth: A CEO Guide*, MCKINSEY & Co. (Apr. 24, 2019), <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-decoupling-of-gdp-and-energy-growth-a-ceo-guide> [<https://perma.cc/TYF7-D4NB>].

<sup>46</sup> See *infra* Section I.A.

<sup>47</sup> *After More than a Decade of Little Change, U.S. Electricity Consumption Is Rising Again*, U.S. ENERGY INFO. ADMIN. (May 13, 2025), <https://www.eia.gov/todayinenergy/detail.php?id=65264> [<https://perma.cc/R8QE-ETP8>].

<sup>48</sup> *Id.*

<sup>49</sup> *Id.*

<sup>50</sup> See Jason Plautz, *Electricity Demand Projected to Rise 25% by 2030*, E&E NEWS: ENERGYWIRE (May 21, 2025), <https://www.eenews.net/articles/electricity-demand-projected-to-rise-25-by-2030/> [<https://perma.cc/K7N9-MMD9>] (describing “a flood of reports warning that electricity growth is set to rise steeply”).

<sup>51</sup> BATRA ET AL., *supra* note 1, at 4; see also BLOOM ENERGY, *supra* note 13, at 2 (“By 2028, data centers are projected to account for 12% of nationwide electricity demand, up from approximately 4% in 2023. Some data center campuses will require more than a gigawatt of power, enough to supply over 800,000 average American homes.” (footnote omitted)).

<sup>52</sup> The nameplate capacity of utility-scale power plants is generally measured in GW or MW of power. There are one billion watts in one GW and one million watts in one MW. See *How Much Power Is 1 Gigawatt?*, U.S. DEP’T OF ENERGY (Aug. 21, 2024), <https://www.energy.gov/eere/articles/how-much-power-1-gigawatt> [<https://perma.cc/DJR9-3GHN>].

demand in 2029.<sup>53</sup> At the end of 2025, that number was revised upward to include an additional 142 GW, primarily due to expected growth in data center demand.<sup>54</sup>

At subnational scales, the changes can be even more dramatic. Individual utilities are anticipating or already seeing rapid growth rates. Virginia's Dominion Energy, which serves the world's largest data center hub, had a peak demand of about seventeen GW in 2024.<sup>55</sup> By 2039, it expects peak demand to grow to about twenty-seven GW.<sup>56</sup> Indiana Michigan Power serves about 600,000 customers and has a present peak demand of just over four GW.<sup>57</sup> In the last few years alone, the utility has amassed 4.4 GW in interconnection requests from potential data centers, which, if built, would more than double the utility's current peak demand.<sup>58</sup> The boom is not uniquely American. Ireland, for example, has seen huge increases in electricity consumption by major users, with similar challenges emerging for its grid.<sup>59</sup>

Several changes are driving these trends. One is increased electrification.<sup>60</sup> A combination of advancing technology, policy incentives, and individual environmental motivations have made electric vehicles increasingly popular.<sup>61</sup> Building electrification is growing as well, as advances in heat-pump technology have made electric heat an increasingly energy-efficient, cost-competitive, and more comfortable option.<sup>62</sup>

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<sup>53</sup> WILSON ET AL., *supra* note 2, at 3.

<sup>54</sup> *Id.* (showing changes in estimated peak demand growth); *see also* BATRA ET AL., *supra* note 1, at 4 (“[R]apid spikes due to data center use and industrial demand were not predicted to occur as quickly as they have.”).

<sup>55</sup> *See* Charles Paullin, *In the World's Data Center Hotbed, How Close Is Too Close, and Who Should Pay?*, INSIDE CLIMATE NEWS (May 1, 2025), <https://insideclimateneeds.org/news/01052025/virginia-dominion-energy-data-center-proposal/> [<https://perma.cc/Z2K6-7WH3>].

<sup>56</sup> *See id.*

<sup>57</sup> Press Release, Ind. Mich. Power, I&M Reaches Settlement Agreement on Powering Our Future Plan (Dec. 21, 2023), <https://www.indianamichiganpower.com/company/news/view?releaseID=9272> [<https://perma.cc/V54Y-973K>]; *see* IND. MICH. POWER, INDIANA IRP STAKEHOLDER MEETING #2, at 6 (Sep. 24, 2024), [https://www.indianamichiganpower.com/lib/docs/community/projects/IM-irp/IN\\_Stakeholder\\_Meeting\\_2.pdf](https://www.indianamichiganpower.com/lib/docs/community/projects/IM-irp/IN_Stakeholder_Meeting_2.pdf) [<https://perma.cc/77PX-SBYE>].

<sup>58</sup> NORRIS ET AL., *supra* note 38, at 8.

<sup>59</sup> *See* Amber Jackson, *Power-Hungry Data Centres Put Pressure on Ireland's Grid*, DATA CENTRE MAG. (Aug. 23, 2024), <https://datacentremagazine.com/critical-environments/power-hungry-data-centres-put-pressure-on-irelands-grid> [<https://perma.cc/ZNU5-3CWX>].

<sup>60</sup> *See* CAITLIN MURPHY ET AL., ELECTRIFICATION FUTURES STUDY: SCENARIOS OF POWER SYSTEM EVOLUTION AND INFRASTRUCTURE DEVELOPMENT FOR THE UNITED STATES, at viii, 1 (2021).

<sup>61</sup> *See Trends in Electric Cars*, INT'L ENERGY AGENCY, <https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-cars> [<https://perma.cc/U986-5KWP>] (last visited Nov. 13, 2025); *U.S. Electric Vehicle Sales Increase More than 10% Year Over Year in Q1: GM Drives EV Growth While Tesla Declines*, COX AUTO. (Apr. 10, 2025), <https://www.coxautoinc.com/market-insights/q1-2025-ev-sales/> [<https://perma.cc/D6YX-FD8M>].

<sup>62</sup> *See* KELSEA DOMBROVSKI, HEATHER GOETSCH, OMKAR GHATPANDE, JEFF MAGUIRE & KIM TRENBATH, OVERVIEW OF BUILDING ELECTRIFICATION TECHNOLOGIES AND MARKET OPPORTUNITIES 7 (2024), <https://www.nrel.gov/docs/fy25osti/88309.pdf> [<https://perma.cc/456J-B6ZM>]; David

In some areas, the price advantages of electric power—advantages created largely by access to cheap renewable electricity—are leading industrial consumers to shift from on-site fossil-fuel-based generation to grid-supplied electricity.<sup>63</sup> The Trump Administration’s attempts to bolster fossil fuel production and consumption may slow these shifts,<sup>64</sup> but they still are likely to continue, especially over the longer term.<sup>65</sup>

The larger driver of increased electricity demand is computing.<sup>66</sup> For years, data processing has been a major use of electric power,<sup>67</sup> and some forms of data processing—like blockchain technology, which is used for cryptocurrency, among other applications—are particularly energy intensive.<sup>68</sup> But increases in projected demand have grown rapidly since the 2022 release of ChatGPT and the ensuing growth in generative AI technologies.<sup>69</sup> Most estimates of future growth in

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Weaver, *What’s the Deal with Air Source Heat Pumps? CUB Investigates*, CITIZENS UTIL. BD. (Mar. 1, 2023), <https://www.citizensutilityboard.org/blog/2023/03/01/whats-the-deal-with-air-source-heat-pumps-cub-investigates/> [<https://perma.cc/98YV-P5A8>].

<sup>63</sup> See VINCENT PETIT, SCHNEIDER ELEC., *THE UNTOLD POTENTIAL AND RATIONALE OF INDUSTRIAL ELECTRIFICATION IN THE UNITED STATES 20* (2024), [https://download.schneider-electric.com/files?p\\_enDocType=White+Paper&p\\_Doc\\_Ref=WP\\_US-Electrification](https://download.schneider-electric.com/files?p_enDocType=White+Paper&p_Doc_Ref=WP_US-Electrification) [<https://perma.cc/7P3E-DEZ7>]; VOLTS: *What in Tarnation Is Going on in Texas?*, at 09:30 (Volts, Apr. 16, 2025), <https://www.volts.wtf/p/what-in-tarnation-is-going-on-in> [<https://perma.cc/9RPP-X2LU>] (describing large-scale electrification of Texas industry).

<sup>64</sup> See ELAINE BUCKBERG & CASSANDRA COLE, *TRUMP EV POLICY OVERHAUL 4* (2025), <https://salatainstitute.harvard.edu/quantifying-trumps-impacts-on-ev-adoption/> [<https://perma.cc/2X4B-BA8B>]; Exec. Order No. 14,261, 90 Fed. Reg. 15,517, 15,517 (Apr. 8, 2025) (announcing a federal policy to support domestic coal production and use).

<sup>65</sup> See Michael Copley, *America’s Clean-Energy Industry Is Growing Despite Trump’s Attacks. At Least for Now*, NPR (Mar. 12, 2025, at 05:33 ET), <https://www.npr.org/2025/03/12/nx-5319056/trump-clean-energy-electricity-climate-change> [<https://perma.cc/P7MH-BYTT>].

<sup>66</sup> See SHEHABI ET AL., *supra* note 6, at 6.

<sup>67</sup> See Rebecca Leppert, *What We Know About Energy Use at U.S. Data Centers amid the AI Boom*, PEW RSCH. CTR. (Oct. 24, 2025), <https://www.pewresearch.org/short-reads/2025/10/24/what-we-know-about-energy-use-at-us-data-centers-amid-the-ai-boom/> [<https://perma.cc/8PKD-G37A>].

<sup>68</sup> See Steven Ferrey, *Cryptocurrency—Legally Navigating the “Highway to Climate Hell,”* 30 U.C.L. ENV’T J. 25, 40–42 (2024) (describing cryptocurrency’s electricity demands).

<sup>69</sup> See Bernard Marr, *A Short History of ChatGPT: How We Got to Where We Are Today*, FORBES (May 19, 2023, at 01:14 ET), <https://www.forbes.com/sites/bernardmarr/2023/05/19/a-short-history-of-chatgpt-how-we-got-to-where-we-are-today/> [<https://perma.cc/9ZG4-KRJA>]; Reid Lifset, Rsch. Scholar, Yale Sch. of the Env’t, Pranava Raparla, Presidential Innovation Fellow, U.S. Dep’t of Energy, Amy Stein, Professor of L., Univ. of Fla. Levin Coll. of L., Lauren Bridges, Assistant Professor in Media Stud., Univ. of Va., Jim McElfish, Senior Advisor, Env’t L. Inst. & Tim Cywinski, Commc’ns Dir., Sierra Club, *Local Environmental Impacts of Data Center Proliferation*, Panel Discussion at the Environmental Law Institute and the Network for Digital Economy and the Environment (Dec. 6, 2024) (discussing a variety of growth estimates due to data centers), in 55 ENV’T L. REP. 10,131, 10,134 (2025); Taiba Jafari, Olexandr Balyk, Lewis (Zhaoyu) Wu & James Glynn, *Projecting the Electricity Demand Growth of Generative AI Large Language Models in the US*, CTR. ON GLOB. ENERGY POL’Y (July 17, 2024), <https://www.energypolicy.columbia.edu/>

electricity demand attribute the lion's share of the projected growth to data processing.<sup>70</sup>

Importantly, data-center-driven demand growth often is not incremental. A single new data center can require hundreds of megawatts (“MW”) of power.<sup>71</sup> And if new data centers appear in clusters, as they often do, a single utility may find itself needing to meet new electricity needs equivalent to those of several major new cities.<sup>72</sup> Before the era of hyperscalers, utilities were not accustomed to that sort of change. In 2024, the Electric Power Research Institute surveyed twenty-five prominent utilities and found that none had ever served “[data center] connections greater than 500 MW.”<sup>73</sup> Nevertheless, at the time of the survey, sixty percent of those same utilities had received individual data center requests for 500 MW or more, and forty-eight percent had requests for 1,000 MW or more.<sup>74</sup>

In some past eras of growing electricity demand, the federal government coordinated growth in electricity generation and transmission and, in many cases, built new supply itself. During World War I and World War II, for example, industrial demand increased

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projecting-the-electricity-demand-growth-of-generative-ai-large-language-models-in-the-us/ [https://perma.cc/P3UY-BEXU].

<sup>70</sup> SHEHABI ET AL., *supra* note 6, at 10; *see, e.g.*, RYAN QUINT, JIECHENG (JEFF) ZHAO & KYLE THOMAS, AN ASSESSMENT OF LARGE LOAD INTERCONNECTION RISKS IN THE WESTERN INTERCONNECTION 8 (2025), [https://www.rtoinsider.com/wp-content/uploads/2025/03/Report\\_WECC-Large-Loads-Risk-Assessment-4.pdf](https://www.rtoinsider.com/wp-content/uploads/2025/03/Report_WECC-Large-Loads-Risk-Assessment-4.pdf) [https://perma.cc/LH8B-EDWP] (attributing eighty percent of large-load interconnection requests to data centers); *see also* Ivan Penn & Karen Weise, *Big Tech's A.I. Data Centers Are Driving Up Electricity Bills for Everyone*, N.Y. TIMES (Aug. 14, 2025), <https://www.nytimes.com/2025/08/14/business/energy-environment/ai-data-centers-electricity-costs.html> [https://perma.cc/H4DZ-FRZL] (discussing how big tech companies' efforts to build data centers may result in increased electricity costs for others).

<sup>71</sup> *See, e.g.*, Ethan Howland, *FERC Rejects Interconnection Pact for Talen-Amazon Data Center Deal at Nuclear Plant*, UTIL. DIVE (Nov. 4, 2024), <https://www.utilitydive.com/news/ferc-interconnection-isa-talen-amazon-data-center-susquehanna-exelon> [https://perma.cc/7GNU-TUWL] (describing Amazon's attempt to buy nuclear power for a 960 MW data center); Peter Behr, *FERC Delivers Firm Guidance on Electricity to AI Industry*, E&E NEWS: ENERGYWIRE (Dec. 19, 2025), <https://www.eenews.net/articles/ferc-delivers-firm-guidance-on-electricity-to-ai-industry/> [https://perma.cc/E2BE-NMUW] (describing more recent FERC order on same); Arcelia Martin, *Meta Strikes 20-Year Nuclear Power Deal with Constellation Energy*, INSIDE CLIMATE NEWS (June 3, 2025), <https://insideclimatenews.org/news/03062025/meta-constellation-nuclear-power-deal> [https://perma.cc/G4LW-WDCH]; Zachary Skidmore, *Ohio Regulators Approve Construction of 200MW Gas Power Plant to Serve Meta's New Albany Data Center*, DATA CTR. DYNAMICS (June 10, 2025), <https://www.datacenterdynamics.com/en/news/ohio-regulators-approve-construction-of-200mw-gas-power-plant-to-serve-meta-data-center-in-new-albany-ohio> [https://perma.cc/5AJK-FVRW].

<sup>72</sup> *See* Manzagol & Hodge, *supra* note 5 (describing rapid growth in Virginia and Texas); Jafari et al., *supra* note 69 (“[N]ew data centers tend to be clustered in particular regions of the United States . . .”).

<sup>73</sup> ELEC. POWER RSCH. INST., UTILITY EXPERIENCES AND TRENDS REGARDING DATA CENTERS 5 (2024).

<sup>74</sup> *Id.*

rapidly, and the federal government responded partly by actively managing the interconnection of existing, private utility systems and partly by constructing its own facilities.<sup>75</sup> Likewise, during the immediate postwar years, when residential demand increased rapidly, the federal government helped meet that demand through significant expansion of federal hydropower and other generation facilities.<sup>76</sup> The Trump Administration has advocated similar efforts,<sup>77</sup> and it already has taken dramatic steps to compel some aging coal plants to stay open despite the environmental and financial impacts of doing so.<sup>78</sup>

But supply-side solutions alone will not meet this moment, either in the short term or the long term. The United States has shuttered many coal and nuclear power plants in recent years,<sup>79</sup> and although they could be restarted,<sup>80</sup> there were good reasons for closing them.<sup>81</sup> Many of them had become prohibitively expensive to operate,<sup>82</sup> and for coal plants, local and regional pollution and climate impacts provided

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<sup>75</sup> See Julie Cohn, Matthew Evenden & Marc Landry, *Water Powers: The Second World War and the Mobilization of Hydroelectricity in Canada, the United States, and Germany*, 15 J. GLOB. HIST. 123, 132–33, 138–41 (2020) (describing wartime consolidation of power and expansion of electricity production).

<sup>76</sup> See Christine A. Klein, *On Dams and Democracy*, 78 OR. L. REV. 641, 642–43 (1999).

<sup>77</sup> See Exec. Order No. 14,318, 90 Fed. Reg. 35,385, 35,385 (July 23, 2025).

<sup>78</sup> See, e.g., Ethan Howland, *Groups Appeal DOE ‘Emergency’ Order Keeping Michigan Plant Online*, UTIL. DIVE (June 20, 2025), <https://www.utilitydive.com/news/doe-emergency-order-consumers-power-plant-appeal-earthjustice> [<https://perma.cc/VL3A-D7TG>]; see also *Fact Sheet: President Donald J. Trump Establishes the National Energy Dominance Council*, THE WHITE HOUSE (Feb. 14, 2025), <https://www.whitehouse.gov/fact-sheets/2025/02/fact-sheet-president-donald-j-trump-establishes-the-national-energy-dominance-council/> [<https://perma.cc/4N67-VUCZ>] (announcing the creation of a new “National Energy Dominance Council” to assist the Trump Administration in expanding energy production); Exec. Order No. 14,156, 90 Fed. Reg. 8,433, 8,433, 8,436 (Jan. 20, 2025), <https://www.whitehouse.gov/presidential-actions/2025/01/declaring-a-national-energy-emergency/> [<https://perma.cc/8EK6-LF65>] (ordering efforts to expand U.S. fossil fuel production).

<sup>79</sup> See, e.g., SETH FEASTER, U.S. ON TRACK TO CLOSE HALF OF COAL CAPACITY BY 2026, at 6 (2023), <https://ieefa.org/resources/us-track-close-half-coal-capacity-2026> [<https://perma.cc/YY3Y-JKEK>]; MARK HOLT & PHILLIP BROWN, CONG. RSCH. SERV., R46820, U.S. NUCLEAR PLANT SHUT-DOWNS, STATE INTERVENTIONS, AND POLICY CONCERNS 1 (2022).

<sup>80</sup> As of 2025, plans were underway to reopen closed nuclear plants in Michigan and Pennsylvania, among other states, in part to address growing electricity demand from data centers. See, e.g., Noël Fletcher, *U.S. Government Is Taking Historic Steps to Restart Nuclear Plants*, FORBES (Aug. 29, 2025, at 17:09 ET), <https://www.forbes.com/sites/noelfletcher/2025/08/28/us-government-is-taking-historic-steps-to-restart-nuclear-plants/> [<https://perma.cc/F6YE-8Z2S>] (discussing Palisades Nuclear Plant in Michigan and Three Mile Island in Pennsylvania).

<sup>81</sup> See ENERGY INNOVATION, COAL POWER 28 PERCENT MORE EXPENSIVE IN 2024 THAN IN 2021, at 1–2 (2025), <https://energyinnovation.org/report/coal-power-28-percent-more-expensive-in-2024-than-in-2021/> [<https://perma.cc/SA4N-Q83M>]; see also HOLT & BROWN, *supra* note 79, at 1 (“[T]he U.S. nuclear power industry in recent years has been facing economic and financial challenges . . .”).

<sup>82</sup> See ENERGY INNOVATION, *supra* note 81, at 1.

independent justifications for retirement.<sup>83</sup> Many utilities are looking to new natural gas plants to fill the power gap, but natural-gas-fired power, like coal, has major climate impacts, and orders for new natural gas turbines are now backlogged for years.<sup>84</sup> New renewable power is an environmentally preferable alternative, and increasingly, it also is cheaper.<sup>85</sup> But generating new renewable energy also can be difficult, particularly in places where state and local politics have turned against wind and solar development.<sup>86</sup> Additionally, bringing wind and solar power to markets will often require new long-distance electric transmission lines, and, for a complex set of reasons, efforts to build those lines and connect new power facilities to them have faced major roadblocks, often causing yearslong delays.<sup>87</sup> The consequence of all these difficulties is that powering the new hyperscalers may be costly and, at times, frustratingly slow.<sup>88</sup>

Electricity systems already are seeing the consequences of these roadblocks. As the number of data center interconnection requests has increased, the interconnection process has become increasingly

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<sup>83</sup> See generally RICHARD L. REVESZ & JACK LIENKE, *STRUGGLING FOR AIR: POWER PLANTS AND THE “WAR ON COAL”* (2016) (describing coal’s highly polluting impacts on the environment).

<sup>84</sup> See Elizabeth Trovall, *Will We Have Enough Natural Gas Turbines to Power AI Data Centers?*, MARKETPLACE (May 20, 2025), <https://www.marketplace.org/story/2025/05/20/turbine-shortage-slows-new-natural-gas-plant-construction> [<https://perma.cc/K93J-6B5P>]; Deborah Gordon & Shannon Hughes, *Reality Check: Natural Gas’s True Climate Risk*, ROCKY MOUNTAIN INST. (July 13, 2023), <https://rmi.org/reality-check-natural-gas-true-climate-risk/> [<https://perma.cc/X3NJ-9QCH>].

<sup>85</sup> See RYAN WISER, MARK BOLINGER, DEV MILLSTEIN & JOACHIM SEEL, *GRID VALUE AND COST OF UTILITY-SCALE WIND AND SOLAR* 4, 6 (2024), [https://eta-publications.lbl.gov/sites/default/files/net\\_value\\_final\\_report.pdf](https://eta-publications.lbl.gov/sites/default/files/net_value_final_report.pdf) [<https://perma.cc/5HVK-928X>] (describing the increasing cost competitiveness of renewables and acknowledging the environmental benefits of renewable energy like wind and solar).

<sup>86</sup> See Christiana Ochoa, Kacey Cook & Hanna Weil, *Deals in the Heartland: Renewable Energy Projects, Local Resistance, and How Law Can Help*, 107 MINN. L. REV. 1055, 1056–57 (2023) (“[M]illions of acres of open land are already foreclosed to renewable energy projects due to rapidly increasing community-level opposition . . .”); MATTHEW EISENSEN ET AL., *COLUMBIA L. SCH., OPPOSITION TO RENEWABLE ENERGY FACILITIES IN THE UNITED STATES* 5 (June 2024 ed. 2024), [https://scholarship.law.columbia.edu/cgi/viewcontent.cgi?article=1227&context=sabin\\_climate\\_change](https://scholarship.law.columbia.edu/cgi/viewcontent.cgi?article=1227&context=sabin_climate_change) [<https://perma.cc/M35U-GAWM>] (detailing “numerous and widespread” state and local laws banning or otherwise restricting new renewable energy projects).

<sup>87</sup> See DANIEL SHAWHAN, MCKENNA PEPLINSKI, SALLY ROBSON, ETHAN RUSSELL, ETHAN ZIEGLER & KAREN PALMER, *POWER DELAYED: ECONOMIC EFFECTS OF ELECTRICITY TRANSMISSION AND GENERATION DEVELOPMENT DELAYS* 1 (2025) (describing delays and their causes); Alexandra Klass, Joshua Macey, Shelley Welton & Hannah Wiseman, *Grid Reliability Through Clean Energy*, 74 STAN. L. REV. 969, 1024, 1038–43 (2022) (describing the permitting, cost allocation, and financing challenges that hinder the construction of new long-distance electric transmission lines).

<sup>88</sup> See Klass et al., *supra* note 87, at 1024; Jeff St. John, *Lots of Demand, Too Little Grid: The State of the US Power Sector*, CANARY MEDIA (Jan. 2, 2025), <https://www.canarymedia.com/articles/transmission/lots-of-demand-too-little-grid-the-us-power-sector-in-2024> [<https://perma.cc/Y7YT-PLGE>] (discussing barriers to large-scale transmission line expansion and grid connections for new generation resources).

messy and slow.<sup>89</sup> Traditionally, a utility only initiates service for a new large-load customer when the utility has enough generation capacity and reserve margin to reliably serve both the new load *and* its existing load.<sup>90</sup> Under this first-come, first-served approach, the interconnection of a 500-plus MW data center can devour a utility's uncommitted capacity in that region and force other potential customers to wait until new generation or transmission is built.<sup>91</sup>

These delays run counter to the fundamental premise that monopoly utilities have an obligation to serve any and all customers within their service territories.<sup>92</sup> As data center load growth rapidly “outrac[es] both annual power grid planning cycles and investment/construction cycles,” several utilities have had to pause or slow data center interconnections.<sup>93</sup> The length of these predicted interconnection delays varies from utility to utility, but four to eight years is a common wait time in stressed regions.<sup>94</sup> Some utilities have predicted up to ten-year waits.<sup>95</sup>

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<sup>89</sup> See Peter Freed & Allison Clements, *How to Reduce Large Load Speculation? Standardize the Interconnection Process*, UTIL. DIVE (Feb. 19, 2025), <https://www.utilitydive.com/news/data-center-large-load-interconnection-process-clements> [<https://perma.cc/YY5V-CSUR>]; QUINT ET AL., *supra* note 70, at 11–19 (describing multiple challenges with large-load interconnection processes).

<sup>90</sup> See OFF. OF CYBERSECURITY, ENERGY SEC., & EMERGENCY RESPONSE, U.S. DEP'T OF ENERGY, *HOW IT WORKS: THE ROLE OF A BALANCING AUTHORITY* 4 (2023), [https://www.energy.gov/sites/default/files/2023-08/Balancing%20Authority%20Backgrounder\\_2022-Formatted\\_041723\\_508.pdf](https://www.energy.gov/sites/default/files/2023-08/Balancing%20Authority%20Backgrounder_2022-Formatted_041723_508.pdf) [<https://perma.cc/9SPV-DUXN>].

<sup>91</sup> See Bianca Giacobone, *Phantom Data Centers Are Flooding the Load Queue*, LATITUDE MEDIA (Mar. 26, 2025), <https://www.latitudemedia.com/news/phantom-data-centers-are-flooding-the-load-queue/> [<https://perma.cc/LUN4-ZCWR>] (discussing how the significant increase in interconnection requests is delaying connections for all prospective customers).

<sup>92</sup> See *supra* notes 27–28 and accompanying text (explaining the duty to serve).

<sup>93</sup> Liuzixuan Lin, Rajini Wijayawardana, Varsha Rao, Hai Nguyen, Wedan Emmanuel Gribga & Andrew A. Chien, *Exploding AI Power Use: An Opportunity to Rethink Grid Planning and Management*, in *E-ENERGY '24: PROCEEDINGS OF THE 15TH ACM INTERNATIONAL CONFERENCE ON FUTURE AND SUSTAINABLE ENERGY SYSTEMS* 434, 434 (2024), <https://dl.acm.org/doi/epdf/10.1145/3632775> [<https://perma.cc/7HLR-UPCN>]. For example, in 2023, rising energy demand in Ohio led investor-owned utility American Electric Power to stop approving new data centers until it finalized a new tariff structure. Yoon Kim, *Guest Blog: Connecting Data Centers to the Grid: An Innovative and Controversial Proposal from AEP Ohio*, SABIN CTR. FOR CLIMATE CHANGE L.: CLIMATE L. (Sep. 12, 2024), <https://blogs.law.columbia.edu/climatechange/2024/09/12/guest-blog-connecting-data-centers-to-the-grid-an-innovative-and-controversial-proposal-from-aep-ohio/> [<https://perma.cc/GR6A-3S8J>].

<sup>94</sup> See Christopher Tozzi, *Why Data Center Grid Connections Are Slowing Down—and How to Fix It*, DATA CTR. KNOWLEDGE 6–7 (Mar. 17, 2025), <https://www.datacenterknowledge.com/energy-power-supply/why-data-center-grid-connections-are-slowing-down-and-how-to-fix-it> [<https://perma.cc/2F8S-TV7W>] (explaining why grid connection delays for data centers have increased from an average of four years to up to seven years); Vivian Lee, Pattabi Seshadri, Clark O’Niell, Archit Choudhary, Braden Holstege & Stefan A. Deutscher, *Breaking Barriers to Data Center Growth*, BOS. CONSULTING GRP. (Jan. 20, 2025), <https://web-assets.bcg.com/pdf-src/prod-live/breaking-barriers-data-center-growth.pdf> [<https://perma.cc/5BVK-2663>] (discussing delays).

<sup>95</sup> NORRIS ET AL., *supra* note 38, at 3.

Compounding the challenges, there are also significant uncertainties about whether that infrastructure, once built, will be used.<sup>96</sup> Utilities' current demand projections may be overestimated, perhaps by wide margins.<sup>97</sup> This potential for overestimation is partly driven by data center developers filing interconnection requests for projects in multiple utilities' territories, but with the expectation that they will ultimately build only a small subset of those projects and abandon the others.<sup>98</sup> As one media account explained, "[e]ven seasoned data center customers like Microsoft, Meta, Amazon and Google propose several times more projects than they're likely to need," and when the companies make their choices, the alternative locations will be left out.<sup>99</sup>

Electricity demand estimates for generative AI and other emerging technologies also are uncertain. Some recent technological advances suggest that generative AI could be done with a small fraction of current electricity demand levels.<sup>100</sup> Indeed, the announcement of one technological breakthrough sent some energy company stock prices plummeting.<sup>101</sup> These efficiency gains may turn out to be more theoretical than real, and greater efficiency also may not lead to reduced electricity consumption; it may just encourage technology companies to do more with AI.<sup>102</sup> But new technologies do often see efficiency gains, and it would be unsurprising—and also beneficial in many ways—if generative AI and other computing systems evolve toward much better ratios of processing power to electricity use.<sup>103</sup> Growth in AI use also could fizzle; whether major AI investments can lead to sustainable profits remains an open question.<sup>104</sup> For all these reasons, electricity

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<sup>96</sup> See Freed & Clements, *supra* note 89 (warning of "rampant speculative behavior by developers across the country").

<sup>97</sup> See Martucci, *supra* note 21.

<sup>98</sup> *Id.*

<sup>99</sup> *Id.*

<sup>100</sup> See NORA WANG ESRAM & CAMRON ASSADI, FUTURE-PROOF AI DATA CENTERS, GRID RELIABILITY, AND AFFORDABLE ENERGY 3–4 (2025), <https://www.aceee.org/white-paper/2025/04/future-proof-ai-data-centers-grid-reliability-and-affordable-energy> [<https://perma.cc/D2LP-LSSV>] (describing the implications of DeepSeek, an AI model that uses much less energy than comparable AI models like ChatGPT); Christa Marshall, 'Game Changer'? What 'DeepSeek' AI Means for Electricity, E&E NEWS: ENERGYWIRE (Jan. 29, 2025, at 06:53 ET), <https://subscriber.politicopro.com/article/eenews/2025/01/29/what-the-deepseek-ai-explosion-means-for-electricity-00201075> [<https://perma.cc/B2DS-B7AF>].

<sup>101</sup> See Brian Martucci, *Generator, Advanced Nuclear Stocks Reel as Low-Cost DeepSeek Chills AI Load Growth Outlook*, UTIL. DIVE (Jan. 28, 2025), <https://www.utilitydive.com/news/ipp-stocks-reel-as-low-cost-deepseek-chills-ai-load-growth-thesis> [<https://perma.cc/3C22-5JP5>].

<sup>102</sup> See James O'Donnell, *DeepSeek Might Not Be Such Good News for Energy After All*, MIT TECH. REV. (Jan. 31, 2025), <https://www.technologyreview.com/2025/01/31/1110776/deepseek-might-not-be-such-good-news-for-energy-after-all/> [<https://perma.cc/KD4K-49WU>].

<sup>103</sup> See ESRAM & ASSADI, *supra* note 100, at 9.

<sup>104</sup> See Matteo Wong, *Silicon Valley's Trillion-Dollar Leap of Faith*, ATLANTIC (July 29, 2024), <https://www.theatlantic.com/technology/archive/2024/07/ai-companies-unprofitable/679278/> [<https://perma.cc/Q3AY-BARQ>] (noting industry analysts' skepticism about AI investments).

suppliers must consider the possibility that they will make major new investments—investments that will need to be paid for somehow by someone—only for their new customers to need much less electricity or to simply disappear.<sup>105</sup>

### B. *Allocating Risks in a New Electricity Era*

The reality that data center growth could go in so many different directions raises a major policy question: Who should shoulder the associated risks? One possibility is for contracts or regulatory constraints to allocate the risks to utilities, requiring them to find sufficient power to serve new customers and to bear the economic burdens if those customers turn out to be expensive to serve—or, worse, if the new customers leave or do not materialize at all.<sup>106</sup> That is the traditional system; as one utility executive explained, “we have an obligation to serve . . . . If they have the land and the ability to build and ramp, they can do that and we have to find the assets to serve them.”<sup>107</sup> And if utilities bear the risk, then a secondary question is whether those risks should be borne by shareholders or ratepayers.<sup>108</sup> Alternatively, utilities and regulators could try to create systems in which the data centers bear the burdens. That could mean requiring data centers to fund new energy infrastructure by paying premium rates. It also could mean requiring them to pay for some guaranteed amount of electricity, whether or not they turn out to need it.<sup>109</sup>

The choice between these—and other—alternatives implicates basic questions about fairness. Should major companies or consumers shoulder economic burdens and risks? Should burdens be borne equally across all classes of customers, with standard tariffs applying equally to all consumers, or should new customers receive whatever preferences they can negotiate? The answers to these questions may

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<sup>105</sup> See Martucci, *supra* note 21.

<sup>106</sup> See MARTIN & PESKOE, *supra* note 18, at 16–18.

<sup>107</sup> Martucci, *supra* note 21 (quoting Interview with Zachary Ruzycki, Dir. of Res. Plan., Great River Energy); see also *supra* notes 27–28 and accompanying text (explaining the obligation to serve).

<sup>108</sup> See Ivan Penn, *Power Companies’ Mistakes Can Cost Billions. Who Should Pay?*, N.Y. TIMES (June 14, 2018), <https://www.nytimes.com/2018/06/14/business/energy-environment/california-fires-utilities.html> [<https://perma.cc/E5KN-3C9H>] (describing similar questions that emerged after utility-caused wildfires in California).

<sup>109</sup> See Meris Lutz, *Ohio Regulators Approve AEP Data Center Interconnection Rules*, UTIL. DIVE (July 10, 2025), <https://www.utilitydive.com/news/Ohio-regulators-approve-aep-data-center-interconnection-rules> [<https://perma.cc/TC3K-W68U>] (reporting on an Ohio Public Utilities Commission order that required new data centers over a certain size to pay minimum monthly bills, resulting in them paying “at least 85% of the energy they expect to need each month, even if they use less, to cover the cost of infrastructure needed to bring electricity to the facilities”).

seem obvious at first, but at least some of that obviousness dissipates on closer examination.<sup>110</sup>

Beyond fairness questions, meeting data center demand also raises questions about incentives, efficiency, and innovation—and does so in a particularly complex and challenging context. As economics scholars have explained, it will often make sense to allocate risks to the entities that are best able to manage those risks, perhaps resulting in innovations that then will provide broader economic benefits.<sup>111</sup> Similar insights underpin market economics more generally: Economic incentives encourage innovation and create value, especially if firms with information advantages hold decision-making authority.<sup>112</sup> But within energy systems, the application of these principles is often complicated by the many ways in which utilities are unlike traditional market actors. Because state law generally allows utilities to hold monopolies over at least some aspects of the service they provide, they can increase revenues and profits by maximizing capital investments and electricity sales and then passing those costs through to customers.<sup>113</sup> This means that their incentives for efficiency and innovation can be much weaker than those of traditional market actors.<sup>114</sup>

That reality has important implications for efforts to allocate the burdens and risks of supplying electricity to new data centers. If,

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<sup>110</sup> See generally Elliot Taubman & Karl Frieden, *Electricity Rate Structures: History and Implications for the Poor*, 10 CLEARINGHOUSE REV. 431 (1976) (discussing the equity and economic issues raised by these choices).

<sup>111</sup> See, e.g., Kenneth J. Arrow & Robert C. Lind, *Uncertainty and the Evaluation of Public Investment Decisions*, 60 AM. ECON. REV. 364, 374–75 (1970) (proposing that allocating risks to entities best able to manage those risks can lead to more efficient investment decisions and improved economic outcomes); Bart Lenderink, Johannes I.M. Halman, Johan Boes, Hans Voordijk & André G. Dorée, *Procurement and Innovation Risk Management: How a Public Client Managed to Realize a Radical Green Innovation in a Civil Engineering Project*, J. PURCHASING & SUPPLY MGMT., Jan. 18, 2022, at 1, 4 (discussing how aligning risk allocation with risk-bearing capacity encourages innovation and broader economic benefits).

<sup>112</sup> See, e.g., N. GREGORY MANKIW, PRINCIPLES OF ECONOMICS 457 (8th ed. 2018) (discussing the problem of information asymmetries in private markets); Rebecca S. Eisenberg & W. Nicholson Price, II, *Promoting Healthcare Innovation on the Demand Side*, 4 J.L. & BIOSCIENCES 3, 12 (2017) (discussing how entities with information advantages can drive innovation).

<sup>113</sup> See Averch & Johnson, *supra* note 30, at 1061–63.

<sup>114</sup> See Kovvali & Macey, *supra* note 30, at 585 (“Utilities do not internalize benefits from cost reductions. They also face risks but do not collect full benefits when they innovate.”); Aneil Kovvali & Joshua C. Macey, *Hidden Value Transfers in Public Utilities*, 171 U. PA. L. REV. 2129, 2168 (2023) [hereinafter Kovvali & Macey, *Hidden Value Transfers*] (“Under rate regulation, utility companies already lack incentives to innovate, are not disciplined by competition, and do not receive informative signals from real price or market mechanisms.”); see also Averch & Johnson, *supra* note 30, at 1052 (discussing how government agencies generally limit the amount of profit a regulated monopoly can realize); Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention* (discussing how monopoly power decreases the incentive to invent), in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY 609, 619–20 (1962).

for example, utilities can pass through the cost of data-center-related infrastructure improvements, they may enthusiastically build and perhaps overbuild that infrastructure, even if data center demand is uncertain.<sup>115</sup> Indeed, if utilities have a duty to serve all customers, they may argue that they have no other choice but to build.<sup>116</sup> And if utilities seek to mitigate that risk to existing customers by requiring data centers to pay for some minimum amount of electricity, regardless of whether they use it, those data centers will have reduced incentives to pursue innovations that lower electricity consumption because such actions will not lower their costs.<sup>117</sup> Other problematic practices also are possible. Utilities that operate both as market actors and regulated monopolists sometimes use creative bookkeeping to maximize the costs assigned to their monopoly customers, thus subsidizing their market operations.<sup>118</sup> The emergence of a new set of major customers may heighten the temptations of and opportunities for such manipulations.<sup>119</sup>

Economic distortions also may affect other consumers. If, for example, a core goal of data center electricity contracting is to ensure that other preexisting consumers are held harmless, those consumers may not receive economic signals that capture the full value of electricity, and they may be less inclined to pursue efficiency improvements or engage in demand-response programs. Those demand-response programs involve paying people to adjust the time or intensity of their electricity use, thus enabling utilities to meet surges in demand without increasing overall supply, and they are widely seen as valuable electricity-management strategies.<sup>120</sup> They also are already available in

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<sup>115</sup> See, e.g., MARTIN & PESKOE, *supra* note 18, at 5, 31 (discussing monopoly utility incentives to overbuild).

<sup>116</sup> See SCOTT HEMPLING, *REGULATING PUBLIC UTILITY PERFORMANCE* 47 (2d ed. 2021) (explaining that “[a] utility is responsible for meeting its service territory’s entire needs, now and in the future,” and is obligated to build the infrastructure and resources “necessary to support its service territory’s economy”).

<sup>117</sup> See, e.g., Severin Borenstein, *Billing Tweaks Don’t Make Net Metering Good Policy*, ENERGY INST. HAAS: ENERGY INST. BLOG (Jan. 4, 2016), <https://energythaas.wordpress.com/2016/01/04/billing-tweaks-dont-make-net-metering-good-policy/> [<https://perma.cc/PX5R-N8NR>] (explaining why fixed charges encourage consumption).

<sup>118</sup> Kovvali & Macey, *Hidden Value Transfers*, *supra* note 114, at 2131–32 (describing strategies electric utilities use to “transfer value from rate regulated affiliates to non-rate regulated affiliates”).

<sup>119</sup> See *id.*

<sup>120</sup> See LINCOLN L. DAVIES, ALEXANDRA B. KLASS, HARI M. OSOFSKY, JOSEPH P. TOMAIN & ELIZABETH J. WILSON, *ENERGY LAW AND POLICY* 331 (3d ed. 2022); *Demand Response*, PJM 1 (Mar. 18, 2024), <https://www.pjm.com/-/media/DotCom/about-pjm/newsroom/fact-sheets/demand-response-fact-sheet.pdf> [<https://perma.cc/7AZ4-V9XV>] (explaining how demand-response aggregators called “Curtailed Service Providers” can serve as brokers); *Fed. Energy Regul. Comm’n v. Elec. Power Supply Ass’n*, 577 U.S. 260, 265 (2016) (explaining how wholesale demand-response markets work); *The Different Types of Demand Response Programs Explained*, ENEL N. AM.

wholesale electricity markets and are offered by retail utilities.<sup>121</sup> But if consumers have few incentives to participate in such programs, demand response is likely to fall well short of its potential.<sup>122</sup>

All these distortions may be accentuated by political influence. If protecting existing consumers is the paramount political goal, data centers may wind up being exploited to subsidize electricity delivery to the rest of the grid.<sup>123</sup> But perhaps the more likely problem is that the emergence of large, powerful, and wealthy new actors with highly focused interests will lead to energy politics in which other consumers' interests hold little sway.<sup>124</sup> Once utilities begin serving major new data centers, those data centers will become essential to the utility's profitability; a massive drop in electricity demand could be financially catastrophic.<sup>125</sup> And if the data center could relocate its operations relatively easily, the leverage could be highly asymmetric. The result might be a dynamic resembling the recurring clashes between sports franchises and cities, with the franchises using asymmetric leverage to negotiate heavily subsidized deals.<sup>126</sup> That dynamic could be particularly pronounced where data centers are operated by or for some of the largest and most powerful companies in the world.<sup>127</sup>

Adding further complexity, these questions are arising while electricity systems are also confronting profoundly important questions about clean energy and climate change. Contracts and policies for data centers inevitably will have impacts on clean energy transitions. They could stall or partially reverse those transitions; already, some data centers are spurring the reopening or delaying the closure of fossil

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(June 26, 2024), <https://www.enelnorthamerica.com/insights/blogs/types-of-demand-response-programs> [<https://perma.cc/MG62-3Z5N>].

<sup>121</sup> See DAVIES ET AL., *supra* note 120, at 331 (describing demand-response programs).

<sup>122</sup> See Bryony Parrish, Phil Heptonstall, Rob Gross & Benjamin K. Sovacool, *A Systematic Review of Motivations, Enablers and Barriers for Consumer Engagement with Residential Demand Response*, ENERGY POL'Y, Mar. 2020, at 1, 1–2 (explaining incentives for demand-response participation).

<sup>123</sup> See MARTIN & PESKOE, *supra* note 18, at 13 (acknowledging this possibility).

<sup>124</sup> Jeffrey Tomich, *Tech Lobby Muscles into Utility Regulatory Thicket*, E&E NEWS: ENERGYWIRE (Jan. 27, 2025, at 06:55 ET), <https://www.eenews.net/articles/tech-lobby-muscles-into-utility-regulatory-thicket/> [<https://perma.cc/CS57-W6NK>] (discussing the growing influence of hyperscalers in energy industry and regulation); MARTIN & PESKOE, *supra* note 18, at 1–2; Penn & Weise, *supra* note 70.

<sup>125</sup> See Penn & Weise, *supra* note 70.

<sup>126</sup> See, e.g., Rick Paulas, *Sports Stadiums Are a Bad Deal for Cities*, ATLANTIC (Nov. 21, 2018), <https://www.theatlantic.com/technology/archive/2018/11/sports-stadiums-can-be-bad-cities/576334/> [<https://perma.cc/QFE8-Z5VT>].

<sup>127</sup> See generally Stein, *supra* note 12 (describing the political implications of Big Tech's increasing importance to energy systems).

fuel power plants, and increased demand could spur investment in new natural gas facilities.<sup>128</sup>

But data center demand might also spur innovations that accelerate grid decarbonization. Data centers' willingness to purchase electricity at higher price points could create opportunities for emerging technologies or for innovations involving old technologies, which could eventually lead to more widespread and affordable use of those innovations. Indeed, Google and Meta are already contracting with geothermal energy providers,<sup>129</sup> and technology companies are exploring new approaches to nuclear power.<sup>130</sup> A New York data center developer has developed a business model that focuses on purchasing renewable energy that would otherwise be curtailed.<sup>131</sup> Grid operators and data centers themselves are turning to AI to improve system operation efficiencies.<sup>132</sup> And although the possibility of data centers accelerating a clean energy transition might seem optimistic, many of the new data centers will serve technology companies that already have corporate commitments to clean energy—and that have track records of acting on those commitments.<sup>133</sup>

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<sup>128</sup> See, e.g., Baddour & Martin, *supra* note 15 (discussing new gas plant proposals and quoting a data center developer as saying that “[e]ven the large hyperscalers are willing to turn a blind eye to their renewable goals for some period of time in order to get access [to electricity]”).

<sup>129</sup> See *infra* notes 161–66 and accompanying text (discussing a contractual arrangement between Google, NV Energy, and Fervo Energy to provide geothermal energy to a Google data center in Nevada); Lamar Johnson, *Meta Signs Geothermal Power Deal for New Mexico Data Centers*, UTIL. DIVE (June 17, 2025), <https://www.utilitydive.com/news/meta-xgs-energy-announce-geothermal-deal-new-mexico-data-centers-ai/750913/> [<https://perma.cc/MZ3F-CZ42>] (discussing Meta’s “deal with geothermal energy producer XGS Energy”).

<sup>130</sup> See sources cited *supra* note 71 (discussing Amazon’s and Meta’s interests in powering their data centers with nuclear power).

<sup>131</sup> Arcelia Martin, *How a Data Center Company Uses Stranded Renewable Energy*, INSIDE CLIMATE NEWS (June 19, 2025), <https://insideclimatenews.org/news/19062025/inside-clean-energy-stranded-renewable-data-centers/> [<https://perma.cc/YJ4N-GDHY>].

<sup>132</sup> See TING LI ET AL., POWERING THE DATA-CENTER BOOM WITH LOW-CARBON SOLUTIONS 8 (2024), [https://rmi.org/wp-content/uploads/dlm\\_uploads/2024/11/powering\\_the\\_data\\_center\\_boom.pdf](https://rmi.org/wp-content/uploads/dlm_uploads/2024/11/powering_the_data_center_boom.pdf) [<https://perma.cc/G7M8-C9C4>] (“[D]igital technologies and AI can significantly improve the accuracy of renewable energy forecasting . . . and enhance the profitability of renewable assets.”); Ethan Howland, *PJM, Google Partner to Speed Grid Interconnection Using AI*, UTIL. DIVE (Apr. 10, 2025), <https://www.utilitydive.com/news/pjm-google-tapestry-grid-interconnection-ai> [<https://perma.cc/J6NL-EKHK>]; Zachary Skidmore, *Nvidia-Backed Emerald AI Raises \$24.5m to Turn Data Centers into Grid Assets*, DATA CTR. DYNAMICS (July 2, 2025), <https://www.datacenterdynamics.com/en/news/nvidia-backed-emerald-ai-raises-245m-to-turn-data-centers-into-grid-assets/> [<https://perma.cc/H55A-RSNP>]; Ben Geman, *Nvidia Stakes New Startup That Flips Script on Data Center Power*, AXIOS (July 1, 2025), <https://www.axios.com/2025/07/01/nvidia-startup-data-center-power> [<https://perma.cc/272N-B9ZL>]; David Rolnick et al., *Tackling Climate Change with Machine Learning*, ACM COMPUTING SURVS., Feb. 2022, at 1, 6–13 (cataloging ways in which machine learning can improve electricity scheduling, demand flexibility, and forecasting, among other benefits).

<sup>133</sup> See Diana DiGangi, *Amazon, Google Prioritizing Net-Zero Goals, Exploring Options for Rising Power Needs*, ESG DIVE (June 5, 2025), <https://www.esgdive.com/news/>

In summary, a wide range of futures is possible. Ideally, data centers might grow rapidly, technological innovations would dramatically lower those data centers' electricity demand, energy supply innovations would help utilities provide that electricity without increasing carbon emissions, heightened demand would accelerate growth in clean energy technologies, and technology companies and other consumers would pay reasonable and affordable prices.<sup>134</sup> These changes also might have positive spillover effects on electricity systems more generally and on the economy as a whole. But whether that future comes to pass may depend, in significant part, on how contracts and regulatory regimes allocate incentives and risks.

### C. *Emerging Contractual Approaches to Allocating Risks*

Already, utilities, regulators, and tech companies are tackling these questions. Notably, many of their initiatives try to shoehorn data centers into a traditional regulatory and contractual model, which assumes utilities will meet peak electricity needs and which tries to minimize the likelihood that data centers will generate either too much or too little demand.<sup>135</sup> But alternative approaches, some of which give utilities more ability to curtail deliveries, are also beginning to emerge.

Most of these initiatives involve tariffs, so some background explanation of electricity tariffs may be helpful. A tariff is a government-approved set of rates and “rules that defines the relationship between a utility and its customers.”<sup>136</sup> Utilities often design tariffs that correspond to their different types of customers—e.g., residential, commercial, or industrial—so that each tariff addresses the distinct needs, costs, and issues associated with that group.<sup>137</sup> In theory, this helps ensure that utility customers only pay for the costs that they are responsible

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amazon-google-hyperscalers-load-growth-demand-energy-data-centers/749950/ [https://perma.cc/3AP5-EFH5]; Jeff St. John, *Google Plans to Build Gigawatts of Clean Power and Data Centers Together*, CANARY MEDIA (Dec. 10, 2024), <https://www.canarymedia.com/articles/clean-energy/google-has-a-20b-plan-to-build-data-centers-and-clean-power-together> [https://perma.cc/5592-47QN].

<sup>134</sup> See generally LI ET AL., *supra* note 132 (exploring such an ideal future state and suggesting some actions to pursue it).

<sup>135</sup> See *infra* notes 142–60 and accompanying text.

<sup>136</sup> *Tariffs*, ST. OF NEV. PUB. UTIL. COMM'N, <https://puc.nv.gov/About/Docs/Tariffs/> [https://perma.cc/ZY2D-N94F] (last visited Nov. 13, 2025).

<sup>137</sup> For a detailed analysis of electric utility cost allocation principles, see JIM LAZAR, PAUL CHERNICK & WILLIAM MARCUS, *ELECTRIC COST ALLOCATION FOR A NEW ERA* 18 (Mark LeBel ed., 2020), <https://www.raponline.org/wp-content/uploads/2023/09/rap-lazar-chernick-marcus-lebel-electric-cost-allocation-new-era-2020-january.pdf> [https://perma.cc/8JBN-F754] (recognizing that “[i]n most situations, cost allocation is a zero-sum process where lower costs for any one group of customers lead to higher costs for another group” but that “the techniques used in cost allocation have been designed to mediate these disputes between competing sets of interests”).

for and do not cross-subsidize the costs attributable to other customer types.<sup>138</sup> Some utilities have decided that the load profiles of data centers are so distinct that they necessitate their own tariff.<sup>139</sup> Other utilities, meanwhile, have simply revised their generic industrial or commercial power tariffs or have left them untouched.<sup>140</sup> Within these approaches, rates and terms further vary depending on the regulatory and policy environments of the states in which utilities operate.<sup>141</sup>

Many of the emerging tariff systems focus on trying to stabilize data centers' electricity demand. That focus derives from assumptions that utilities will need to build sufficient capacity to meet data centers' needs while also protecting themselves and their ratepayers from the risk that capacity will be underutilized.<sup>142</sup> Those assumptions are not just preferences; instead, they are baked into traditional systems of electricity regulation.<sup>143</sup>

Regional grid operators, state public utility commissions, and electric utilities themselves all play important roles in assessing and responding to predicted demand. They do so in two primary ways. First, regional grid operators ensure that utility participants maintain

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<sup>138</sup> See *id.* at 18–19.

<sup>139</sup> See, e.g., Ohio Power Co. for New Tariffs Related to Data Ctrs., No. 24-508-EL-ATA, 2025 WL 2272159, at \*7 (Ohio Pub. Utils. Comm'n 2025); Letter from Robert M. Garvin, Exec. Vice President External Affs., WEC Energy Grp., to Cru Stublely, Sec'y to the Comm'n, Pub. Serv. Comm'n of Wis. 1–2 (Mar. 31, 2025), <https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=539747> [<https://perma.cc/4HYS-4547>].

<sup>140</sup> See, e.g., IND. MICH. POWER CO., SCHEDULE OF TARIFFS AND TERMS AND CONDITIONS OF SERVICE GOVERNING SALE OF ELECTRICITY IN THE STATE OF INDIANA sheet no. 21.3–21.7 (2025), [https://www.indianamichiganpower.com/lib/docs/ratesandtariffs/Indiana/IM\\_IN\\_TB\\_20\\_09-29-2025.pdf](https://www.indianamichiganpower.com/lib/docs/ratesandtariffs/Indiana/IM_IN_TB_20_09-29-2025.pdf) [<https://perma.cc/MVF5-UCAD>]; JERRAD HAMMER, CHEYENNE LIGHT, FUEL & POWER CO., SCHEDULE OF RATES FOR ELECTRIC SERVICE AVAILABLE IN THE ENTIRE TERRITORY SERVED BY CHEYENNE LIGHT, FUEL & POWER COMPANY D/B/A BLACK HILLS ENERGY sheet no. 20 (2017), [https://www.blackhillsenergy.com/sites/blackhillsenergy.com/files/clfp\\_electricity.pdf](https://www.blackhillsenergy.com/sites/blackhillsenergy.com/files/clfp_electricity.pdf) [<https://perma.cc/EUA7-HMDZ>].

<sup>141</sup> Whether a state's electricity market is traditionally regulated or restructured determines how new energy generation facilities are planned and financed and what types of companies can build them. In states with traditional markets, data center customers cannot enter into direct power purchase agreements with third-party generation sources. See Tim McDonnell, *Google Is Reinventing the Clean Power Market*, SEMAFOR (June 19, 2024, at 10:32 ET), [www.semafor.com/article/06/19/2024/google-is-reinventing-the-clean-power-market](http://www.semafor.com/article/06/19/2024/google-is-reinventing-the-clean-power-market) [<https://perma.cc/7PWX-E8EZ>]; see also William Boyd & Ann E. Carlson, *Accidents of Federalism: Ratemaking and Policy Innovation in Public Utility Law*, 63 UCLA L. REV. 810, 835–40 (2016) (discussing different state models of utility regulation).

<sup>142</sup> Jeff St. John, *Utilities Are Flying Blind on Data Center Demand. That's a Big Problem.*, CANARY MEDIA (Feb. 25, 2025), <https://www.canarymedia.com/articles/utilities/utilities-are-flying-blind-on-data-center-demand-thats-a-big-problem> [<https://perma.cc/T9XY-RWJB>] (“If utilities build new power plants to serve proposed data centers that never materialize, other utility customers, from small businesses to households, will be left paying for that infrastructure.”); see *supra* notes 93–105 and accompanying text (discussing the risks of inaccurate demand forecasts).

<sup>143</sup> See *supra* notes 106–09 and accompanying text.

sufficient generation capacity to meet peak demand, with an appropriate reserve margin, by applying a concept called “resource adequacy.”<sup>144</sup> Since the early days of the electric grid, the industry standard for resource adequacy has been the minimum amount of electric resources needed to meet a “loss of load expectation”—in other words, a loss of power—of one day within a ten-year period, or 2.4 hours per year.<sup>145</sup> In recent years, experts have increasingly argued that this “one-in-ten” standard, which was adopted many decades ago and without any real analysis, has resulted in grid operators requiring excess capacity at costs that far exceed the desired or actual value to consumers.<sup>146</sup> This critique raises concerns that individual utilities’ overestimates of increased data center demand will cause similar overestimates of the generation needed for regional resource adequacy.<sup>147</sup> Second, beyond the regional resource adequacy framework, state law in many parts of the country requires that individual utilities own, or otherwise procure through contracts or market purchases, sufficient energy resources to meet the needs of current and future customers.<sup>148</sup>

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<sup>144</sup> See FED. ENERGY REGUL. COMM’N, *supra* note 28 (explaining resource adequacy); Tim Fryfogle, *ReliabilityFirst Long-Term Reliability Assessment Highlights Resource Adequacy Risk in MISO, PJM Over Next 10 Years*, RELIABILITYFIRST (Jan. 13, 2025), <https://www.rfirst.org/resource-center/reliabilityfirst-long-term-reliability-assessment/> [<https://perma.cc/DUA3-Z6NP>] (reporting on conservative but industry-standard reliability targets); Sarah Toth Kotwis & Aaron Schwartz, *Surprisingly, There Is No National Standard for Resource Adequacy*, ROCKY MOUNTAIN INST. (Apr. 11, 2024), <https://rmi.org/surprisingly-there-is-no-national-standard-for-resource-adequacy/> [<https://perma.cc/AC2P-UCBK>] (explaining that the U.S. electric grid has been “extremely reliable”).

<sup>145</sup> Fryfogle, *supra* note 144; see also MICHAEL HOGAN & DAVID LITTELL, *GET WHAT YOU NEED: RECLAIMING CONSUMER-CENTRIC RESOURCE ADEQUACY 2* (2020), <https://www.raponline.org/wp-content/uploads/2023/09/rap-hogan-littell-consumer-centric-resource-adequacy-2020-june.pdf> [<https://perma.cc/3F2M-PCHQ>] (explaining the industry standard for regional resource adequacy).

<sup>146</sup> HOGAN & LITTELL, *supra* note 145, at 5 (discussing a study showing that the resource adequacy standard applied by one regional grid operator regularly “exceed[ed] by a wide margin what consumers would consider to be adequate value for their money”); see also KEVIN CARDEN, NICK WINTERMANTEL & JOHANNES PFEIFENBERGER, *THE ECONOMICS OF RESOURCE ADEQUACY PLANNING 1–2* (2011), <https://pubs.naruc.org/pub/FA865D94-FA0B-F4BA-67B3-436C4216F135> [<https://perma.cc/9BFA-SVFP>] (questioning whether the one-in-ten reserve margin standard still makes sense); Ethan Howland, *NERC Overstates MISO Reliability Risks: Market Monitor*, UTIL. DIVE (June 6, 2025), <https://www.utilitydive.com/news/nerc-miso-reliability-market-monitor-ferc-capacity> [<https://perma.cc/G6EB-ESHN>] (quoting an independent market monitor’s statement that “[one regional grid operator] has been vastly overestimating the power supplies it will need in coming years to meet demand for electricity”).

<sup>147</sup> See Howland, *supra* note 146 (discussing criticisms of one regional grid operator’s estimates).

<sup>148</sup> See, e.g., CAL. PUB. UTIL. CODE § 380 (West 2025) (establishing requirements for resource adequacy planning); see also BRUCE BIEWALD, DEVI GLICK, SHELLEY KWOK, KENJI TAKAHASHI, JUAN PABLO CARVALLO & LISA SCHWARTZ, *BEST PRACTICES IN INTEGRATED RESOURCE PLANNING 1–8* (2024) (defining and describing state-level integrated resource planning and its relationship with resource adequacy).

The emerging tariffs attempt to meet these requirements through several recurring features, some of which are already in widespread use for existing industrial and commercial electricity customers and others of which are new. First, they often require minimum demand payments, which are fixed charges based on a customer's contract capacity or historic demand levels rather than actual energy use.<sup>149</sup> Some tariffs also mandate that data centers sign long-term contracts for power, sometimes with periods as long as twenty years.<sup>150</sup> Tariffs also establish minimum load factor requirements, which means that they require data centers to maintain a certain ratio of average load to peak load across a designated time period, with the goal of limiting the permitted magnitude of any demand fluctuations.<sup>151</sup> And when tariffs do provide flexibility for data centers, sometimes by allowing them to leave the system without paying an exit fee, they can require several years of notice.<sup>152</sup>

Indiana Michigan Power's Industrial Power Tariff exemplifies this general approach. Indiana Michigan Power proposed modifications to its tariff in July 2024 in response to the "unprecedented" load growth caused by "significant hyper-scaler business investments" in northern Indiana—investments like the three new multibillion-dollar projects announced by Microsoft, Google, and Amazon Web Services in 2024 alone.<sup>153</sup> Like many other revised tariffs, the Industrial Power Tariff's new provisions primarily focus on securing long-term financial

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<sup>149</sup> Indiana Michigan Power's tariff for large-load industrial customers, for example, requires payments that equal the greater of eighty percent of the customer's contract capacity or eighty percent of the customer's previously established monthly billing demand during the past eleven months. IND. MICH. POWER CO., *supra* note 140, sheet no. 21.5. This eighty percent threshold significantly exceeds the sixty percent minimum demand levels that both Indiana Michigan Power and Ohio Power require for standard industrial customers. *Id.* sheet no. 21.1; OHIO POWER CO., SCHEDULE sheet no. 220-3 to 220-7 (2024), <https://dam.assets.ohio.gov/image/upload/puco.ohio.gov/emplibrary/files/docketing/tariffs/Electric/Ohio%20Power%20dba%20AEP%20Ohio/PUCO%2021.pdf> [<https://perma.cc/7XP7-U9TY>].

<sup>150</sup> See ANDREW SATCHWELL ET AL., ELECTRICITY RATE DESIGNS FOR LARGE LOADS 8 (2025) (describing tariffs with twelve- and fifteen-year term requirements); Lutz, *supra* note 109 (describing the Ohio Power tariff, which permits up to a twelve-year contract); KY. POWER CO., RATES, TERMS, AND CONDITIONS FOR FURNISHING ELECTRIC SERVICE sheet 8-2 to 8-3 (2024), <https://psc.ky.gov/tariffs/Electric/Kentucky%20Power%20Company/Tariff.pdf> [<https://perma.cc/7SPK-5EHT>] (requiring twenty years, with a five-year notice period for termination).

<sup>151</sup> See, e.g., MONT.-DAKOTA UTILS. CO., STATE OF NORTH DAKOTA ELECTRIC RATE SCHEDULE: HIGH DENSITY CONTRACTED DEMAND RESPONSE RATE 45, at 1 (2023), <https://www.montana-dakota.com/wp-content/uploads/PDFs/Rates-Tariffs/NorthDakota/Electric/NDElectric45.pdf> [<https://perma.cc/3S34-MQSW>].

<sup>152</sup> See Ind. Mich. Power Co. for Approval of Modifications to Its Indus. Power Tariff, No. 46,097, at \*37 (Ind. Util. Regul. Comm'n 2025), [https://www.in.gov/iurc/files/ord\\_46097\\_021925.pdf](https://www.in.gov/iurc/files/ord_46097_021925.pdf) [<https://perma.cc/WZW7-TADR>].

<sup>153</sup> *Id.* at \*1, \*3–4; Ethan Howland, *Indiana Regulators Approve 'Large Load' Interconnection Rules*, UTIL. DIVE (Feb. 20, 2025), [www.utilitydive.com/news/indiana-iurc-large-load-interconnection-data-center-aep-amazon-google](http://www.utilitydive.com/news/indiana-iurc-large-load-interconnection-data-center-aep-amazon-google) [<https://perma.cc/VCS9-BZK3>].

commitments from large-load customers.<sup>154</sup> The provisions include (1) a minimum contract length of twelve years, (2) a minimum monthly billing demand payment of eighty percent, (3) an additional monthly “Minimum Charge” payment, (4) a requirement for collateral, and (5) an exit fee requirement if the customer seeks to reduce contract capacity or terminate the contract.<sup>155</sup>

Other tariff provisions add flexibility to the agreement, but only modestly so. On the front end of the contract, the “Load Ramp Period” provision gives large-load customers up to five years to reach their maximum contract capacity.<sup>156</sup> On the back end, the “Contract Capacity Reductions” provision allows the customer to “reduce its contract capacity at any time after the first five (5) years of the Contract Term by up to 20%” without the payment of an exit fee or penalty—but the customer must provide Indiana Michigan Power with “at least 42 months written notice prior to the beginning of the . . . Delivery Year for which the reduction is sought.”<sup>157</sup>

The Industrial Power Tariff mitigates the financial risk of large-load customers reducing their demand unexpectedly. Beyond that mitigation function, however, the tariff does little else. It does not directly pass through the costs of new power generation projects to the specific customers they are being built to serve. It does not enable less capacity to be built by establishing a required interruptibility mechanism that might reduce the customer’s contribution to peak load levels. It does not provide customers any way to ensure that their loads are powered by clean energy on an hour-by-hour basis. The tariff’s approach to risk mitigation reflects a traditional conception of the utility-ratepayer relationship. In this conception, the utility’s job is to reliably serve the customer’s load, not to facilitate the customer’s preferred generation source or to interrupt the customer’s service during periods of peak demand.<sup>158</sup>

Other tariffs have taken a different approach, at least on interruptibility, by permitting the utility to suspend service in certain shortage situations. This decision to include a cutoff switch reflects a policy judgment that prioritizes grid stability and community power access over unfettered energy consumption by data centers. How this cutoff switch is designed varies by tariff. Ohio Power’s Data Center Tariff allows the utility to suspend service, with Ohio Public Utilities

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<sup>154</sup> The special large-load provisions of the Industrial Power Tariff apply to “new or expanded facilities with contract capacity of at least 70 MW or 150 MW aggregated across a company.” Howland, *supra* note 153.

<sup>155</sup> IND. MICH. POWER Co., *supra* note 140, sheet no. 21.3–21.7.

<sup>156</sup> *Id.* sheet no. 21.3.

<sup>157</sup> *Id.* sheet no. 21.4.

<sup>158</sup> See *supra* notes 27–28 and accompanying text.

Commission approval, “if customer usage exceeds its contract capacity by more than 1,000 [kilowatts].”<sup>159</sup> Other tariffs, like the Montana-Dakota Utilities High Density Contracted Demand Response Rate, give the utility more discretion by enabling it to interrupt service “for up to 200 hours annually or as included in the electric service agreement.”<sup>160</sup>

Some large-load tariffs, such as the Clean Transition Tariff negotiated by NV Energy and Google, innovate toward different goals.<sup>161</sup> The core goals of this tariff were to accommodate Google’s interest in 24/7 access to carbon-free energy and NV Energy’s interest in protecting its other customers from the potential costs associated with supplying Google’s new data centers.<sup>162</sup> In another state, Google might accomplish this goal by directly contracting with suppliers, but a traditionally regulated state like Nevada only allows customers to purchase power from their local utility.<sup>163</sup> The tariff responds to this challenge by allowing NV Energy to enter into contracts with clean energy suppliers and to pass those costs through to Google, along with the costs of supplemental electricity provided by the utility’s existing generation fleet when the power from the contracted clean energy sources is insufficient.<sup>164</sup> The pass-through ensures that other utility customers are protected from rate increases, as do contractual requirements that Google pay for new generation even if that generation turns out to be unnecessary.<sup>165</sup> Nevada regulators approved the tariff in 2025, and Google will rely on a major new geothermal project to supply much of its needed electricity.<sup>166</sup>

<sup>159</sup> Ohio Power Co. for New Tariffs Related to Data Ctrs., No. 24-508-EL-ATA, 2025 WL 2272159, at \*9 (Ohio Pub. Utils. Comm’n 2025).

<sup>160</sup> MONT.-DAKOTA UTILS. CO., *supra* note 151, at 1.

<sup>161</sup> See Grid Talk, *Nevada Utility and Google Strike Innovative Green Accord*, U.S. DEP’T OF ENERGY (Aug. 16, 2024), <https://www.energy.gov/grid-talk/articles/grid-talk-nevada-utility-and-google-strike-innovative-green-accord> [<https://perma.cc/B6SQ-T2GK>]; Caitlin Flanagan, *Clean Transition Tariffs: An Innovative Way to Accelerate Power Sector Emission Reductions*, CTR. FOR CLIMATE & ENERGY SOLS. (Aug. 20, 2024), <https://www.c2es.org/2024/08/clean-transition-tariffs-an-innovative-way-to-accelerate-power-sector-emission-reductions/> [<https://perma.cc/6YEC-EQJR>].

<sup>162</sup> See Lewis (Zhaoyu) Wu, Abraham Silverman & Zach Wendling, *Guest Blog: Powering Data Centers with Clean Energy: Google’s Clean Transition Tariff*, SABIN CTR. FOR CLIMATE L.: CLIMATE L. (Oct. 29, 2024), <https://blogs.law.columbia.edu/climatechange/2024/10/29/guest-blog-powering-data-centers-with-clean-energy-googles-clean-transition-tariff/> [<https://perma.cc/M69R-6W3F>].

<sup>163</sup> *Id.*

<sup>164</sup> Advice Letter No. 547 at 47–48, Nev. Power Co. to Implement Clean Transition Tariff, No. 24-0522, 2025 WL 1135557 (Nev. Pub. Util. Comm’n 2025) <https://ob.nv.gov/puc/api/Document/AWFq%C3%81TfzYJQXHIFQvWE6PcTDesDhz5cNaD4hXQnH%C3%-81VuRE6gl76Np%C3%81%C3%89HT5dT3gG60IzoBEGIdrdHErOm6ZTV6UG0%3D/?OverlayMode=View> [<https://perma.cc/QHD3-H7YT>].

<sup>165</sup> See *id.* at 8; see also Wu et al., *supra* note 162 (“Because the utility is passing 100% of the costs . . . to [Google], the [Clean Transition Tariff] protects other ratepayers from the financial risks of these high-cost premium projects.”).

<sup>166</sup> See Emma Penrod, *NV Energy Seeks New Tariff to Supply Google with 24/7 Power From Fervo Geothermal Plant*, UTIL. DIVE (June 21, 2024), <https://www.utilitydive.com/news/>

In 2025, Google entered into an agreement that provides a potential model for advancing clean energy goals while also providing load-management flexibility. Google's tariff agreement with Indiana Michigan Power includes a Clean Capacity Arrangement and a custom demand-response program, both of which will support Google's proposed two-billion-dollar data center campus in the utility's Indiana service territory.<sup>167</sup> As reported, this arrangement would transfer a certain amount of "long-term accredited capacity from clean energy resources"<sup>168</sup> into the utility's capacity portfolio at PJM, thus helping the utility meet its capacity obligations in the regional transmission organization ("RTO")<sup>169</sup> while adding carbon-free electricity to the grid. As for the custom demand-response program, "[w]hen the grid is under stress, Google will reduce or shift its electricity consumption [at the data center], thereby helping [Indiana Michigan Power] lower peak demand, reduce its own capacity and transmission needs, and deliver system-wide cost and reliability benefits."<sup>170</sup>

State legislatures are also beginning to weigh in on data center tariffs. In 2025, Minnesota enacted a law that, among other provisions, prohibits utilities from passing data center costs through to other consumers and requires them to continue to meet the state's mandate for carbon-free electricity despite the increased demand.<sup>171</sup> Also in 2025, Texas enacted a law that, among other things, allows mandatory

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google-ferro-nv-energy-nevada-puc-clean-energy-tariff [https://perma.cc/WW5P-5YPY]; Carlo Cariaga, *Nevada Approves First-of-Its-Kind Geothermal Power Supply Agreement*, THINKGEO ENERGY (May 19, 2025), <https://www.thinkgeoenergy.com/nevada-approves-first-of-its-kind-geothermal-power-supply-agreement/> [https://perma.cc/U64J-8T8Q].

<sup>167</sup> Sonal Patel, *Google, I&M Strike Landmark Deal to Share Clean Capacity and Flex AI Load*, POWER (Aug. 6, 2025), <https://www.powermag.com/google-im-strike-landmark-deal-to-share-clean-capacity-and-flex-ai-load/> [https://perma.cc/SED8-5WND].

<sup>168</sup> *Id.*

<sup>169</sup> RTOs are voluntary, nonprofit, member organizations under the jurisdiction of the Federal Energy Regulatory Commission ("FERC") that, among other things, operate the U.S. high-voltage transmission grid in most of the country and run auction-based markets for the sale of wholesale energy, capacity, ancillary services, and other electric grid needs. *See, e.g.*, Klass et al., *supra* note 87, at 1058–59 (describing RTOs); KERRY WORTHINGTON, *ENGAGEMENT BETWEEN STATES AND REGIONAL TRANSMISSION ORGANIZATIONS 1* (2022), <https://pubs.naruc.org/pub/6C1AA0FC-1866-DAAC-99FB-993D01E9FDA5> [https://perma.cc/VR39-TSME] (same). PJM is the RTO for most of the Northeastern and part of the Midwestern United States. *Electric Power Markets*, FERC, <https://www.ferc.gov/electric-power-markets> [https://perma.cc/2Y4W-2L8Q] (last visited Dec. 20, 2025).

<sup>170</sup> Patel, *supra* note 167; *see also* Jeff St. John, *Google's New Plan to Keep Its Data Centers from Stressing the Grid*, CANARY MEDIA (Aug. 28, 2025), <https://www.canarymedia.com/articles/utilities/google-ai-data-center-flexibility-help-grid> [https://perma.cc/3QJ3-N8XR] (discussing the demand-response component of the agreement).

<sup>171</sup> *See* Kirsti Marohn, *Data Centers Face New Regulations, Some Worry They Fall Short of Protecting Water, Residents*, MPR NEWS (June 18, 2025, at 04:00 ET), <https://www.mprnews.org/story/2025/06/18/data-centers-face-new-regulations-in-minnesota> [https://perma.cc/EYD5-TMEM].

curtailment for electric loads over seventy-five MW.<sup>172</sup> This requirement allows utilities to order such customers to decrease power use or switch to backup generation in periods of high demand.<sup>173</sup> Other state legislatures may soon follow suit.<sup>174</sup>

#### D. *Supply-Side Connect-and-Manage*

The primary question addressed by this Article is how to manage the entrance of major new *consumers* into electricity systems. But that question resembles questions about how to integrate new *suppliers* into the grid. Indeed, the debates over approaches to suppliers are much more developed than the discussions about consumers, and these supply-side approaches offer potential lessons for how to manage new electricity consumers.

In much of the United States, new power generators can connect to the grid only once regional grid operators are confident that the grid has sufficient transmission capacity to handle the new electricity, not just routinely but also at times of high electricity supply.<sup>175</sup> Often, also, grid managers use assessment approaches that, according to many critics, excessively favor traditional fossil fuel generation—which, not coincidentally, is often generated by facilities owned by the same utilities that dominate grid management.<sup>176</sup> The consequences have been slow interconnection queues, massive backlogs, and significant costs for new entrants—particularly renewable energy sources—even as demand for new generation grows.<sup>177</sup> In other words, at the same time

<sup>172</sup> Brian Martucci, *Texas Law Gives Grid Operator Power to Disconnect Data Centers During Crisis*, UTIL. DIVE (June 25, 2025), <https://www.utilitydive.com/news/texas-law-gives-grid-operator-power-to-disconnect-data-centers-during-crisi/751587/> [<https://perma.cc/Y5ZR-6F22>].

<sup>173</sup> *Id.*

<sup>174</sup> See, e.g., Bianca Giacobone, *State Lawmakers Stand Between Ratepayers and Data Center Costs*, LATITUDE MEDIA (Oct. 15, 2025), <https://www.latitudemedia.com/news/state-lawmakers-stand-between-ratepayers-and-data-center-costs/> [<https://perma.cc/S45G-8DWM>] (discussing states' efforts to regulate data centers, their energy demands, and their impacts on the costs of electricity).

<sup>175</sup> See Tozzi, *supra* note 94 (explaining the utility grid connection process); Dan Charles, *Off the Grid: Computer Models That Forecast Overloaded Power Lines Are Holding Back U.S. Solar and Wind Energy Projects*, 381 SCIENCE 1042, 1042–43 (2023).

<sup>176</sup> See, e.g., Shelley Welton, *Rethinking Grid Governance for the Climate Change Era*, 109 CALIF. L. REV. 209, 248–49 (2021) (“RTOs’ market reforms are protectionist maneuvers by incumbents—in particular, fossil-fuel generation owners—to prop up the fossil fuel industry against encroachment by these resources.”); see also Catherine Hausman, *Power Flows: Transmission Lines, Allocative Efficiency, and Corporate Profits*, 115 AM. ECON. REV. 2574, 2597 (2025) (finding that some incumbent utilities have economic incentives to block transmission lines that would convey low-cost renewable power).

<sup>177</sup> See *Grid Connection Backlog Grows by 30% in 2023, Dominated by Requests for Solar, Wind, and Energy Storage*, LAWRENCE BERKELEY NAT’L LAB’Y (Apr. 10, 2024), <https://emp.lbl.gov/news/grid-connection-backlog-grows-30-2023-dominated-requests-solar-wind-and-energy-storage> [<https://perma.cc/RZX6-T8XV>] (“[P]roposed projects are mired in lengthy and uncertain

supply challenges are often cited as reasons for slow connections for new consumers, new electricity suppliers are also struggling to connect to the grid.<sup>178</sup>

The Electric Reliability Council of Texas (“ERCOT”), which manages the Texas grid,<sup>179</sup> has taken a very different approach. It allows new generators to connect to the grid, but with the new generation bearing a higher risk that its ability to sell power will be curtailed at times of oversupply.<sup>180</sup> Because of this approach, ERCOT has brought new electricity supply—much of it renewable—onto the grid much faster than other regions, with positive consequences, so far, for grid stability.<sup>181</sup> As Part III discusses in more detail, this “connect-and-manage” approach provides a potential model for expedited interconnections for data centers.<sup>182</sup>

## II. ANALOGIES AND PRECEDENTS FROM OTHER RESOURCES

Much of the discussion of the challenges of supplying the new hyperscalers seems to assume these challenges are distinctive to electricity allocation. In some ways, of course, this assumption is accurate; electricity is an idiosyncratic resource, and data centers have never been built at this pace before. But in other ways, the situation is not so novel. Legal regimes for other resources have long dealt with challenges of scarcity and variability. This Part focuses on two examples. It begins with a different energy resource—natural gas—and shows how Congress and regulators used interruptible contracts and markets to address ongoing scarcity issues. It then leaves the energy realm and evaluates how the Western water law doctrine of prior appropriation also provides lessons for addressing today’s electricity demand challenges.

### A. *Contracting for Energy Scarcity: Natural Gas Regulation and Markets*

As described above, electricity systems have generally been premised on the assumption that utilities have a duty to serve customers,

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interconnection study processes, and most interconnection requests are ultimately cancelled and withdrawn.”).

<sup>178</sup> *See id.*

<sup>179</sup> *About ERCOT*, ELEC. RELIABILITY COUNCIL OF TEX., <https://ercot.com/about> [<https://perma.cc/67QT-H5KV>] (last visited Nov. 13, 2025).

<sup>180</sup> TYLER H. NORRIS, *BEYOND FERC ORDER 2023: CONSIDERATIONS ON DEEP INTERCONNECTION REFORM 4* (2023), <https://dukespace.lib.duke.edu/items/a01518a9-444b-48c2-b681-7d335b9d3535> [<https://perma.cc/SK6N-P4PC>] (crediting ERCOT’s approach for providing generators with “the ability to interconnect much more quickly [to the grid] with fewer network upgrades in exchange for bearing more curtailment risk and not receiving capacity compensation” (footnotes omitted)).

<sup>181</sup> *See id.* at 2, 4, 6.

<sup>182</sup> *See infra* Section III.A.

would meet demand at nearly all times, and would maintain sufficient capacity so that even peak demand periods could pass without curtailments or blackouts.<sup>183</sup> For natural gas systems, the duty to serve was also part of common law and regulatory history, but it has been largely replaced by a contracts- and payment-based system, particularly with regard to nonresidential customers.<sup>184</sup> The story of these contracts is complicated, and it offers mixed lessons. As set forth below, however, the use of firm and interruptible contracts for gas, coupled with regulatory innovations to allow the secondary transfer of pipeline capacity when firm shippers do not need it, can reduce risk and increase systemic efficiency and reliability. Interruptible contracts thus provide a promising model—with some caveats—for addressing the challenges of data-center-driven electricity demand increases.

### 1. Overview of Interruptible and Firm Natural Gas Contracts

Interruptible natural gas contracts are agreements under which a pipeline sells or transports natural gas to power plants, industrial customers, or other users, with the understanding that the pipeline may cut off that service if it lacks the capacity to deliver sufficient gas.<sup>185</sup> These contracts are priced below firm contracts, which are contracts that guarantee uninterrupted service and are generally held by local distribution companies (“LDCs”)<sup>186</sup> and gas customers without backup supplies.<sup>187</sup> Interruptible contracts tend to bring down overall gas system rates because they allow the pipeline’s cost of service to be allocated to

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<sup>183</sup> See *supra* notes 106–07, 144–48 and accompanying text.

<sup>184</sup> See Jim Rossi, *Universal Service in Competitive Retail Electric Power Markets: Whither the Duty to Serve?*, 21 ENERGY L.J. 27, 27–28 (2000) (discussing deregulation of the natural gas industry).

<sup>185</sup> 18 C.F.R. § 284.9 (2025) (defining “[i]nterruptible transportation service” as meaning that “capacity used to provide the service is subject to a prior claim by another customer or another class of service and receives a lower priority than such other classes of service” and may not be charged a reservation fee); Tyler Hodge & Chris Cassar, *Natural Gas Power Plants Purchase Fuel Using Different Types of Contracts*, U.S. ENERGY INFO. ADMIN. (Feb. 27, 2018), <https://www.eia.gov/todayinenergy/detail.php?id=35112> [<https://perma.cc/Z5HK-955S>] (describing firm and interruptible contracts); *Fairless Energy, LLC v. FERC*, 77 F.4th 1140, 1144 n.2 (D.C. Cir. 2023) (discussing firm and interruptible contracts); see also PAUL W. PARFOMAK, ASHLEY J. LAWSON & MICHAEL RATNER, CONG. RSCH. SERV., R48127, NATURAL GAS RELIABILITY: ISSUES FOR CONGRESS 4–6 (2024) (discussing use of interruptible contracts).

<sup>186</sup> See PARFOMAK ET AL., *supra* note 185, at 3 (discussing LDCs).

<sup>187</sup> See 18 C.F.R. § 284.7 (2025) (defining “[f]irm transportation service” as service that “is not subject to a prior claim by another customer or another class of service and receives the same priority as any other class of firm service” and can be charged a reservation fee by the pipeline to recover a portion of its fixed costs); INTERSTATE NAT. GAS ASS’N OF AM., SERVICE PRIMER FACT SHEET 1 (2024), [https://ingaa.org/wp-content/uploads/2024/02/INGAA\\_ServicePrimer\\_FactSheet.pdf](https://ingaa.org/wp-content/uploads/2024/02/INGAA_ServicePrimer_FactSheet.pdf) [<https://perma.cc/9H4D-HVX7>] (discussing how pipelines are built to serve their “firm service commitments” and that “[f]irm service guarantees delivery without interruption (except in

an additional class of customers and because they provide operational flexibility to the pipeline.<sup>188</sup> Historically, interruptible contracts were held by large industrial facilities, power plants, or commercial facilities that could adjust their operations or switch to alternative fuels during times of interruption.<sup>189</sup> The basic concept is risk transferring: Customers accept supply risk in exchange for cost savings.

Interruptible natural gas contracts first emerged in the 1930s and 1940s as a means to attract industrial customers who could make use of pipeline companies' excess gas capacity.<sup>190</sup> Pipeline companies, having expanded their pipeline systems in the 1930s, began advertising natural gas as a better and cheaper heating fuel than coal and oil.<sup>191</sup> As coal and fuel oil prices rose in the late 1930s and 1940s, demand for natural gas surged.<sup>192</sup> Buyers sought both firm and interruptible service, but interruptible service was particularly attractive because prices were low and service disruptions occurred less frequently than originally expected, making interruptible service essentially "firm" for a large portion of the year.<sup>193</sup>

## 2. *Natural Gas Industry Expansion and Dysfunction: The 1950s to the Early 1970s*

The natural gas industry underwent significant changes between the 1950s and 1970s, shaped largely by increasing demand, declining domestic gas production, and regulatory missteps.<sup>194</sup> In the aftermath of World War II, technological advancements, such as improvements in high-pressure pipeline materials and the associated development of long-distance gas pipelines, contributed to rapid industry expansion.<sup>195</sup> But a 1954 Supreme Court case marked a pivotal shift in the regulation of the natural gas industry and eventually led to the natural gas crisis of

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extraordinary circumstances, such as an earthquake or terrorist attack that disables the pipeline) at the customer's primary firm delivery point").

<sup>188</sup> See Nelson Lee Smith, *Rate Regulation by the Federal Power Commission*, 36 AM. ECON. REV. 405, 421–22 (1946).

<sup>189</sup> See *id.*; see also Homer Bigart, *Gas Shortage Poses a Nationwide Threat of Cutbacks*, N.Y. TIMES, Nov. 21, 1971, at 1 (acknowledging that factories that have interruptible contracts "have the capacity to shift to alternate fuels").

<sup>190</sup> See Emery Troxel, *Inflation in Price-Regulated Industries*, 22 J. BUS. U. CHI. 1, 14 (1949).

<sup>191</sup> See *id.*

<sup>192</sup> See *id.*

<sup>193</sup> See *id.*

<sup>194</sup> See, e.g., Richard J. Pierce, Jr., *Natural Gas Regulation, Deregulation, and Contracts*, 68 VA. L. REV. 63, 66–69 (1982) (discussing problems with federal regulation of the natural gas industry).

<sup>195</sup> See OFF. OF POL'Y & ANALYSIS, FED. ENERGY ADMIN., *THE NATURAL GAS SHORTAGE: A PRELIMINARY REPORT* 1 (1975).

the 1970s.<sup>196</sup> In *Phillips Petroleum Co. v. Wisconsin*,<sup>197</sup> the Supreme Court held that the Federal Power Commission (“FPC”)<sup>198</sup> had jurisdiction to regulate the prices of natural gas sold by producers to interstate pipeline companies.<sup>199</sup> Prior to the decision, producer sales to pipeline companies had been generally considered exempt from federal price regulation.<sup>200</sup>

The consequences of the Supreme Court’s ruling were far-reaching. It greatly increased the FPC’s administrative burden; the Agency was now required to regulate thousands of independent gas producers.<sup>201</sup> The Commission initially attempted to do so by using individual cost-of-service rate cases — “treat[ing] producers as individual public utilities and [setting] limits on each producer’s prices individually according to his ‘costs of service.’”<sup>202</sup> This method quickly became unmanageable.<sup>203</sup> By 1960, only ten rate cases out of thousands had been resolved.<sup>204</sup>

To cope with this burden, in 1961, the FPC shifted its approach and adopted an “area rate” methodology, setting area-wide ceiling prices for entire producing regions on the basis of historical average costs.<sup>205</sup> This change promised “significant administrative advantages.”<sup>206</sup> The country could be divided into several producing regions, each subject to a different price ceiling. The FPC’s rate proceedings would be reduced from the thousands to a mere handful.<sup>207</sup> The FPC, however, based the resulting price ceilings on outdated cost datasets from the 1950s; those datasets failed to reflect rising marginal costs associated with gas production.<sup>208</sup> As a result, the FPC implemented artificially low rates, which left producers with little incentive to develop new supplies for

<sup>196</sup> See *Pierce*, *supra* note 194, at 66 & n.14, 69.

<sup>197</sup> 347 U.S. 672 (1954).

<sup>198</sup> The FPC, created by Congress in 1920, was the predecessor to today’s FERC. See PAUL W. PARFOMAK, CONG. RSCH. SERV., R48349, THE FEDERAL ENERGY REGULATORY COMMISSION (FERC) 1–2 (2025). The Department of Energy Organization Act §§ 401–407, Pub. L. No. 95–91, 91 Stat. 565, 582–87 (1977) (codified as amended at 42 U.S.C. §§ 7171–7177), gave FERC much of the FPC’s authority, including over the natural gas industry. See PARFOMAK, *supra*, at 1–3.

<sup>199</sup> See *Phillips Petrol. Co.*, 347 U.S. at 677.

<sup>200</sup> See Richard J. Pierce, Jr., *Reconstituting the Natural Gas Industry from Wellhead to Burnertip*, 9 ENERGY L.J. 1, 6–8 (1988); see also 15 U.S.C. § 717 (regulating natural gas prices).

<sup>201</sup> See Joe H. Foy, *Federal Regulation of Independent Natural Gas Producers—An Adventure in Pragmatism*, 21 VAND. L. REV. 1, 2–3 (1967) (discussing the *Phillips Petroleum Co.* decision and the burdens it placed on the FPC).

<sup>202</sup> Stephen Breyer & Paul W. MacAvoy, *The Natural Gas Shortage and the Regulation of Natural Gas Producers*, 86 HARV. L. REV. 941, 952 (1973).

<sup>203</sup> See *id.* at 953–54.

<sup>204</sup> *Id.*

<sup>205</sup> See *id.* at 958; *Pierce*, *supra* note 200, at 8.

<sup>206</sup> See *Pierce*, *supra* note 200, at 8.

<sup>207</sup> See *id.*

<sup>208</sup> See *Pierce*, *supra* note 194, at 67 n.17.

the interstate market.<sup>209</sup> Producers also diverted gas to unregulated intrastate markets that offered better prices.<sup>210</sup> Severe natural gas shortages ensued.<sup>211</sup>

### 3. *The Curtailment Era: The 1970s*

As supplies dwindled, interstate pipelines were increasingly unable to fulfill delivery obligations.<sup>212</sup> Interruptible contracts became centrally important to the pipelines' responses.<sup>213</sup> The first formal curtailments of natural gas occurred in 1970 and primarily affected industrial customers who held interruptible contracts.<sup>214</sup> Curtailments soon became routine, and interruptible customers bore the brunt of reductions, sometimes for months on end.<sup>215</sup> Eventually, by 1972, interstate pipelines ran out of interruptible contracts to curtail, and large-scale curtailments of firm contracts ensued.<sup>216</sup> Between 1970 and 1976, firm contract curtailments grew by a factor of twenty.<sup>217</sup>

The interruptions in the early 1970s, though initially limited, foreshadowed more extreme shortages and prompted the FPC to take a more active role in prioritizing end users. Gas demand was outpacing production at an alarming level, exacerbating concerns about the stability of long-term supply.<sup>218</sup> In response, in 1971, the FPC issued Order 431, marking a shift toward formalized curtailment strategies.<sup>219</sup> The FPC required interstate pipelines to submit curtailment plans as

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<sup>209</sup> See Bigart, *supra* note 189, at 56.

<sup>210</sup> Pierce, *supra* note 200, at 9.

<sup>211</sup> See *id.* at 9–10; Paul L. Joskow, *Natural Gas: From Shortages to Abundance in the United States*, 103 AM. ECON. REV. 338, 338–39 (2013).

<sup>212</sup> See CHARLES BLANCHARD, *THE EXTRACTION STATE* 160 (2021).

<sup>213</sup> *Id.*

<sup>214</sup> *Id.* Curtailment is defined as “[t]he difference between the volume of gas the interstate pipelines will actually deliver to their customers . . . and the . . . contractual obligations[] of these pipelines.” OFF. OF TECH. ASSESSMENT, U.S. CONG., *AN ANALYSIS OF THE IMPACTS OF THE PROJECTED NATURAL GAS CURTAILMENTS FOR THE WINTER 1975–76*, at xi (1975).

<sup>215</sup> See OFFICE OF TECH. ASSESSMENT, *supra* note 214, at 3.

<sup>216</sup> BLANCHARD, *supra* note 212, at 160.

<sup>217</sup> Joskow, *supra* note 211, at 338. Conditions were so drastic that, in some cases, schools would close due to a lack of available gas for heat. See Erin L. Nissley, *Local History: 1977 Brought Frigid Temperatures, Natural Gas Shortage*, *TIMES-TRIB.* (Sep. 12, 2015, at 14:00 ET), <https://www.thetimes-tribune.com/2015/09/12/local-history-1977-brought-frigid-temperatures-natural-gas-shortage/> [<https://perma.cc/2U7N-DZV6>].

<sup>218</sup> See BLANCHARD, *supra* note 212, at 160–61.

<sup>219</sup> Measures for Protection of Reliable and Adequate Natural Gas Service, 36 Fed. Reg. 7505 (Apr. 21, 1971). Order 431 was a policy statement that ordered pipeline companies to take “all steps necessary for the protection of as reliable and adequate service as present supplies and capacities will permit.” *Id.* at 7505.

amendments to their tariffs.<sup>220</sup> Each curtailment plan would govern how gas supplies would be allocated in the event of a shortage.<sup>221</sup> The curtailment plans submitted under Order 431, however, revealed wide disparities in philosophy and implementation.<sup>222</sup> Some pipelines proposed curtailment on a pro rata basis (i.e., equal percentage reductions across customer classes), whereas others proposed curtailment based on end use (i.e., based on whether the gas was consumed at its end point, such as in a home, a school, or an industrial process).<sup>223</sup>

Soon after, in 1973, the FPC established a national policy of curtailment based on end use.<sup>224</sup> This marked a regulatory pivot away from strict adherence to private contract rights.<sup>225</sup> The Commission rejected the idea that contractual commitments should necessarily dictate the allocation of a scarce public resource during a crisis.<sup>226</sup> Instead, “[h]uman need, consumer protection, and safety” required prioritization.<sup>227</sup>

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<sup>220</sup> J. Richard Tiano, *The Limits of Federal Regulation of Natural Gas Curtailments*, 64 GEO. L.J. 27, 30 (1975). Curtailment plans fell under the FPC’s jurisdiction over the transportation of natural gas: “[T]he matter of interrupting service is one largely related . . . to transportation and thus within the jurisdiction of the Federal Power Commission to control, in accommodation of any conflicting interests among various states.” *Panhandle E. Pipe Line Co. v. Pub. Serv. Comm’n*, 332 U.S. 507, 523 (1947); *see also* *Fed. Power Comm’n v. La. Power & Light Co.*, 406 U.S. 621, 642 (1972) (“Since curtailment programs fall within the FPC’s responsibilities . . . the Commission must possess broad powers to devise effective means to meet these responsibilities.”).

<sup>221</sup> *See* *North Carolina v. FERC*, 584 F.2d 1003, 1007–08 (D.C. Cir. 1978) (discussing regulatory requirements for pipeline curtailment plans).

<sup>222</sup> *See id.* at 1007 (“The [pipelines’] plans reflected a wide range of views as to the proper priorities for delivery. Some plans were based on end use; others, on contract entitlement.”); George R. Hall, *Natural Gas Curtailment Policy: Where Do We Go from Here?*, ENERGY J., Oct. 1981, at 43, 47.

<sup>223</sup> *North Carolina v. FERC*, 584 F.2d at 1007; *see* Hall, *supra* note 222, at 47; *see also* *La. Power & Light Co.*, 406 U.S. at 642–47 (upholding the FPC’s policy of curtailment based on end use rather than contract status and rejecting arguments favoring industrial customers).

<sup>224</sup> *See* *Utilization and Conservation of Natural Resources*, 38 Fed. Reg. 1503, 1503–04 (Jan. 15, 1973) (codified as amended at 18 C.F.R. § 2.78 (2025)); *Ark. Power & Light Co. v. Fed. Power Comm’n*, 517 F.2d 1223, 1227 & n.11 (D.C. Cir. 1975) (discussing this national policy and FPC opinions setting forth multiple priority-of-service categories based primarily on the end use of gas). *See generally* *Louisiana v. Fed. Power Comm’n*, 503 F.2d 844 (5th Cir. 1974) (discussing FPC opinions establishing end-use priorities in pipeline curtailment plans).

<sup>225</sup> *See* *Louisiana v. Fed. Power Comm’n*, 503 F.2d at 868, 872–73 (remanding curtailment plan to the FPC in part because facts did not support the FPC’s assumption that holders of interruptible contracts “have alternate fuel sources available” and “put their gas to inferior uses,” suggesting that priority based on end use was most consistent with the Natural Gas Act’s antidiscrimination provisions); *see also* *Ark. Power & Light Co.*, 517 F.2d at 1233–34 (reaching the same conclusion).

<sup>226</sup> *Utilization and Conservation of Natural Resources*, 38 Fed. Reg. at 1504 (“We are impelled to direct curtailment on the basis of end use rather than on the basis of contract simply because contracts do not necessarily serve the public interest requirement of efficient allocation of this wasting resource.”).

<sup>227</sup> RICHARD H.K. VIETOR, *ENERGY POLICY IN AMERICA SINCE 1945*, at 276 (1984).

Under this regulatory framework, customers were classified by their ability to absorb service interruptions. Residential and small commercial customers received top priority because of their essential heating needs, followed by firm industrial and commercial customers, and, finally, interruptible customers.<sup>228</sup> Interruptible customers were prioritized based on size, with the highest-daily-volume customers being the least prioritized for service.<sup>229</sup> Each successive priority level would need to be curtailed in full before moving on to the next highest priority.<sup>230</sup> The rationale for putting interruptible customers at the bottom of the list was not just adherence to contract. Instead, it was the idea that customers who could more easily switch fuels or manage operations should be curtailed first to minimize social and economic disruption, and the FPC expected—and assumed—that holders of interruptible contracts would have the capacity for fuel switching.<sup>231</sup>

Through the end of the 1970s crisis, the courts generally upheld the general authority of the FPC—and later the Federal Energy Regulatory Commission (“FERC”)—to set curtailment priorities on the basis of end use.<sup>232</sup> However, courts also repeatedly invalidated the Commission’s application of those priorities, including on grounds that the Commission had assumed, without factual basis, that interruptible contract holders either had alternative fuel sources available or were suppliers of end users with lower priority.<sup>233</sup> The consequence of these Commission orders and judicial holdings was that interruptible contract holders still usually had the lowest priority, but not always; the Commission, with the support or prodding of the courts, sometimes prioritized end use over contract type.<sup>234</sup>

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<sup>228</sup> *Id.* at 276–77; *see also* North Carolina v. FERC, 584 F.2d at 1007–08 (listing in order priority end-use categories); *Ark. Power & Light Co.*, 517 F.2d at 1227 (same).

<sup>229</sup> VIETOR, *supra* note 227, at 277.

<sup>230</sup> *Id.*; *see also* North Carolina v. FERC, 584 F.2d at 1008 (stating that this regulatory framework required “full curtailment” of lower priority categories before any curtailment of higher priority categories could begin).

<sup>231</sup> *See* Hall, *supra* note 222, at 47–48; *see also* North Carolina v. FERC, 584 F.2d at 1012–15 (finding FERC’s implementation of curtailment plans for pipelines was based on inadequate data and resulted in undue discrimination).

<sup>232</sup> *See, e.g.*, Fed. Power Comm’n v. La. Power & Light Co., 406 U.S. 621, 632, 647 (1972) (upholding the FPC’s policy of curtailment based on end use rather than contract status under the Natural Gas Act). For discussion of the transition from the FPC to FERC, *see supra* note 198.

<sup>233</sup> *See, e.g.*, *supra* note 225; North Carolina v. FERC, 584 F.2d at 1012 (finding that FERC had insufficient facts to determine whether the plan would “ensure the protection of high-priority end uses”); Christopher Whitman Moore, Note, *Administrative Law—Natural Gas Regulation: FERC Must Consider Actual Impact of Curtailment Plans*, 57 N.C. L. REV. 287, 293–96 (1979) (discussing these and similar cases); Richard J. Pierce, Jr., *The Choice Between Adjudicating and Rulemaking for Formulating and Implementing Energy Policy*, 31 HASTINGS L.J. 1, 1–4 (1979) (discussing and criticizing FERC’s gas curtailment proceedings).

<sup>234</sup> *See, e.g.*, *La. Power & Light Co.*, 406 U.S. at 632, 647.

#### 4. *The Natural Gas Policy Act of 1978 and Beyond: A Return to Markets and the Development of a Capacity Release Program*

By the late 1970s, the cumulative effects of misaligned regulatory incentives, administrative complexity, and widespread shortages prompted calls for even greater reform.<sup>235</sup> Congress enacted the Natural Gas Policy Act of 1978 (“NGPA”)<sup>236</sup> and the Natural Gas Wellhead Decontrol Act of 1989.<sup>237</sup> These acts deregulated wellhead prices but retained FERC’s authority to regulate interstate pipeline rates, charges, and practices in the public interest.<sup>238</sup> Likewise, FERC enacted a series of orders to first incentivize and later require interstate pipelines to provide open-access transmission service,<sup>239</sup> unbundle their merchant and transportation functions,<sup>240</sup> and refrain from granting preferred transmission rates to gas supply companies they owned.<sup>241</sup> After these orders, all pipelines exited the sales business and now only provide transportation service.<sup>242</sup>

The net effect of these changes was to dramatically expand the role of market competition in the natural gas industry and to abandon any

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<sup>235</sup> See *United Distrib. Cos. v. FERC*, 88 F.3d 1105, 1123 (D.C. Cir. 1996); see also Pierce, *supra* note 200, at 22 (summarizing steps taken by Congress and FERC to create functional gas markets).

<sup>236</sup> Natural Gas Policy Act of 1978, Pub. L. No. 95-621, 92 Stat. 3350 (codified as amended at 15 U.S.C. §§ 3301–3432).

<sup>237</sup> Natural Gas Wellhead Decontrol Act of 1989, Pub. L. No. 101-60, 103 Stat. 157 (codified as amended in scattered sections of 15 U.S.C.).

<sup>238</sup> See DAVIES ET AL., *supra* note 120, at 597 (discussing these statutes); *The History of Regulation*, NATURALGAS.ORG, <https://naturalgas.org/regulation/history/> [<https://perma.cc/7XQ3-DC97>] (last visited Nov. 13, 2025) (same).

<sup>239</sup> Providing open-access transmission service means offering long-distance transmission of gas or electricity to anyone who will pay the standard rate for it, much as a ferry or train will transport anyone who pays the published ticket price. See *Glossary: Open Access Transmission Tariff*, SW. POWER POOL, <https://spp.org/glossary/?term=Open%20Access%20Transmission%20Tariff%C2%A0%C2%A0> [<https://perma.cc/F772-UXNP>] (last visited Nov. 13, 2025); see also, e.g., Janie M. Chermak, *Order 636 and the U.S. Natural Gas Industry*, 24 RES. POL’Y 207, 209 (1998) (describing open-access pipeline requirements).

<sup>240</sup> Unbundling means that the companies had to maintain separation between the divisions carrying out these functions. Unbundling is a common first step toward establishing open-access markets. See *Order No. 636—Restructuring of Pipeline Services*, FERC (Aug. 7, 2025), <https://www.ferc.gov/order-no-636-restructuring-pipeline-services> [<https://perma.cc/6EA8-JPZ9>]; Richard Craswell, *Tying Requirements in Competitive Markets: The Consumer Protection Issues*, 62 B.U.L. REV. 661, 664–68 (1982).

<sup>241</sup> See generally *Associated Gas Distrib. v. FERC*, 824 F.2d 981 (D.C. Cir. 1987) (describing and upholding in substantial part Order 436, which imposed an open-access requirement on certain pipelines); *United Distrib. Cos. v. FERC*, 88 F.3d 1105, 1125–29 (D.C. Cir. 1996) (describing and upholding in substantial part Order 636, which required pipelines to unbundle their sales and transportation services).

<sup>242</sup> See *United Distrib. Cos.*, 88 F.3d at 1123–28.

federal curtailment policy based on end use.<sup>243</sup> Instead, going forward, all capacity scheduling and curtailment would be based on the parties' contractual terms — interruptible or firm — on a pro rata basis within the firm category and by price within the interruptible category.<sup>244</sup> In recent years, FERC has confirmed that its policy is based on the principle that “capacity should be allocated based on which customer values it the most, and customers are to be treated equally to enable competition.”<sup>245</sup>

Importantly, as part of this new market-based approach, FERC established a capacity release program.<sup>246</sup> That program allows customers with excess supply to release—i.e., resell—any unused capacity to other customers.<sup>247</sup> Parties can also enter into Asset Management Arrangements (“AMAs”) in which “a party agrees to manage gas supply and delivery arrangements, including transportation and storage capacity, for another party,” further increasing efficient use of pipeline capacity, particularly for shorter-term transactions.<sup>248</sup> According to FERC, “AMAs maximize the utilization and value of pipeline capacity by creating a mechanism for capacity holders to use third party experts to manage their pipeline capacity,” resulting “in ultimate savings for end-use customers by providing for lower gas supply costs and more efficient use of the pipeline grid.”<sup>249</sup> In other words, the program allows market participants to manage risk, creates additional potential revenue

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<sup>243</sup> Although the NGPA directed FERC to enact rules to ensure that pipeline curtailment plans protected gas deliveries for statutorily defined “essential agricultural uses” and “high-priority users,” see 15 U.S.C. §§ 3391–3392, FERC and the courts have limited the application of this directive to nationwide supply shortages, which have not occurred. 18 C.F.R. §§ 281.201–215 (2025) (implementing regulations); *United Distrib. Cos.*, 88 F.3d at 1143–48 (discussing NGPA provisions and FERC orders on curtailment policies); INTERSTATE NAT. GAS ASS'N OF AM., *supra* note 187, at 2 (“Neither FERC nor the interstate pipeline may discriminate against or favor a customer based on how the customer plans to use the gas. . . . [N]either FERC nor interstate [pipelines] can disregard contracts during periods of extreme weather . . .”).

<sup>244</sup> See *United Distrib. Cos.*, 88 F.3d at 1143–48. Although FERC no longer issues curtailment orders to pipelines on the basis of use, states have authority to curtail firm contract holders to prioritize gas deliveries on the basis of use, and states still exercise that authority in weather and other emergency situations. See, e.g., *RRC Commissioners Vote to Ensure Supply for Texans Relying on Natural Gas in Emergencies*, R.R. COMM'N OF TEX. (Apr. 12, 2022), <https://www.rrc.texas.gov/news/041222-curtailment-rule/> [<https://perma.cc/D5N2-8A9B>] (discussing Texas's curtailment rules); MICH. PUB. SERV. COMM'N, NATURAL GAS CURTAILMENT PROCEDURES WORKGROUP REPORT 10–11 (2020), [https://www.michigan.gov/mpsc/-/media/Project/Websites/mpsc/workgroups/ng-curtailment/Natural\\_Gas\\_Curtailment\\_Procedures\\_Workgroup\\_Report.pdf](https://www.michigan.gov/mpsc/-/media/Project/Websites/mpsc/workgroups/ng-curtailment/Natural_Gas_Curtailment_Procedures_Workgroup_Report.pdf) [<https://perma.cc/4A52-DC6F>] (discussing a proposal to modify a range of gas pipeline curtailment priorities on the basis of use).

<sup>245</sup> *Nw. Pipeline LLC*, 174 FERC ¶ 61,255, para. 19 (Mar. 31, 2021).

<sup>246</sup> See FERC, ENERGY PRIMER: A HANDBOOK FOR ENERGY MARKET BASICS 20 (2023).

<sup>247</sup> *Id.*

<sup>248</sup> *Capacity Release Frequently Asked Questions*, N. NAT. GAS 2 (Mar. 11, 2025), [https://www.northernnaturalgas.com/Document%20Postings/Capacity\\_Release\\_FAQs.pdf](https://www.northernnaturalgas.com/Document%20Postings/Capacity_Release_FAQs.pdf) [<https://perma.cc/7ZWG-VNK2>] (discussing AMAs).

<sup>249</sup> *Rice Energy Mktg. LLC*, 153 FERC ¶ 61,048, para. 4 (Oct. 15, 2015).

for holders of firm contracts, and promotes more efficient use of pipeline capacity throughout the year.<sup>250</sup>

To help that new market function and to prevent undue discrimination, FERC also took steps to promote transparency. It required all capacity release transactions to be conducted through the pipeline—to avoid secret deals between buyers and sellers—and required the pipeline to follow FERC regulations regarding posting and bidding of releases made through the program.<sup>251</sup>

This story of natural gas markets is complicated. Nevertheless, several important principles emerge, each with potential lessons for electricity allocation. The most important lesson is that a combination of interruptible contracts, firm contracts, and secondary markets can allocate resources effectively. The interruptible contracts provide a basis for curtailing resource distribution, whereas secondary markets allocate shortage burdens to the gas users who can best afford to manage those shortages. Yet this system had its struggles, particularly in the 1970s, when curtailments were massive and the capacity release program had not yet emerged.<sup>252</sup> During those years, principles for curtailment were widely and often successfully contested, leading to abundant litigation, uncertainty, and, ultimately, additional rounds of reform.<sup>253</sup>

### *B. Beyond Energy Scarcity: Allocating Water Rights in the West*

Natural gas is not the only resource for which a combination of policy and markets has addressed short-term or long-term capacity shortages. This Section discusses how water law addresses shortages and the lessons that emerge from those approaches. As with natural gas, the most important lesson is that a combination of curtailable entitlements and trading regimes can be a successful resource management strategy.

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<sup>250</sup> Promotion of a More Efficient Capacity Release Market, 73 Fed. Reg. 37,058, 37,079 (June 30, 2008) (describing the benefits of AMAs); *see also* 18 C.F.R. § 284.8 (2025) (discussing capacity release regulations); *Rice Energy*, 153 FERC ¶ 61,048, para. 2 (describing capacity release program); *Interstate Nat. Gas Ass'n of Am. v. FERC*, 285 F.3d 18, 29 (D.C. Cir. 2002) (upholding refinements to capacity release program made by FERC Order 637); *Interstate Nat. Gas Ass'n of Am. v. FERC*, 617 F.3d 504, 506 (D.C. Cir. 2010) (upholding refinements to capacity release program made by FERC Order 712); Cheryl M. Foley, *Natural Gas Transportation: Shipper-Must-Have-Title Rule and Capacity Release Requirements* (describing FERC's capacity release rules), in SKADDEN ENERGY LAW HANDBOOK 178, 178–80 (4th ed. 2016).

<sup>251</sup> *Rice Energy*, 153 FERC ¶ 61,048, paras. 2–3; *see also Interstate Nat. Gas*, 285 F.3d at 34 (stating that capacity release program “reduces transactions costs and increases transparency, helping economic actors make rational decisions for other aspects of their operations, e.g., decisions on how much firm capacity they really need, and, for example, for a fuel-switchable industrial user, whether to use or sell some of its capacity”). Firm releases of one year or less are not subject to the price cap. Foley, *supra* note 250, at 180; *see* 18 C.F.R. § 284.8; N. NAT. GAS, *supra* note 248, at 3.

<sup>252</sup> *See supra* notes 212–23 and accompanying text.

<sup>253</sup> *See supra* notes 232–34 and accompanying text.

That strategy can facilitate economic development, allow reallocation of resources to higher value uses, and encourage innovation.<sup>254</sup> Nevertheless, as with natural gas, there are cautionary elements to the water law story. Figuring out the right principles for allocating scarce water has not been easy, even when governing law at first appears elegantly simple, and putting principles into practice has often been difficult.<sup>255</sup>

### 1. *The Promise of Prior Appropriation*

The West is famously arid,<sup>256</sup> and the creators of Western water law systems understood that their fundamental challenge would be managing scarcity.<sup>257</sup> They could have done so, as modern electricity managers often do, through some combination of development limits and obligations for water providers to develop adequate supplies.<sup>258</sup> Indeed, Western water management has used elements of both strategies, but not with the assumption that supplies always would be sufficient.<sup>259</sup> Instead, Western lawmakers—the first of whom were miners pursuing California’s Gold Rush<sup>260</sup>—developed a water-rights system called prior appropriation, which is, at its core, a set of mechanisms for allocating shortage.<sup>261</sup> On paper, those mechanisms are simple. The holders of older, or “senior,” water rights are entitled to have their rights fulfilled before the holders of newer, or more “junior,” water rights are entitled to any water at all.<sup>262</sup> Or, to put it differently, junior

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<sup>254</sup> See *infra* Section II.B.1.

<sup>255</sup> See *infra* Section II.B.2.

<sup>256</sup> See WALLACE STEGNER, *WHERE THE BLUEBIRD SINGS TO THE LEMONADE SPRINGS* 60 (1992) (describing the West as “a semi-desert with a desert heart”); J.W. POWELL, *REPORT ON THE LANDS OF THE ARID REGION OF THE UNITED STATES*, at vii, 2 (Wash., Gov. Printing Off. 2d ed. 1879) (anticipating challenges aridity would create).

<sup>257</sup> See, e.g., *United States v. Gerlach Live Stock Co.*, 339 U.S. 725, 728–29 (1950) (describing, rather colorfully, California’s mismatches of water availability and need).

<sup>258</sup> See *supra* notes 106–07 and accompanying text.

<sup>259</sup> See generally Lincoln L. Davies, *Just a Big, “Hot Fuss”? Assessing the Value of Connecting Suburban Sprawl, Land Use, and Water Rights Through Assured Supply Laws*, 34 *ECOLOGY L.Q.* 1217 (2007) (discussing laws that require development projects to identify secure water supplies); A. Dan Tarlock & Sarah B. Van de Wetering, *Growth Management and Western Water Law: From Urban Oases to Archipelagos*, 14 *HASTINGS W.-NW. J. ENV’T L. & POL’Y* 983, 998 (2008) (discussing the duty to serve in Western water law).

<sup>260</sup> See CHARLES F. WILKINSON, *CROSSING THE NEXT MERIDIAN* 232 (1992) (describing the miners’ role).

<sup>261</sup> As legal historians have explained, the first concern was geographic shortage. Westerners were concerned that most lands were arid, and a legal system that limited water use to riparian parcels could limit economic development and create monopolies. See generally David B. Schorr, *Appropriation as Agrarianism: Distributive Justice in the Creation of Property Rights*, 32 *ECOLOGY L.Q.* 3 (2005) (explaining the antimonopoly origins of prior appropriation).

<sup>262</sup> See *Atchison v. Peterson*, 87 U.S. 507, 511–15 (1874) (explaining the origins and basic elements of prior appropriation law).

water users are welcome to enter the water-rights system, even when water in that system already is under heavy demand, but they do so knowing their position will be precarious.<sup>263</sup>

As prior appropriation systems have evolved, they have developed another key feature: Appropriative water rights generally are transferable. Early prior appropriation systems tied water rights closely to their original place and purpose of use, meaning that a right could not be sold separately from the land to which it was attached.<sup>264</sup> But by the end of the twentieth century, all Western states allowed transfers.<sup>265</sup> Often, the transfers go to more junior users who place a higher economic value on their water uses,<sup>266</sup> and those transfers often are made possible either by increased efficiencies in water use or by the selective fallowing of lower-value crops.<sup>267</sup> This combination of features—clear initial entitlements to water, along with trading mechanisms that allow reallocation of water to higher-value uses—has earned prior appropriation the enduring adoration of resource economists.<sup>268</sup>

Empirical assessments of prior appropriation systems are less common than theoretically grounded praise, but the limited available evidence suggests that prior appropriation can deliver on its promise, at least in some ways. Multiple studies have found that combining clearly defined water rights with water trading can increase the overall economic value of water access, even if laws also cap water withdrawals.<sup>269</sup> More generally, the system clearly works to at least some extent. Prior appropriation is the law of much of the West, and despite constant

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<sup>263</sup> See *id.*

<sup>264</sup> See Karrigan Börk & Sonya Ziaja, *Amoral Water Markets?*, 111 GEO. L.J. 1335, 1358 (2023) (describing traditional limits on water transfers).

<sup>265</sup> See TODD DOHERTY & ROD SMITH, W. GOVERNORS ASS'N & W. STATES WATER COUNCIL, *WATER TRANSFERS IN THE WEST*, at viii (2012) (showing that water transfers are happening in all Western states).

<sup>266</sup> See Kristiana Hansen, Richard Howitt & Jeffrey Williams, *An Econometric Test of Water Market Structure in the Western United States*, 55 NAT. RES. J. 127, 131–34 (2014) (describing typical buyers and sellers).

<sup>267</sup> See BARTON H. THOMPSON, JR., *LIQUID ASSET: HOW BUSINESS AND GOVERNMENT CAN PARTNER TO SOLVE THE FRESHWATER CRISIS* 99–100 (2024).

<sup>268</sup> See Schorr, *supra* note 261, at 8–9 (describing this view and compiling sources); H. Stuart Burness & James P. Quirk, *Appropriative Water Rights and the Efficient Allocation of Resources*, 69 AM. ECON. REV. 25, 25–26 (1979) (explaining the efficiencies of tradable appropriative rights).

<sup>269</sup> See, e.g., Sarah Ann Wheeler, *Debunking Murray-Darling Basin Water Trade Myths*, 66 AUSTRALIAN J. AGRIC. & RES. ECON. 797, 798 (2022) (“Economists have traditionally been supportive of the efficiency gains that can be derived from water trade . . .”); Andrew B. Ayres, Kyle C. Meng & Andrew J. Plantinga, *Do Environmental Markets Improve on Open Access? Evidence from California Groundwater Rights*, 129 J. POL. ECON. 2817, 2821 (2021); H.J. Vaux, Jr. & Richard E. Howitt, *Managing Water Scarcity: An Evaluation of Interregional Transfers*, 20 WATER RES. RSCH. 785, 791 (1984).

warnings of impending doom, Western water systems have mostly succeeded in meeting human needs.<sup>270</sup>

Prior appropriation systems also appear to spur innovation, at least among relatively junior appropriators. Empirical studies of the relationships between water-right seniority and innovation do not exist.<sup>271</sup> Nevertheless, there is compelling anecdotal evidence that holders of relatively insecure rights will try to find creative ways to meet their water needs, sometimes leading to innovations that provide broader societal value.

One example is the difference in water management strategies between urban Southern California, where many water users rely on relatively insecure water contracts and rights, and the San Francisco Bay Area, where relatively secure senior rights are more prevalent.<sup>272</sup> Notwithstanding its decidedly mixed reputation in water policy circles, Southern California has been a hotbed of water management innovation, pursuing pioneering efforts in water recycling and reuse,<sup>273</sup> managed aquifer recharge,<sup>274</sup> desalination,<sup>275</sup> and water transfers.<sup>276</sup> With the possible exception of Las Vegas—which also has limited water

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<sup>270</sup> Dave Owen, *The Water District and the State*, 134 *YALE L.J.* 1, 29 (2024).

<sup>271</sup> We were unable to find any such studies.

<sup>272</sup> Much of urban Southern California's water comes from the California State Water Project. See *Our Foundation: Securing Our Imported Supplies*, METRO. WATER DIST. S. CAL., <https://www.mwdh2o.com/securing-our-imported-supplies/> [<https://perma.cc/XY26-BTRZ>] (last visited Nov. 13, 2025). The project is operated by the California Department of Water Resources ("DWR"), which holds the water rights and delivers water under contracts. See *State Water Project*, VALLEY WATER, <https://www.valleywater.org/your-water/where-your-water-comes/imported-water/state-water-project> [<https://perma.cc/6YFS-7WQP>] (last visited Nov. 13, 2025). The rights are more junior than those held by San Francisco and by water suppliers in the East Bay: The contracts contain shortage provisions, which allow DWR to deliver less than the full contract amount. See *Plan. & Conservation League v. Dep't of Water Res.*, 100 Cal. Rptr. 2d 173, 180 (Ct. App. 2000) (describing the contracts). See generally NORRIS HUNDLEY, JR., *THE GREAT THIRST* (rev. ed. 2001) (describing the history of California water development).

<sup>273</sup> See Carl Smith, *California County Recycles All Its Wastewater, a World First*, GOVERNING (Apr. 28, 2023), <https://www.governing.com/now/california-county-recycles-all-its-wastewater-a-world-first> [<https://perma.cc/L8EE-PU9E>]; see also Ian James, *L.A. to Build a Facility to Purify Wastewater so It's Fit for Consumption*, L.A. TIMES, Nov. 28, 2024, at A1 (discussing the current and future uses of such recycled water); Adam W. Olivieri, Brian Pecson, James Crook & Robert Hultquist, *California Water Reuse—Past, Present and Future Perspectives* (discussing advances in water reuse, many of them made in California), in 5 *ADVANCES IN CHEMICAL POLLUTION, ENVIRONMENTAL MANAGEMENT AND PROTECTION* 65, 66–67 (Paola Verlicchi ed., 2020).

<sup>274</sup> See, e.g., *Groundwater Management*, ORANGE CNTY. WATER DIST., <https://www.ocwd.com/what-we-do/groundwater-management/> [<https://perma.cc/Y45L-SLLB>] (last visited Nov. 13, 2025).

<sup>275</sup> See Jim Robbins, *As Water Scarcity Increases, Desalination Plants Are on the Rise*, *YALE ENV'T* 360 (June 11, 2019), <https://e360.yale.edu/features/as-water-scarcity-increases-desalination-plants-are-on-the-rise#> [<https://perma.cc/P3ZM-Z7ET>] (describing the desalination plant in California).

<sup>276</sup> See VALLEY WATER, *supra* note 272 (describing the largest water transfer in U.S. history); METRO. WATER DIST. S. CAL., *supra* note 272 (describing transfers and water-banking arrangements).

rights<sup>277</sup>—and with the caveat that much more work remains to be done,<sup>278</sup> perhaps no part of the country has done as much to advance innovative water management, and the benefits for water supply reliability have been significant.<sup>279</sup> Farther north, the situation is quite different. With some limited exceptions,<sup>280</sup> the kinds of water reuse, desalination, groundwater recharge, and water transfer projects that have become increasingly common in Southern California remain rare and small in most of the Bay Area.<sup>281</sup>

This is one comparison, but the basic point it makes—that necessity really can be the mother of invention—is likely to hold true for prior appropriation more generally.<sup>282</sup> By allowing entities to obtain insecure water rights, the system allows more water users to participate.<sup>283</sup> It also creates powerful incentives for users with more insecure rights to find innovative hedges against their insecurity. Conversely, such innovation is less likely when water users are assured that their suppliers will meet their needs, particularly if those users have no realistic mechanism for selling unused water.<sup>284</sup>

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<sup>277</sup> See *Drought and Conservation Measures*, L.V. VALLEY WATER DIST., <https://www.lvwd.com/conservation/measures/index.html> [<https://perma.cc/7XPH-AJJ4>] (last visited Nov. 13, 2025).

<sup>278</sup> See Liam Dillon, *Does State Have Enough Water for New Residents?*, L.A. TIMES, June 1, 2022, at A1 (noting that existing inefficiencies are still significant).

<sup>279</sup> See Alvar Escriva-Bou, Annabelle Rosser & Ellen Hanak, *How Are California's Cities Managing the Drought?*, PUB. POL'Y INST. CAL. (Oct. 31, 2022), <https://www.ppic.org/blog/how-are-californias-cities-managing-the-drought/> [<https://perma.cc/N8H6-AUQ9>] (“Urban agencies are generally in decent shape—despite the drought—because they have made massive investments to reduce long-term demand and improve supply reliability over the past few decades.”).

<sup>280</sup> Among Northern California water lawyers, the Santa Clara Valley Water District has a reputation for innovation. See *One Water Spotlight: Santa Clara Valley Water District*, CAL. WATER ENV'T ASS'N, <https://www.cwea.org/news/one-water-spotlight-santa-clara-valley-water-district/> [<https://perma.cc/6VGF-JCQD>] (last visited Nov. 13, 2025). For a description of water sources and programs, see Home Page for Valley Water, VALLEY WATER, <https://www.valleywater.org/> [<https://perma.cc/8D4J-YKXP>] (last visited Dec. 20, 2025).

<sup>281</sup> See S.F. PUB. UTILS. COMM'N, 2020 URBAN WATER MANAGEMENT PLAN FOR THE CITY AND COUNTY OF SAN FRANCISCO § 6.2 (2021), [https://www.sfpuc.gov/sites/default/files/programs/UWMP\\_2020.pdf](https://www.sfpuc.gov/sites/default/files/programs/UWMP_2020.pdf) [<https://perma.cc/9ELZ-F6V8>] (stating that ninety-seven percent of the San Francisco Public Utilities Commission's water supplies come from imported surface water, with the remaining three percent coming from local groundwater and water recycling and reuse).

<sup>282</sup> It also is a more general principle of water law. See Julio Berbel & Encarna Esteban, *Droughts as a Catalyst for Water Policy Change. Analysis of Spain, Australia (MDB), and California*, GLOB. ENV'T CHANGE, Sep. 2019, at 1, 3.

<sup>283</sup> The ability to allow holders of tenuous rights to enter the system contributes to common charges that Western water is severely over appropriated. See, e.g., Theodore E. Grantham & Joshua H. Viers, *100 Years of California's Water Rights System: Patterns, Trends and Uncertainty*, ENV'T RSCH. LETTERS, Aug. 2014, at 1, 6–7 (using mapping to show rivers where total water-right claims exceed flow, often by wide margins).

<sup>284</sup> See Vanessa Casado Pérez, *Water Reallocation in the West: Government and Markets*, 2025 UTAH L. REV. 235, 240–42 (warning that prior appropriation has not created strong efficiency incentives for agricultural users holding senior water rights).

## 2. *The Challenges of Prior Appropriation*

This account of prior appropriation might make it sound like a promising model for accommodating new entrants to electricity systems, and, indeed, it is. But there are other facets to the story. The practice of prior appropriation is much messier and in some ways less successful than the theory. And some of the struggles and critiques of prior appropriation systems also hold lessons for energy law.

### a. *The Limits of Priority*

One recurring problem is prior appropriation's uneven commitment to its own principles. As many commentators have pointed out, the core element of a prior appropriation system—curtailment of junior users in times of shortage—is sometimes aspirational.<sup>285</sup> There are some Western states where rules of priority are enforced effectively,<sup>286</sup> but in others, they are enforced only for some users or watersheds, or they are hardly enforced at all.<sup>287</sup> In many watersheds, a combination of side contracts, informal understandings, and gaps in oversight means that water is allocated more according to a mix of community norms and take-what-you-can-get water grabs than by anything resembling strict rules of priority.<sup>288</sup> Meanwhile, even the idea that water-right priority might be enforced more vigorously sometimes provokes howls of protest from major water users.<sup>289</sup>

That political opposition highlights another important and broader lesson from water resource management: Curtailing politically and economically powerful resource users is hard, even if that curtailment is what the law seems to require.<sup>290</sup> In much of the West, that curtailment

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<sup>285</sup> See W.M. Hanemann, *The Economic Conception of Water*, in WATER CRISIS: MYTH OR REALITY? 61, 72 & n.23 (Peter P. Rogers et al. eds., 2006).

<sup>286</sup> See, e.g., ALVAR ESCRIBA-BOU ET AL., ACCOUNTING FOR CALIFORNIA'S WATER 44, 52 (2016), [http://www.ppic.org/content/pubs/other/716EHR\\_appendix.pdf](http://www.ppic.org/content/pubs/other/716EHR_appendix.pdf) [<https://perma.cc/T422-F7QK>] (describing priority-based curtailment in Colorado, referring to it as “swift, effective, and relatively uncontroversial”).

<sup>287</sup> See, e.g., GREEN NYLEN ET AL., *supra* note 35, at 84; Benson, *supra* note 35, at 689 (describing Western states' reluctance to enforce rules of priority).

<sup>288</sup> See Hanemann, *supra* note 285, at 72 & n.23 (stating that “[o]n the ground in at least some Western states, the practice seems to be rather different” from prior appropriation principles). Hanemann's statement is consistent with assessments one Author has repeatedly heard from California water-rights regulators.

<sup>289</sup> See, e.g., *Water Rights*, ASS'N CAL. WATER AGENCIES, <https://www.acwa.com/water-rights/> [<https://perma.cc/5FE8-T63S>] (describing bills that would allow state water-rights regulators to gather more information and bring faster and more effective enforcement against unlawful diversions as “an attack on the current water rights system”).

<sup>290</sup> See, e.g., Felicity Barringer, *New Mexico Farmers Seek 'Priority Call' as Drought Persists*, N.Y. TIMES (Mar. 26, 2013), <https://www.nytimes.com/2013/03/27/us/new-mexico-farmers-push-to-be-made-a-priority-in-drought.html> [<https://perma.cc/B6ZL-GDH7>] (“We have it in the state

does happen; in dry years, for example, major California water users may receive only a fraction of their contractual water allocations,<sup>291</sup> and curtailments in some other Western watersheds are common.<sup>292</sup> But as any participant in Western water law or politics can attest, there is constant litigation and political lobbying surrounding these limits, particularly when there is any ambiguity in governing law.<sup>293</sup> That should not be surprising. When the value of a resource is much higher than the cost of a team of lawyers and lobbyists, powerful entities will take the economically rational course and do what they can to oppose cutoffs.

The challenges do not just arise from discrepancies between clear legal principles and implementation practices. Instead, prior appropriation systems have long been beset by questions about what the governing rules *should* be. As a legal matter, priority is not the only allocation principle that matters, even in a prior appropriation system. In all Western states, legal doctrines like reasonable- and beneficial-use requirements potentially limit the scope of water rights and allow them to evolve over time.<sup>294</sup> Similarly, in some Western states, doctrines like public ownership of water and the public trust doctrine provide property-law-based opportunities for regulatory authorities to revise or limit the scope of rights.<sup>295</sup> Some critics of Western water law see these doctrines as the great hopes for water law reform, potentially providing a basis for allocating water according to principles of equity or environmental benefit rather than strict priority.<sup>296</sup> In contrast, many water users—and some academics—see these doctrines as foundational

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Constitution: First in time, first in right. But that's not how it's practiced.” (quoting Interview with Dudley Jones, Manager, Carlsbad Irrigation Dist.).

<sup>291</sup> See CAL. DEP'T WATER RES., THE STATE WATER PROJECT DELIVERY CAPABILITY REPORT 2023, at 5.42 (2024) (showing contractual amounts and actual deliveries for California's State Water Project).

<sup>292</sup> GREEN NYLEN ET AL., *supra* note 35, at 84.

<sup>293</sup> See Owen, *supra* note 270, at 19–20 (describing the political and legal influence of Western water districts).

<sup>294</sup> See, e.g., Imperial Irrigation Dist. v. State Water Res. Control Bd., 275 Cal. Rptr. 250, 265–66 (Ct. App. 1990) (explaining the evolving nature of reasonable- and beneficial-use requirements). *But see* Janet C. Neuman, *Beneficial Use, Waste, and Forfeiture: The Inefficient Search for Efficiency in Western Water Use*, 28 ENV'T L. 919, 922–23 (1998) (arguing that these doctrines have exerted relatively little influence on Western water allocation).

<sup>295</sup> See, e.g., Light v. State Water Res. Control Bd., 173 Cal. Rptr. 3d 200, 211–12 (Ct. App. 2014); Lawrence v. Clark County, 254 P.3d 606, 607 (Nev. 2011). See generally Samuel T. Ayres, Note, *State Water Ownership and the Future of Groundwater Management*, 131 YALE L.J. 2213 (2022) (describing state ownership doctrine and its implications).

<sup>296</sup> See, e.g., Carol Necole Brown, *Drinking from a Deep Well: The Public Trust Doctrine and Western Water Law*, 34 FLA. ST. U. L. REV. 1, 26–30 (2006); Brian E. Gray, *The Reasonable Use Doctrine in California Water Law and Policy*, in SUSTAINABLE WATER 83, 94–103 (Allison Lassiter ed., 2015).

threats to clarity and predictability, both of which are often described as prior appropriation's chief virtues.<sup>297</sup>

These debates are intertwined with broader critiques of prior appropriation.<sup>298</sup> The system has no shortage of detractors. As legal historian David Schorr has aptly put it, “many see in prior appropriation a symbol of everything that is wrong about private-property regimes in natural resources: environmental degradation; inequality; nonsustainability; giveaways of public property.”<sup>299</sup> Critics charge—with some basis—that the system tends to privilege water uses that have roots in nineteenth- and early-twentieth-century distributions of wealth and power rather than present-day equities and needs.<sup>300</sup> A closely related critique begins with the foundational value—priority-based allocation—upon which prior appropriation is founded. Emphasizing priority creates a powerful incentive to be the first to appropriate water and, lest the right be lost, to sustain that use.<sup>301</sup> That rush to claim resources can lead to overuse and can undermine incentives for efficiency and conservation.<sup>302</sup>

#### *b. The Limits of Water Markets*

Prior appropriation systems' reliance on water trading also has seen mixed success. Most Western states do have some water trading,<sup>303</sup> and

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<sup>297</sup> See Barton H. Thompson, Jr., *The Public Trust Doctrine: A Conservative Reconstruction & Defense*, 15 SE. ENV'T L.J. 47, 47–49 (2006) (summarizing critiques of the doctrine and observing that “what environmentalists and public-access advocates like about the doctrine, conservatives hate”); James L. Huffman, *Institutional Constraints on Transboundary Water Marketing*, in WATER MARKETING—THE NEXT GENERATION 31, 38–39 (Terry L. Anderson & Peter J. Hill eds., 1997); Roderick E. Walston, *The Public Trust Doctrine in the Water Rights Context: The Wrong Environmental Remedy*, 22 SANTA CLARA L. REV. 63, 64 (1982).

<sup>298</sup> See, e.g., Eric T. Freyfogle, *Water Rights and the Common Wealth*, 26 ENV'T L. 27, 40–41 (1996) (arguing that both water markets and prior appropriation reflect and reinforce flawed values).

<sup>299</sup> Schorr, *supra* note 261, at 9.

<sup>300</sup> See Ian James, ‘A Foundation of Racism’: California’s Antiquated Water Rights System Faces New Scrutiny, L.A. TIMES (Mar. 6, 2023, at 05:00 PT), <https://www.latimes.com/environment/story/2023-03-06/is-californias-antiquated-water-rights-system-racist> [<https://perma.cc/7ZJ9-TF25>].

<sup>301</sup> See Robert Haskell Abrams, *Prior Appropriation and the Commons*, 37 UCLA J. ENV'T L. & POL'Y 141, 152 (2019).

<sup>302</sup> See *N. Kern Water Storage Dist. v. Kern Delta Water Dist.*, 54 Cal. Rptr. 3d 578, 590 (Ct. App. 2007) (“[T]he rights holder is subject to forfeiture for *not using* water, a practice generally thought to be socially responsible and usually called ‘conservation.’”).

<sup>303</sup> The phrase “water market” has fraught meaning, and not all water trading occurs through systems that could accurately be described as markets. See Joseph W. Dellapenna, *The Importance of Getting Names Right: The Myth of Markets for Water*, 25 WM. & MARY ENV'T L. & POL'Y REV. 317, 324–26 (2000) (arguing that the phrase “water market” is overused).

trading has sometimes played significant roles in reallocating water.<sup>304</sup> But those examples are outliers; on the whole, Western trading is still a small part of water allocation.<sup>305</sup> Water-market proponents often lament that minor role, arguing that a variety of traditional water law doctrines and newer procedural requirements make water transactions overly difficult.<sup>306</sup> Meanwhile, a largely separate set of critics has charged that when water trading does take on a larger role, it tends to favor moneyed interests, typically at the expense of less wealthy communities and environmental protection.<sup>307</sup> Though for different and sometimes conflicting reasons, many water law experts would see experience with water markets as a cautionary tale.<sup>308</sup>

A closer look at the reasons why water trading has sometimes struggled may add some nuance to the debate. Both proponents and critics of water trading identify several recurring reasons why trading has done less than its proponents might have hoped. One reason is peculiar to the geography of water systems. With the exception of bottled drinking water, water is too expensive to transport on trucks or trains, which means water distribution relies on dedicated canals and pipes.<sup>309</sup> Those networks of canals and pipes are unidirectional and are far less extensive than, say, the electrical grid, which severely limits the set of places that can trade with each other.<sup>310</sup>

A second reason is transparency. Abundant information about products and prices is a prerequisite for an efficient market, and with water, that abundant information rarely exists.<sup>311</sup> Neither government

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<sup>304</sup> See generally Jedidiah Brewer, Robert Glennon, Alan Ker & Gary Libecap, *Transferring Water in the American West: 1987–2005*, 40 U. MICH. J.L. REFORM 1021 (2007) (describing the extent of Western water markets); THOMPSON, *supra* note 267, at 99–100.

<sup>305</sup> See Casado Pérez, *supra* note 284, at 241–42 (“Even very active water markets, such as those in California, Texas, or Arizona, trade only between 2 and 4% of overall water used.”).

<sup>306</sup> See, e.g., THOMPSON, *supra* note 267, at 100–06 (explaining constraints on water markets). See generally TERRY L. ANDERSON & PAMELA SNYDER, *WATER MARKETS* (1997) (arguing that water markets are promising and inappropriately hamstrung).

<sup>307</sup> See, e.g., Börk & Ziaja, *supra* note 264, at 1368–71 (advancing this critique).

<sup>308</sup> See, e.g., *id.*; Christine A. Klein, *Water Transfers: The Case Against Transbasin Diversions in the Eastern States*, 25 UCLA J. ENV'T L. & POL'Y 249, 249 (2007).

<sup>309</sup> See Peter H. Gleick & Meena Palaniappan, *Peak Water Limits to Freshwater Withdrawal and Use*, 107 PNAS 11,155, 11,158 (2010).

<sup>310</sup> See THOMPSON, *supra* note 267, at 98 (noting the importance of conveyance infrastructure); Dave Owen, *Water and Taxes*, 50 U.C. DAVIS L. REV. 1559, 1601–02 (2017) (describing geographic limits on water trading).

<sup>311</sup> See Kurt Schwabe, Mehdi Nemat, Clay Landry & Grant Zimmerman, *Water Markets in the Western United States: Trends and Opportunities*, WATER, Jan. 2020, at 1, 13; ANDREW AYRES ET AL., *IMPROVING CALIFORNIA'S WATER MARKET: HOW WATER TRADING AND BANKING CAN SUPPORT GROUNDWATER MANAGEMENT* 19–20 (2021) (emphasizing the importance and absence of transparency).

entities nor private entities have created the kinds of centralized trading systems that exist for things like stocks, futures, or electrons.<sup>312</sup>

A third reason—and the reason most commonly identified in the existing literature on water trading—is legal complexity.<sup>313</sup> Moving water around often has third-party effects, and lawmakers have often responded to those potential effects by requiring governmental reviews—sometimes extensive—of water transfers.<sup>314</sup> Those reviews raise transaction costs, sometimes to prohibitive levels.<sup>315</sup> Likewise, many Western states continue to place substantive constraints on water transfers, including prohibitions on speculative accumulation of water and on pursuing transfers that might harm other water users.<sup>316</sup>

For all these reasons, few water lawyers would describe Western water law’s combination of priority-based rights and trading systems as a paragon of effective resource management. Its uneven successes provide no shortage of cautionary lessons, perhaps the most important of which is that implementing even a seemingly simple and clear system for allocating shortage can turn out to be practically difficult and politically fraught. But the system also has shown promise in some ways. It offers a functional basis for allocating variable resources and, at least for junior right holders, creates incentives for innovation.<sup>317</sup> And, as will be discussed in more detail in the next Part, some of these concerns and critiques might be less salient for electricity allocation than they have been for water.

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<sup>312</sup> The United States’s approach contrasts with that of Australia, which has established centralized, government-run websites with detailed information on water rights. *See Water Information*, AUSTRALIAN GOV’T BUREAU OF METEOROLOGY, <http://www.bom.gov.au/water/dashboards/#/water-markets/national/state/at> [<https://perma.cc/4XND-WVLP>] (last visited Nov. 13, 2025). Australia’s water markets are also more widely praised than their American counterparts. *See, e.g.*, James Horne & R. Quentin Grafton, *The Australian Water Markets Story: Incremental Transformation* (“The [Murray-Darling Basin] water markets are widely considered to be highly developed and well managed relative to other places in the world, including the United States.” (citations omitted)), in *SUCCESSFUL PUBLIC POLICY* 165, 167 (Joannah Luetjens et al. eds., 2019).

<sup>313</sup> *See, e.g.*, THE HAMILTON PROJECT, *SHOPPING FOR WATER: HOW THE MARKET CAN MITIGATE WATER SHORTAGES IN THE AMERICAN WEST* 3 (2014), [https://www.hamiltonproject.org/wp-content/uploads/2023/01/how\\_the\\_market\\_can\\_mitigate\\_water\\_shortage\\_in\\_west\\_brief.pdf](https://www.hamiltonproject.org/wp-content/uploads/2023/01/how_the_market_can_mitigate_water_shortage_in_west_brief.pdf) [<https://perma.cc/JCE4-934W>] (“[A] myriad of legal and regulatory restrictions . . . aggravate relative water scarcity and existing price disparities . . .”).

<sup>314</sup> *See* Philip Womble & W. Michael Hanemann, *Water Markets, Water Courts, and Transaction Costs in Colorado*, WATER RES. RSCH., Apr. 2020, at 1, 3 (identifying limits and noting that “[a] substantial academic literature identifies transaction costs as barriers to water marketing”).

<sup>315</sup> *See id.*

<sup>316</sup> *See* THOMPSON, *supra* note 267, at 100–06 (describing restrictions). For a vigorous defense of those kinds of restrictions, see generally Freyfogle, *supra* note 298 (arguing that the third-party effects of water transfers are significant and should be addressed).

<sup>317</sup> *See supra* notes 272–81 and accompanying text.

### III. ALLOCATING ELECTRICITY: IMPLICATIONS AND RECOMMENDATIONS

This Article's accounts of natural gas and water management demonstrate that there are multiple ways to allocate variably available resources. Modern-day electricity law's preferred approach—ensuring that sufficient supply will always meet (and exceed) demand and only then allowing interconnections for major new users—is not the only option. Yet this account also shows how these alternative approaches can go awry, which leads to a different set of cautionary lessons. This Part applies both types of lessons to the challenges facing today's electricity systems. This Part begins by developing a conceptual framework for a demand-side connect-and-manage system for utilities and state regulators to address large-load electricity supply. It then explains why that general approach is promising and why it might even work better for electricity than it has for natural gas and water, but also what important challenges are likely to remain.

#### A. *Demand-Side Connect-and-Manage: A Specific Proposal*

The core elements of a demand-side connect-and-manage approach would be (1) an option for new large loads to connect to the grid, even if supplies and transmissions systems cannot meet demand at all times; (2) authority for state-regulated utilities to curtail those new users; and (3) secondary markets in which large loads can use trading to hedge against the risk of curtailments. But that conceptual explanation leaves many questions unresolved.<sup>318</sup> The goal of this Article is not to flesh out all the details but to answer several likely questions and create a framework and context.

One key question is whom the class of curtailable electricity users would include. Many possibilities exist, but this Article proposes that curtailable use be limited to major new industrial and commercial users, probably with a specific size threshold.<sup>319</sup> Existing consumers and smaller new consumers—for example, households and most businesses—would continue to operate under the duty-to-serve regime. This approach would limit riskier electricity-service arrangements to large and sophisticated companies, which generally have the resources to make informed business decisions and to participate strategically in markets, while

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<sup>318</sup> One such question is whether new data centers should pay connection fees, which might offset costs they create for other electricity consumers, or should connect for free, as most other consumers do. This Article expresses no opinion on that question, but notes that its recommendations are compatible with regulatory systems with or without connection fees.

<sup>319</sup> See *supra* Section I.B (discussing specific large-load tariffs). For an example of a size threshold, see Ohio Power Co. for New Tariffs Related to Data Ctrs., No. 24-508-EL-ATA, 2025 WL 2272159, at \*1 (Ohio Pub. Utils. Comm'n 2025) (setting a twenty-five MW threshold).

protecting less sophisticated consumers from vulnerability. Relatedly, these limits would probably also increase the approach's political viability. Utilities and political leaders are unlikely to embrace a system that places average households at increased risk of blackouts.<sup>320</sup>

A second key question is what principles should drive curtailment decisions. Again, there are multiple possibilities. Electricity managers could use temporal priority, as is done in prior appropriation.<sup>321</sup> They could allow new users to contract for different levels of service—and pay different rates—as is done for natural gas pipelines.<sup>322</sup> They could allocate curtailments on the basis of some regulatory or legislative entity's judgments about the social utility of different electricity uses, as happened, often unsuccessfully, with natural gas in the 1970s<sup>323</sup> and as sometimes happens with water during droughts.<sup>324</sup> Or, plausibly if less desirably, grid managers could curtail the entities that hold the least political clout.

This Article advocates curtailment based on a combination of contractual and, within contract types, temporal-priority-based systems, rather than systems based on judgments of social utility (or political influence), for two reasons. First, a social-utility judgment already is embedded in the recommendation to maintain duty-to-serve requirements for households and other smaller users.<sup>325</sup> Second, with smaller users already protected, additional social-utility decisions would just involve judgments about the relative needs of major commercial and industrial companies. Regulators might make those judgments—to provide perhaps the most appealing example, they might decide that in a time of shortage, cryptocurrency operations always should be curtailed first<sup>326</sup>—but the payoff probably would not be worth the effort. Most

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<sup>320</sup> See Thom Patterson, *Genesis of Recall Rooted in California Energy Crisis*, CNN (Oct. 7, 2003, at 12:38 ET), <https://www.cnn.com/2003/ALLPOLITICS/10/06/energy.crisis/index.html> [<https://perma.cc/QY6D-S8EZ>] (linking the recall that ended California Governor Gray Davis's career to blackouts).

<sup>321</sup> See *supra* notes 260–62 and accompanying text.

<sup>322</sup> See *supra* notes 185–89 and accompanying text.

<sup>323</sup> See *supra* notes 224–32 and accompanying text.

<sup>324</sup> See, e.g., CAL. WATER BDS., REFERENCE GUIDE ON THE EMERGENCY REGULATION AND CURTAILMENT ORDERS IN THE SACRAMENTO–SAN JOAQUIN DELTA (DELTA) WATERSHED 3–4 (2021), [https://www.waterboards.ca.gov/drought/delta/docs/refg\\_eregorder.pdf](https://www.waterboards.ca.gov/drought/delta/docs/refg_eregorder.pdf) [<https://perma.cc/GBR6-VLMG>] (explaining that water use may be curtailed to preserve health and safety flows). Allocation based on the reasonableness of water use, rather than temporal priority, also is part of the riparian water-rights systems used in much of the Eastern United States. See, e.g., *Harris v. Brooks*, 283 S.W.2d 129, 133 (Ark. 1955).

<sup>325</sup> See *supra* notes 319–20 and accompanying text.

<sup>326</sup> See Leigh Cummings, Note, *Cryptocurrency Mining and Grid Stabilization in Texas: ERCOT's Opportunity for Redemption*, 53 TEX. ENV'T L.J. 168, 186–88 (2023) (describing critiques of cryptocurrency while acknowledging arguments that cryptocurrency's flexibility could support demand-response programs).

such judgments likely would involve time-consuming and highly contestable determinations about which forms of data processing matter most, and regulators and utilities will not be well situated to make those judgments. Categorical rules and market ordering would be much more efficient.

A third key question is who would implement the system. This proposal envisions operating rules and principles coming from the utilities but based on policy provided by state legislators and regulators and subject to approval by those regulators. As discussed in Part I, the Minnesota and Texas legislatures have already directed utilities and public utility commissions to implement new policies around data center grid impacts and curtailments,<sup>327</sup> and state commissions have also begun to use existing authority to do the same.<sup>328</sup> Other states can follow suit. Such a state-based approach fits comfortably within the jurisdictional divide Congress created in the Federal Power Act of 1935,<sup>329</sup> which gives FERC authority to regulate wholesale sales of electricity in interstate commerce and retains state jurisdiction over retail sales.<sup>330</sup>

Indeed, in 2025, when PJM<sup>331</sup> asked FERC for authorization to address data center large loads using a framework that included voluntary and mandatory curtailments, numerous commentators objected on grounds that such actions exceeded FERC's jurisdiction and infringed on state authority.<sup>332</sup> Similar jurisdictional concerns arose when the Department of Energy proposed that FERC adopt a rule that would create standardized interconnection procedures and terms

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<sup>327</sup> See *supra* notes 171–73 and accompanying text.

<sup>328</sup> See *supra* notes 159–60 and accompanying text.

<sup>329</sup> 16 U.S.C. §§ 791a–828c.

<sup>330</sup> See *id.* § 824(a)–(b)(1); Matthew R. Christiansen & Joshua C. Macey, *Long Live the Federal Power Act's Bright Line*, 134 HARV. L. REV. 1360, 1371–74 (2021) (discussing the Federal Power Act's jurisdictional line between federal and state regulation).

<sup>331</sup> See *supra* note 169.

<sup>332</sup> See generally, e.g., STU BRESLER & TIM HORGER, LARGE LOAD ADDITIONS PJM CONCEPTUAL PROPOSAL AND REQUEST FOR MEMBER FEEDBACK (2025), <https://www.pjm.com/-/media/DotCom/committees-groups/cifp-lla/2025/20250818/20250818-item-03---pjm-conceptual-proposal-and-request-for-member-feedback--presentation.pdf> [<https://perma.cc/3SL8-NG4Q>] (proposing the creation of a “Non-Capacity-Backed Load” service for new large loads); PJM, CRITICAL ISSUE FAST PATH—LARGE LOAD ADDITIONS: STAKEHOLDER COMMENTS (2025), <https://www.pjm.com/-/media/DotCom/committees-groups/cifp-lla/postings/20250828-stakeholder-comments-cifp-lla.pdf> [<https://perma.cc/BT5E-758X>] (summarizing criticism of PJM proposal, including jurisdictional objections); Ethan Howland, *PJM Stakeholders Overwhelmingly Pan Proposal for Data Center Interconnection*, UTIL. DIVE (Sep. 3, 2025), <https://www.utilitydive.com/news/pjm-stakeholders-ncbl-data-center-fast-track/759096/> [<https://perma.cc/XF9Y-CJML>] (discussing PJM's plan to address new data centers and acknowledging criticism that suggests this would represent a jurisdictional overreach); Alexander C. Kaufman, *Hyperscalers Give PJM a Counterproposal on Load Flexibility*, LATITUDE MEDIA (Oct. 8, 2025), <https://www.latitudemedia.com/news/hyperscalers-give-pjm-a-counterproposal-on-load-flexibility/> [<https://perma.cc/4P9W-6794>] (same).

for large-load transmission-system connections and that included curtailment provisions.<sup>333</sup>

In the meantime, FERC has directed PJM to revise its Open Access Transmission Tariff to include options for interim and permanent firm and nonfirm—i.e., curtailable—transmission service, thus enabling large loads colocated with generation plants to reduce their reliance on the transmission grid.<sup>334</sup> According to FERC Commissioner David Rosner, these new options will support faster grid connections for large loads, reduce “strain on the grid,” and lower everyone’s electricity costs.<sup>335</sup> Whether the federal courts ultimately confirm that FERC and RTOs have authority under the Federal Power Act for such regulation of large-load interconnections to the transmission grid remains to be seen. Even if courts do confirm this authority, however, there will likely still be a significant role for state regulation of utility tariffs governing large loads, including regulation of pricing and curtailment terms.<sup>336</sup>

A final important question is how long the system would last. It could be a temporary bridging strategy, primarily for periods when peak demand outstrips or threatens to outstrip supply. Innovative storage technologies might become so effective that fluctuations in electricity supply and demand are no longer a major issue.<sup>337</sup> But mismatches between supply, demand, and transmission capacity also could be recurring features of electricity systems for years to come. Going forward, connect-and-manage approaches for both supply and demand may be essential features of energy law.

### B. *Advantages of Demand-Side Connect-and-Manage*

This Article’s discussions of natural gas and water suggest that this kind of system can work. But neither natural gas history nor the Western experience with prior appropriation doctrine for water provides unequivocal support for our proposal; each experience is

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<sup>333</sup> See Letter from Chris Wright, Sec’y of Energy, U.S. Dep’t of Energy, to David Rosner, Chairman, FERC 8–14 (Oct. 23, 2025), <https://www.energy.gov/sites/default/files/2025-10/403%20Large%20Loads%20Letter.pdf> [<https://perma.cc/ACC6-DEDT>]; Francisco “A.J.” Camacho, *Wright Calls on FERC to ‘Reform’ Grid Regulations*, E&E NEWS: ENERGYWIRE (Oct. 24, 2025, at 06:59 ET), <https://www.eenews.net/articles/wright-calls-on-ferc-to-reform-grid-regulations/> [<https://perma.cc/NQG6-AYEZ>]; Nico Portuondo, *Wright’s Data Center Push Draws Republican Scrutiny*, E&E NEWS: E&E DAILY (Oct. 30, 2025, at 06:48 ET), <https://www.eenews.net/articles/wrights-data-center-push-draws-republican-scrutiny-2/> [<https://perma.cc/WV5M-N6KG>].

<sup>334</sup> PJM Interconnection, L.L.C., 193 FERC ¶ 61,217, para. 160 (2025) (describing required new transmission services); *id.* paras. 4–11 (Rosner, Comm’r, concurring); *see also id.* at 7 figs. 1–4 (illustrating the different transmission service options).

<sup>335</sup> *Id.* paras. 4, 11.

<sup>336</sup> *Id.* para. 167 (majority opinion) (describing state jurisdiction).

<sup>337</sup> This seems unlikely, but energy storage is growing rapidly. *See U.S. Battery Capacity Increased 66% in 2024*, U.S. ENERGY INFO. ADMIN. (Mar. 12, 2025), <https://www.eia.gov/todayinenergy/detail.php?id=64705> [<https://perma.cc/E6LQ-9U86>].

also replete with cautionary lessons. In the discussion that follows, this Section explains several reasons why, despite some reasons for caution, demand-side connect-and-manage offers promise for electricity—and might work significantly better than it does for water or natural gas.

One reason is that the need for curtailment might turn out to be relatively modest. In a 2025 study, researchers from Duke University evaluated the GW of new electricity demand that could be added to the U.S. electric grid “before total load exceeds what system planners are prepared to serve, provided the new load can be temporarily curtailed as needed.”<sup>338</sup> The researchers found that the U.S. grid could add “76 GW of new load” and that such an addition would require “an average annual load curtailment of 0.25%.”<sup>339</sup> Seventy-six GW is not a small amount of power: It is “equivalent to 10% of the nation’s current aggregate peak demand.”<sup>340</sup> And curtailment rates of 0.25% are relatively modest. Additionally, curtailments, when they happen, “would be relatively short, at an average of 1.7 hours,” and for ninety percent of the curtailment periods, no more than fifty percent of the new load would need to be curtailed.<sup>341</sup> Those curtailment rates, while modest, are not trivial; most people and businesses would not want to be without power for even one day per year.<sup>342</sup> But they are tiny compared with the curtailment rates that natural gas systems confronted in the 1970s<sup>343</sup> or that water systems in parts of the West face every year.<sup>344</sup> And if major electricity users can insure against that risk—perhaps through flexibility in power use or through procuring backup supplies—a 0.25% or even one percent curtailment rate might seem like a much more manageable problem than waiting years for a grid connection.<sup>345</sup>

Additionally, some of the administrative challenges of a demand-side connect-and-manage approach are likely to be much smaller for electricity than they are for other resources—particularly water. Curtailment rules are hard to enforce against water users partly because water distribution systems are so dispersed and, often, information poor.<sup>346</sup> Some Western water systems are meticulously monitored,

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<sup>338</sup> See NORRIS ET AL., *supra* note 38, at 2, 4.

<sup>339</sup> *Id.* at 2. The report also provides data showing the increased new load that could be added at 0.5% (ninety-eight GW) and 1.0% (126 GW) curtailment rates. *Id.*

<sup>340</sup> *Id.*

<sup>341</sup> *Id.*

<sup>342</sup> At a 0.25% curtailment rate, an electricity user would be curtailed for approximately eighty-five hours per year. *Id.* at 20.

<sup>343</sup> See *supra* Section II.A.

<sup>344</sup> See *supra* Section II.B.

<sup>345</sup> See BLOOM ENERGY, *supra* note 13, at 3 (discussing significantly longer timelines to connect to utility grids than data centers have expected, resulting in data centers turning to on-site power generation).

<sup>346</sup> See Alvar Escrivá-Bou, Henry McCann, Ellen Hanak, Jay Lund & Brian Gray, *Accounting for California’s Water*, 8 CAL. J. POL. & POL’Y, no. 3, 2016, at 1, 11–18 (describing information gaps in California water management).

but with many, just getting basic information about flows and diversions is difficult, especially on a real-time basis.<sup>347</sup> Additionally, turning off supply is rarely as simple as having a manager or regulator flip a switch.<sup>348</sup> Electricity management is much more information rich—grid engineering cannot function without high levels of information—and grid operations are centrally coordinated to a degree that even the most sophisticated water systems cannot approach.<sup>349</sup> That should make enforcing priority rules much more technologically feasible.

Third, secondary markets could work better because trading electricity is likely to be easier than trading natural gas pipeline capacity and much easier than trading water. Water exchanges are often precluded by the limited or nonexistent capacity to convey water from places of availability to places of need.<sup>350</sup> A buyer in Wyoming, for example, cannot purchase water from a seller in Washington, no matter how much each party might wish to complete the deal. And even when infrastructure might allow water trades, the third-party and environmental effects of those trades can be prohibitively difficult to manage.<sup>351</sup> Natural gas trading does not involve the same types of third-party impacts, and pipeline networks are much more extensive than they are for water, but infrastructure limits on transfers still are an issue.<sup>352</sup>

The electric grid also has bottlenecks and interconnection challenges, but those challenges pale in comparison to the difficulties involved with moving water across large geographic areas.<sup>353</sup> Diverting more water from a river has more direct environmental—and often cultural—impacts than shifting the paths of electrons.<sup>354</sup> Additionally,

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<sup>347</sup> See *id.*; MOLLY BRUCE ET AL., INFORMATION NEEDS FOR WATER MARKETS 16 (2024), [https://www.law.berkeley.edu/wp-content/uploads/2023/09/Information-Needs-for-Water-Markets\\_2024-11-14.pdf](https://www.law.berkeley.edu/wp-content/uploads/2023/09/Information-Needs-for-Water-Markets_2024-11-14.pdf) [<https://perma.cc/TFA3-8CJ3>] (describing water managers' perceptions of important information gaps).

<sup>348</sup> In some states, water regulators can physically close a headgate, but doing so generally requires driving out to the headgate. See GREEN NYLEN ET AL., *supra* note 35, at 84 & n.442 (describing this authority).

<sup>349</sup> See OFF. OF CYBERSECURITY, ENERGY SEC., & EMERGENCY RESPONSE, *supra* note 90, at 2 (describing the activities of a balancing authority).

<sup>350</sup> See Owen, *supra* note 310, at 1601–02.

<sup>351</sup> See Joseph L. Sax, *Understanding Transfers: Community Rights and the Privatization of Water*, 14 HASTINGS W.-NW. J. ENV'T L. & POL'Y 33, 37 (2008) (describing the importance of third-party effects).

<sup>352</sup> See *Market Dynamics Vary at Key Natural Gas Pricing Hubs*, U.S. ENERGY INFO. ADMIN. (Oct. 23, 2024), <https://www.eia.gov/todayinenergy/detail.php?id=63504> [<https://perma.cc/U5Q9-QYHQ>] (describing interconnection but also areas where infrastructure limits supply).

<sup>353</sup> See Oskar Kvarnström, Alessio Scanziani, Rena Kuwahata & Jacques Warichet, *Grid Congestion Is Posing Challenges for Energy Security and Transitions*, INT'L ENERGY AGENCY (Mar. 25, 2025), <https://www.iea.org/commentaries/grid-congestion-is-posing-challenges-for-energy-security-and-transitions> [<https://perma.cc/D539-SPV8>].

<sup>354</sup> See Freyfogle, *supra* note 298, at 32 (“Water flows are . . . communally embedded . . .”).

electricity markets already are robust, and the exchanges required for a demand-side connect-and-manage approach to work would just build upon existing systems.<sup>355</sup>

Indeed, a simple and plausible hypothetical illustrates how the system might function. Suppose a cluster of major new data centers is located in a jurisdiction that allows or requires utilities to impose a mandatory curtailment requirement on new large loads. At times of peak demand or insufficient transmission capacity, the data center might allocate some data-processing tasks to different times of day or to other data centers with reduced curtailment risks.<sup>356</sup> It might also contract with a company that aggregates and sells demand-response commitments—many such entities already exist<sup>357</sup>—and that company would produce sufficient demand reductions to compensate for the data center energy use that might otherwise be curtailed.<sup>358</sup> Or the data center might install a large battery array, which it could use to lower its take of grid energy at times of high prices and as a backup supply.<sup>359</sup> None of these strategies are novel, and that is the key point. A demand-side connect-and-manage model might lead to new technological innovations and business models,<sup>360</sup> but it also could work with the technologies and business models that already exist.<sup>361</sup>

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<sup>355</sup> See Kvarnström et al., *supra* note 353.

<sup>356</sup> The extent to which data centers can do this is debated. See Severin Borenstein, *Can Data Centers Flex Their Power Demand?*, ENERGY INST. HAAS: ENERGY INST. BLOG, (Apr. 14, 2025), <https://energyathaas.wordpress.com/2025/04/14/can-data-centers-flex-their-power-demand/> [<https://perma.cc/QLR3-BHHZ>] (questioning “the common narrative that data centers are so expensive that they must run at 100% of capacity once they are built in order to make them pencil out”).

<sup>357</sup> See, e.g., *FAQ—Demand Response Providers (DRPs)/Aggregators*, CAL. PUB. UTILS. COMM’N, <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/registered-demand-response-providers-drps-aggregators-and-faq> [<https://perma.cc/MB8Q-8M3H>] (last visited Nov. 13, 2025).

<sup>358</sup> See *supra* notes 120–22 and accompanying text (explaining demand response and the role of demand-response aggregators).

<sup>359</sup> See, e.g., VOLTS: *Can Data Centers Be Good Grid Citizens?* (Volts, July 2, 2025), <https://www.volts.wtf/p/can-data-centers-be-good-grid-citizens> [<https://perma.cc/4HF2-2JD3>] (describing how “combining large-scale batteries with a more efficient internal power network” can reduce grid impacts of data centers); Julian Spector, *In a First, a Data Center Is Using a Battery to Get Online Faster*, CANARY MEDIA (Oct. 24, 2025), <https://www.canarymedia.com/articles/batteries/aligned-data-center-get-online-faster> [<https://perma.cc/VN7J-DXKG>].

<sup>360</sup> Jeff St. John, *Georgia Hashes Out Plan to Let Data Centers Build Their Own Clean Energy*, CANARY MEDIA (Dec. 5, 2025), <https://www.canarymedia.com/articles/clean-energy/georgia-data-centers-build-clean-energy> [<https://perma.cc/U9A3-S7CP>] (reporting on efforts to create a regulatory and business pathway in Georgia to allow data centers to procure solar energy directly rather than exclusively through the regulated monopoly utility).

<sup>361</sup> See *supra* note 132 and accompanying text (discussing how AI can improve grid capacity and data center flexibility).

### C. Cautionary Lessons

Both natural gas and water management suggest that connect-and-manage approaches could work for major new electricity users. But they also provide cautionary lessons, which the designers of connect-and-manage systems would be wise to consider.

The most important lesson is that finding and sticking to simple curtailment rules is difficult. For both water and natural gas, governing law appears to provide elegantly simple allocation principles—temporal priority for water and contractual priority for natural gas.<sup>362</sup> For a variety of reasons, however, both systems have struggled to adhere to those principles. With water, one key reason has been the informational challenges associated with quantifying and implementing water rights.<sup>363</sup> But another reason has been widespread reluctance to follow—or even outright hostility toward—priority as a core allocation principle.<sup>364</sup> Many critics of Western water systems have argued that other principles—social equity, the reasonableness of use, or the need for environmental protection—should override temporal priority, and Western water law provides some legal grounding for these claims.<sup>365</sup> Consequently, principles for allocation are often evolving and contested in practice as well as in theory. As discussed above, natural gas allocation raised similar challenges during the 1970s and 1980s, and regulators and courts were sometimes reluctant to simply allocate gas according to contractual terms.<sup>366</sup>

For electricity allocation, similar debates could easily arise. If shortages are infrequent and somewhat predictable and major energy users are prepared for those shortages, curtailments might proceed with relatively little controversy.<sup>367</sup> That is particularly likely if the need for curtailments is transparent and mechanisms for imposing them are straightforward; as any lawyer knows, clear rules often limit disputes,

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<sup>362</sup> See *supra* Part II.

<sup>363</sup> See *supra* notes 311–12 and accompanying text.

<sup>364</sup> See *supra* notes 285–89 and accompanying text.

<sup>365</sup> See Freyfogle, *supra* note 298, at 42 (“Beneficial use as it stands today is an affront to attentive citizens who know stupidity when they see it . . .”).

<sup>366</sup> See *supra* notes 224–34 and accompanying text.

<sup>367</sup> This is a plausible scenario. See NORRIS ET AL., *supra* note 38, at 25 (predicting that curtailments would be rare); see also CARLO BRANCUCCI ET AL., FLEXIBLE DATA CENTERS: A FASTER, MORE AFFORDABLE PATH TO POWER 3–7 (2025), [https://cdn.prod.website-files.com/60dbdcca2e4b1919e8894fa5/6930abf1be0f36db6fc27157\\_Whitepaper%20-%20With%20Appendix.pdf](https://cdn.prod.website-files.com/60dbdcca2e4b1919e8894fa5/6930abf1be0f36db6fc27157_Whitepaper%20-%20With%20Appendix.pdf) [<https://perma.cc/7N7L-V4UA>] (modeling a study showing technical feasibility of flexible (i.e., curtailable) electricity service for data centers, with that flexibility resulting in faster connection time, reduced need to build new supply, and grid power available to such data centers with flexible service more than ninety-nine percent of all hours of the year).

while ambiguity and procedural complexity invite contestation.<sup>368</sup> But if the need for curtailment grows, major users are almost certain to argue for more nuanced standards. And they may have a point; there may be situations in which a simple priority rule would lead to curtailments in places where the grid benefits would be minor and the impacts would be large, and grid managers might conclude that a different standard for curtailments would make more sense.<sup>369</sup>

Another clear and intertwined lesson is that curtailment can get very political. With water, users routinely contest the need for specific curtailments and, sometimes, the need for regulatory systems that might even consider curtailment.<sup>370</sup> Similarly, with natural gas, many of the court decisions and orders of the 1970s and 1980s arose because major users were willing to challenge curtailment plans in court.<sup>371</sup> That sort of conflict does not always arise; there are places in the West where water use curtailment is nearly as routine as a stoplight's curtailment of traffic.<sup>372</sup> But if the stakes are high enough, electricity users probably will resist curtailment, even when it might seem necessary. If those users are some of the largest companies in the world, their resistance may have some force.<sup>373</sup>

A final caution, which again arises primarily from water management, is that allocation and curtailment rules can create perverse incentives. One recurring critique of prior appropriation is that it encourages would-be water users to divert water early, thus establishing the seniority of their rights, and to maintain those diversions, lest those rights be lost because of nonuse.<sup>374</sup> In other words, key aspects of the system

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<sup>368</sup> See Louis Kaplow, *Rules Versus Standards: An Economic Analysis*, 42 DUKE L.J. 557, 564 (1992) (arguing that rules will often outperform standards in inducing compliance).

<sup>369</sup> This might happen because congestion is rarely uniform across large areas of the grid. See, e.g., MISO, 2024 NEAR-TERM CONGESTION STUDY REPORT 9–10 (2024) (showing results of congestion modeling exercises).

<sup>370</sup> See, e.g., Joe Parris, *Negotiations Continue on Complicated Idaho Water Fight, Groundwater Users Remain Optimistic*, KTVB (June 13, 2024, at 18:40 MT), <https://www.ktvb.com/article/news/agriculture/inside-ag/negotiations-continue-complicated-idaho-water-rights-fight-groundwater-users-farmers-optimistic-deal/277-880f491f-64df-4e36-b864-dc16d5ac1bbc> [<https://perma.cc/Q28V-B6PZ>]; Camille von Kaenel, *California Lawmaker Drops Plan to Regulate Senior Water Rights Holders*, E&E NEWS: GREENWIRE (June 12, 2024, at 11:00 ET), <https://www.eenews.net/articles/california-lawmaker-drops-plan-to-regulate-senior-water-rights-holders/> [<https://perma.cc/7K34-2GJ2>] (describing successful opposition to water-rights regulation).

<sup>371</sup> See *supra* notes 224–34 and accompanying text (discussing challenges).

<sup>372</sup> See GREEN NYLEN ET AL., *supra* note 35, at 84 (“Some states curtail quickly, with minimal procedure.”).

<sup>373</sup> See generally Stein, *supra* note 12 (discussing the political implications of Big Tech's increasing influence on energy systems).

<sup>374</sup> See *WaterWatch of Or. v. Water Res. Dep't*, 501 P.3d 507, 510 (Or. 2021) (“That use-it-or-lose-it frame of prior appropriation provides an incentive for water right holders to divert and use as much water as possible to maintain their rights.”).

discourage conservation.<sup>375</sup> Similarly, if priority is a basis for allocating scarce electricity, data centers will have an incentive, though probably a fairly modest one, to rush construction and claim higher-priority rights. Furthermore, if electricity shortages are to be allocated on the basis of minimizing economic injury rather than some strict priority standard, major users may have a disincentive to invest in contingency plans; the entities without such plans will have the strongest claims of vulnerability.

These are all significant concerns, and they explain why this Article has emphasized relatively simple and predictable operating principles over more nuanced and contextual social-value-based judgments.<sup>376</sup> They also explain why legislators, regulators, and utilities would be wise to specify their rules transparently and to offer as much notice of curtailments as is possible—and why, even with transparency and notice, grid managers should be prepared for controversy. Nevertheless, this potential for controversy is not a reason to avoid connect-and-manage approaches, for controversy is almost always a consequence of allocating a scarce resource. And, as explained below, at least some periods of electricity scarcity are probably unavoidable.

#### *D. Why Not a Federal Supply-Side Solution?*

This Article has emphasized a somewhat decentralized and market-oriented solution to the challenge of supplying data-center-related increases in electricity demand. That emphasis might raise another question, to which this final Section responds: Why not rely instead on a federal-government-led push to boost electricity supplies? After all, as noted in Part I, the United States has taken similar approaches during past periods of demand growth. During World War II, industrial demand increased rapidly, and the federal government undertook aggressive efforts to boost supplies.<sup>377</sup> Throughout the middle part of the twentieth century, the federal government also was actively involved in building energy generation facilities, most of which supplied hydropower.<sup>378</sup> The Trump Administration has advocated similar efforts,<sup>379</sup> and it already has taken dramatic and costly steps to compel some aging coal plants to stay open.<sup>380</sup> Perhaps, one might think, large-scale power plant construction is due for a renaissance, with the federal government playing an active, facilitative role.

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<sup>375</sup> See *N. Kern Water Storage Dist. v. Kern Delta Water Dist.*, 54 Cal. Rptr. 3d 578, 590 (Ct. App. 2007) (noting this perverse incentive).

<sup>376</sup> See *supra* notes 325–326 and accompanying text.

<sup>377</sup> See Cohn et al., *supra* note 75, at 132–33 (discussing wartime interconnection actions).

<sup>378</sup> See *supra* note 76 and accompanying text (discussing federal dam-building era).

<sup>379</sup> See *supra* note 77 and accompanying text (discussing Executive Order No. 14,318 issued under the Trump Administration).

<sup>380</sup> See *supra* note 78 and accompanying text (discussing Trump Administration actions).

Explaining the pitfalls of this approach and the lessons one should and should not draw from historic periods of electric grid expansion are subjects for another article. Nevertheless, there are a few reasons why the more decentralized, demand-side approaches are likely to remain necessary. The most important reason is that no matter how aggressively the United States pursues a new electricity generation boom, growth in generation will likely struggle to catch up with growth in demand.<sup>381</sup> There still will be mismatches to manage. And those struggles are particularly likely if the United States is trying to achieve that growth during a period of economic protectionism and turbulence.<sup>382</sup>

Additionally, the historic experience with building a way out of energy crises is a decidedly mixed one. For much of the twentieth century, that approach seemed to work reasonably well.<sup>383</sup> Energy production grew dramatically while prices dropped, and the massive environmental costs of building large-scale hydropower and fossil fuel facilities had not yet become major political concerns.<sup>384</sup> But the politics shifted,<sup>385</sup> economies of scale dissipated,<sup>386</sup> prices began to climb;<sup>387</sup> and, eventually, many utilities were left trying to pass through to their ratepayers the costs of expensive power plants that were never put to use.<sup>388</sup> That history does not undercut the arguments for constructing new supply or, in some settings, for an active federal role in promoting electricity generation and transmission expansion.<sup>389</sup> But it does counsel caution about placing too many eggs in the supply-side basket. Complementary approaches will be needed, and this Article has proposed a promising option.

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<sup>381</sup> See *supra* notes 77–88 and accompanying text (summarizing challenges to building new power generation facilities).

<sup>382</sup> See Brian Martucci, *Tariffs to Spike Power Generation Costs: Reports*, UTIL. DIVE (June 9, 2025), <https://www.utilitydive.com/news/tariffs-to-spike-power-generation-costs-reports> [<https://perma.cc/6GGU-JGHT>].

<sup>383</sup> See RICHARD F. HIRSH, *POWER LOSS* 46–51 (1999) (describing the success of the “grow-and-build” strategy).

<sup>384</sup> See *id.*

<sup>385</sup> See *id.* at 63–70.

<sup>386</sup> See Laurits R. Christensen & William H. Greene, *Economies of Scale in U.S. Electric Power Generation*, 84 J. POL. ECON. 655, 656 (1976).

<sup>387</sup> See Earle H. O’Donnell & Laurel W. Glassman, *Industrial Opportunities to Engage in Direct Purchase of Electricity: The Purchaser’s Perspective*, 7 J. ENERGY & NAT. RES. L. 101, 104–05 (1989) (describing “spiraling energy costs”).

<sup>388</sup> See Richard J. Pierce, Jr., *The Regulatory Treatment of Mistakes in Retrospect: Canceled Plants and Excess Capacity*, 132 U. PA. L. REV. 497, 497–99 (1984).

<sup>389</sup> See Cohn et al., *supra* note 75, at 133 (discussing ways in which the federal government successfully promoted energy development during World War II).

### CONCLUSION

The United States's electricity systems stand at a consequential juncture. In one possible future, the duty-to-serve, excess-capacity governance system will continue to reign supreme, but new generation will come online slowly. The resulting shortfalls could lead to the resurrection of coal-fired power plants, data centers seeking side deals with electricity providers, and, despite these efforts, inadequate supplies for growing industries and lowered service quality for existing consumers. Alternatively, the United States might respond to growing demand with a flurry of new power plant construction, only for data center growth to fall well short of projections, leaving utilities and their customers paying huge bills for a collection of white elephants. Neither scenario is desirable.

Drawing inspiration from management systems for water and natural gas, this Article has proposed another way. Major new users could be allowed to connect to the grid and receive service with the understanding that they could be curtailed in the rare circumstances when demand exceeds supplies. Those users also could use secondary markets to hedge against the risk of curtailment. New generation still would likely be needed, but not as quickly and not as much. And the risks associated with supply-demand mismatches would be borne primarily by data centers, which are run by or for large, sophisticated companies able to manage those risks, rather than by ordinary consumers. The system also would create powerful incentives for innovation, which might lead to new technologies, new business models for energy production and distribution, or both. It is not guaranteed that these salutary effects would occur; experience with water and natural gas, as well as common sense, suggest that connect-and-manage systems will inevitably face challenges. But even though it creates risks, this alternative system may be the best way forward.