# GOVERNING THE ENERGY BOTTLENECK

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**Abstract:** The electrical grid is falling short of its mandate to accommodate new generation—much of which happens to be "clean" zero-carbon generation—and load (demand). The bottleneck of grid access, which has vexed renewable energy developers, now threatens industries seeking massive quantities of electricity to power single facilities—large loads such as data centers and other artificial intelligence operations.

Many of these highly capitalized loads seek clean energy generation; they could, in theory, fund an energy renaissance and provide scale-based benefits for all consumers. But loads that obtain service or go off grid—co-locating directly with generation—are impacting other consumers' rates and the reliability of service on a networked grid, not offering a renaissance.

The demands for new energy for large loads push the boundaries of what constitutes "just, reasonable, and not unduly discriminatory" electricity service provided by utilities and other grid operators. They raise critical questions about whether factors such as national security and job creation or displacement should affect loads' priority for grid service; how electricity rates should be designed; and how to realize the already-urgent task of connecting new, clean generation.

During World War II, federal leadership rapidly expanded energy generation and transmission. We are not in a world war—and we do not have an energy emergency caused by inadequate domestic energy. But extensive investments in an expanded transmission grid and generation capacity—and updated governance for this grid—are necessary, this time without top-down mandates.

New standards must ensure reliable delivery of electricity to all, fair allocation of large load costs among electricity consumers, and maximization of system benefits. The institutions responsible for these standards are not adapting quickly enough, however. This Article frames the central elements

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of this new electricity governance regime and proposes substantive policy pathways for a rapidly-changing system.

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## INTRODUCTION

The U.S. electric grid and its governance system are now one of the major impediments to economic growth.[3] Generators of zero-carbon energy are clamoring to connect to the grid yet facing long lags.[4] At the same time, demand for electricity ("load") is skyrocketing.[5] Data centers for activities ranging from national air defense to sports betting; artificial intelligence (AI); crypto mining; electrolysis to produce clean (zero carbon) hydrogen; and the electrification of transportation and buildings all contribute to this explosion of demand. [6] Yet the private actors that own and operate the grid are falling

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[3] Statement of Frederick S. "Stu" Bresler on Behalf of PJM Interconnection, L.L.C., Overview of Large Co-Located Load Issues at 4-5 (2024), https://www.pjm.com/-/media/DotCom/library/reports-notices/testimony/2024/20241101-statement-of-stu-bresler-for-ferc-technical-conference-on-colocated-load.ashx (citing the North American Electric Reliability Corporation CEO for the proposition that "unprecedented growth in electric demand is outpacing available capacity to meet that demand"); FED. ENERGY REG. COMM'N, LARGE LOAD CO-LOCATED AT GENERAL FACILITIES TECHNICAL CONFERENCE TRANSCRIPT 8 (2024) [hereinafter "FERC Transcript"] at 16-17 (Commissioner See: "I see data centers and the promise of AI as critical for our economy, and for matters of national security, and I share an eagerness to find new ways to accommodate these important and increasing loads"); Fed. Energy Reg. Comm'n, Order Rejecting Amendments to Interconnection Service Agreement, 189 FERC ¶ 61,078, dissent at 2-3 (Nov. 1, 2024) [hereinafter "FERC Order Rejecting Amendments"] (Commissioner Phillips: "I am deeply concerned that in failing to demonstrate regulatory leadership and flexibility we are putting at risk our country's pole position" on Artificial Intelligence).

[4] *See* JOACHIM SEEL ET AL., LAWRENCE BERKELEY NATL. LAB., GENERATOR INTERCONNECTION COSTS TO THE TRANSMISSION SYSTEM 3 (2023) (observing that "[g]enerator capacity actively seeking transmission interconnection is rapidly increasing in most balancing areas"); Abraham Silverman, Columbia Ctr. On Global Energy Policy, Outlook for Pending Generation in the PJM Interconnection Queue (2024), https://www.energypolicy.columbia.edu/publications/outlook-for-pending-generation-in-the-pjm-interconnection-queue/ (describing the long line for interconnection).

[5] FERC Transcript, *supra* note 3, at 10-11 (Commissioner Christie: "Load has been flat most everywhere in American [sic] for 20 years. But now we're seeing load forecasts shooting up, right? Depending on how much numbers you want to accept, they're either skyrocketing, or they're just rapidly increasing, whatever term you want to use . . .").

[6] ARMAN SHEHABI ET AL., LAWRENCE BERKELEY NATL. LAB., 2024 UNITED STATES DATA CENTER ENERGY USAGE REPORT 5 https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf (reporting that data centers represented 1.9% (76TWh [terawatt-hours]) of total US electricity consumption in 2018, and increased to 4.4% (176 TWh) in 2023, and projected additional increases by 2028 to between 6.7% and 12% of total US electricity consumption); U.S. Energy Info. Admin., Electric

short. They are failing to rapidly interconnect new generation—most of it zero-carbon generation—and are not servicing large loads as quickly as service is demanded.[7] As they strive to partially accommodate demands and address other system challenges such as growing weather extremes, electricity prices are rising, exacerbating current consumers' energy burdens.[8]

Physical limitations of a modern, highly-networked grid with inadequate transmission, and the piecemeal, siloed governance system guiding grid decisions, largely drive these challenges.[9] In 2024, the Federal Energy Regulatory Commission (FERC) denied a proposed increase in electricity service to a load center and similarly blocked special wholesale electricity

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Power Monthly, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=table_d_1 (showing that electric vehicle charging consumption over the same period, grew from 1.58 TWh in 2018 to 7.60 TWh from 2018 to 2023); ERCOT, Large Loads – Impact on Grid Reliability and Overview of Revision Request Package 5 (2023), https://www.ercot.com/committees/tac/lfltf/2023 (follow link "PUBLIC-Overview of Large Load Revision Requests for 8.16.23 Workshop") ("ERCOT, like many grids around the world, is seeing an unprecedented amount of larger Loads interconnecting."); NORTH AMERICAN ELECTRIC RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT 8, 15, 33 (2024) [hereinafter "NERC 2024 Long-Term Assessment"[ (noting that "[e]lectricity peak demand and energy growth forecasts over the 10-year assessment period continue to climb; demand growth is now higher than at any point in the past two decades" and observing that "New England is forecasting unprecedented demand growth [35% over current peak forecast] driven by electrification of heating and transportation," and large increases in peak demand forecasts throughout the United States due to the electrification of heating and transportation); T. BRUCE TSUCHIDA ET AL., BRATTLE GROUP, ELECTRICITY DEMAND GROWTH AND FORECASTING IN A TIME OF CHANGE (2024), https://www.brattle.com/wp-content/uploads/2024/05/Electricity-Demand-Growth-and-Forecasting-in-a-Time-of-Change-1.pdf (observing that data centers alone are projected to add new load equal to New York City's load "every five years or so"); FERC Transcript, *supra* note 3 (observing that for the New York grid operator—NY ISO—the "shift to electrification of heating and transportation" will "outweigh the large loads [large industrial operations and data centers] by the time you get out in the 10 year and 10 year plus horizon").

[7] Elevate Energy Consulting, An Assessment of Large Load Interconnection Risks in the Western Interconnection 8, https://www.wecc.org/sites/default/files/documents/products/2025/Report_WECC%20Large%20Loads%20Risk%20Assessment%204.pdf (noting that for ten utilities in the Western Interconnection, the total load (demand) capacity waiting in queues is 44,650 MW, which is "nearly equivalent" to the total system peak demand for those utilities). In other words, this is a doubling in demand.

[8] *See, e.g.*, MOLLY ROBERTSON, RESOURCES FOR THE FUTURE, WHY PRICES SOARED IN RECENT AUCTION HELD BY A MAJOR ELECTRIC GRID OPERATOR, Oct. 4, 2024, https://www.resources.org/common-resources/why-prices-soared-in-a-recent-auction-held-by-a-major-electric-grid-operator/ (describing the factors driving the regional grid operator PJM's unprecedented $14.7 billion auction for new generation capacity).

[9] For overall siloing governance challenges, *see* Alexandra Klass, Joshua Macey, Shelley Welton, and Hannah Wiseman, Grid Reliability Through Clean Energy, 74 Stan. L. Rev. 969 (2022).

rates to cover the costs of large load—particularly crypto mining.[10] At the same time, some state utility commissions oversaw major utility investments in generation capacity to serve large load, in some cases resulting in substantially higher rates for existing customers.[11]

The impacts of the inadequate federal and state governance system for a changing grid could be widespread. Utilities could build too much new generation—much of it fossil-fueled—based on inaccurate demand projections. Residential and commercial customers' energy costs could rise dramatically; in some areas, they already are. And for large load proponents, some energy regulators believe that FERC, in failing to modify old governance principles, is "creating unnecessary roadblocks to an industry that is necessary for our national security."[12] In emphasizing missed opportunities to-date, large load proponents argue that by demanding and building massive amounts of new generation, large load sources "could well anchor the development of the very energy infrastructure that our nation so sorely needs."[13] Indeed, many of these loads have deep pockets and are willing to pay for any generation that can be rapidly constructed.[14]

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[10] FERC Order Rejecting Amendments, *supra* note 8; Fed. Energy Reg. Comm'n, Order Rejecting Proposed Rate Schedules, 188 FERC ¶ 61,132 (2024) [hereinafter "FERC Order Rejecting Proposed Rate"]. The order rejecting Amazon's increased use of electricity from Talen's nuclear plant demonstrates how law impedes the growth of large load. The order rejecting higher rates for large load, and incentivizing the load to space itself evenly geographically, would appear to be the path for large load but may cause utilities—which requested the rate increase to accommodate this load—to find other ways to block it. It also will push any higher utility costs caused by large loads to other customer classes.

[11] Eliza Martin and Ari Peskoe, Extracting Profits from the Public: How Utility Ratepayers Are Paying for Big Tech's Power 16. For some innovative utility approaches to-date, which seemingly better link the costs of new, large load to that load, see ANDREW SATCHWELL ET AL., LAWRENCE BERKELEY NATL. LAB., ELECTRICITY RATE DESIGNS FOR LARGE LOADS: EVOLVING PRACTICES AND OPPORTUNITIES (2025), https://eta-publications.lbl.gov/sites/default/files/2025-01/electricity_rate_designs_for_large_loads_evolving_practices_and_opportunities_final.pdf; Joint Legislative Audit and Review Commission (JLARC), COMMONWEALTH OF VIRGINIA, REPORT TO THE GOVERNOR AND THE GENERAL ASSEMBLY OF VIRGINIA, DATA CENTERS IN VIRGINIA 2024 at v, https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf (observing that although staff found that current electricity rates "appropriately allocate costs to the customers responsible for incurring them, including data center customers," the sheer increase in demand will cause "new generation and transmission" to be "built that would not otherwise be built" and that utilities will have to import more electricity to serve all customers, resulting in an estimated $14 to $37 average monthly electricity bill increase in constant dollars by 2040 (not including inflation) for typical residential customers.

[12] FERC Order Rejecting Amendments, *supra* note 8, at 3 (Commissioner Phillips, dissenting).

[13] FERC Transcript, *supra* note 3, at 9.

[14] FERC Transcript, *supra* note 4, at 81 (comments of Senior Vice President, LS Power Development LLC: "We've talked to a lot of data centers, they're not that price sensitive . . . .").

As we explore here, however, much of the new construction appears to primarily benefit the large loads with deep pockets, failing to produce the synergies between industrial and retail load that previously arose from a networked grid. The new construction is also not predominantly zero-carbon "clean" energy, in part due to transmission interconnection lags for this energy.[15]

During the last surge of load growth—when the United States entered World War II—those responsible for providing a reliable and adequate supply of electricity came through.[16] Utilities that controlled transmission lines allowed new generators and users to interconnect with the transmission lines to send and receive electricity.[17] Much of this happened on the back of centralized governance—federal mandates for generation and transmission expansions.[18]

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[15] *See e.g.*, Chevron's as GE Nova's natural gas-fired "power foundries" for data centers. Engine no. 1, chevron, and GE to power U.S. data centers, Chevron, Jan. 28, 2025, https://www.chevron.com/newsroom/2025/q1/power-solutions-for-us-data-centers. *See also* Commonwealth of Virginia Corporation Comm'n, *supra* note 3, at 226 (noting a Virginia data center that built an on-site natural gas fired power plant); *id*. at 196 ("Last week, Google announced a partnership with Intersect Power and TPG . . . whereby we will build new data centers in co-development with new generation going forward").

[16] Commonwealth of Virginia State Corp. Comm'n, Data Load Center Technical Conference 13 (2024) (describing current load growth due to data centers as "a once-in-a-generation challenge and the largest load growth scenario since the conclusion of World War II"); JULIE COHN, THE GRID: BIOGRAPHY OF AN AMERICAN TECHNOLOGY 143 (2017):

> [A] [Federal Power Commission] survey [after 1935]. . . indicated that eastern and midwestern industrial centers of the country threatened to run short of power. . . . Further, the survey urged that "careful planning under Federal supervision of new power plants and facilities for transmission is required to promote the safety and welfare of the Nation.' . . . . The survey concluded that interconnection and coordination could obviate the need for much of the new capacity otherwise required.").

*See also infra* note 18 (describing extensive investments in transmission).

[17] *Opinions and Decisions of the Federal Power Commission, With Appendix of Selected Orders in the Nature of Opinions*, ed. Federal Power Commission, vol. 2 (showing World War II interconnection orders); JULIE COHN, BAKER INSTITUTE, CONNECTING PAST AND FUTURE: A HISTORY OF TEXAS' ISOLATED POWER GRID (2022), https://www.bakerinstitute.org/research/connecting-past-and-future-history-texas-isolated-power-grid (describing numerous Federal Power Commission orders and emergency orders requiring utilities and regions to interconnect to support wartime activity); COHN, THE GRID, *supra* note 16, at 149-150:

> The interconnections built through federal and private sector cooperation proved critical to meeting defense power demands. All told, . . . the government and private utilities together assured that hundreds of billions of kilowatt-hours of electricity traveled across roughly two hundred thousand miles of power lines to both defense and domestic users. With only a 25 percent increase of installed capacity from 1940 to 1945, the nation's power system generated nearly 60 percent more electricity during the war years.

[18] *Supra* note 17.

Federal leadership drove up energy production by approximately 60% through a combination of new generation and transmission capacity.[19]

Two executive orders in January of 2025, from two different administrations,[20] similarly call for increased federal involvement in expanding grid access in the name of national security – without increasing costs or reducing reliability for residential customers. Top-down, centralized mandates akin those of the 1940s are not advisable; we are not in the throes of a world war, and President Trump's declaration of an energy emergency, designed in part to spur classified, military-approved construction of fossil fueled energy for data centers, problematically steers U.S. energy development away from energy markets and public sentiment.[21] Nor are the purported drivers of an energy emergency—inadequate production of fossil fuels and related infrastructure—present. The real emergency lies in high retail prices driven largely by inadequate regional transmission investments by utilities; rising weather extremes; and, inadequate rate governance to allocate the costs of new, large demand to load loads.

We must find alternative ways for the electricity grid to meet the mandate long placed on it—to provide all electricity demanded, all of the time, in a reliable fashion, and at a "just" (fair) and reasonable price.[22] This grid also must meet the more recent yet urgent mandate of addressing climate change. As it stands, we are notably short of that mark.[23]

The U.S. grid is a highly networked one. While the first electricity service was distinctly local, utilities quickly realized the economies of scale of interconnecting with each other to share power.[24] Three large, regional interconnected mazes of wires emerged in North America, and for a long

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[19] Cohn, *The Grid*, 112.

[20] https://www.whitehouse.gov/presidential-actions/2025/01/declaring-a-national-energy-emergency/, https://bidenwhitehouse.archives.gov/briefing-room/presidential-actions/2025/01/14/executive-order-on-advancing-united-states-leadership-in-artificial-intelligence-infrastructure/

[21] Executive Order, Declaring a National Energy Emergency, Jan. 20, 2025, https://www.whitehouse.gov/presidential-actions/2025/01/declaring-a-national-energy-emergency/; Executive Order, Establishing the National Energy Dominance Council, Feb. 14, 2025, https://www.whitehouse.gov/presidential-actions/2025/02/establishing-the-national-energy-dominance-council/. These orders prioritize fossil fuels and wholly omit solar, wind, and batteries, despite solar and batteries dominating recent additions of U.S. electricity generation capacity and offering the lowest levelized cost of energy. U.S. Energy Info. Admin., Solar, battery storage to lead new U.S. generating capacity additions in 2025 (Feb. 24, 2025), https://www.eia.gov/todayinenergy/detail.php?id=64586,

[22] Federal Power Act, 16 U.S.C. §§ 824d, 824e.

[23] Many utilities are proactively addressing a dynamic situation to accommodate large load, however, as we acknowledge and explore in our solutions in Part IV. For a survey of utilities' numerous and diverse strategies to modify rates and service for large loads, see Satchwell et al., *supra* note **Error! Bookmark not defined.**.

[24] *See infra* Part I.

time, this interconnection produced benefits; utilities built new generation that leveraged synergies between industrial load and retail demand.[25] But these benefits are waning: with inadequate transmission and slow processes for interconnection to the network, many large loads now view the network as a burden, not an opportunity.

When digital firms cannot connect generation or access existing electricity from the networked U.S. grid, they are proposing to revert to the highly localized, non-networked electricity system of the 1900s.[26] Some of the digital industry is physically flexible—it can locate essentially anywhere—and some firms are proposing to build their own generation sources, or co-locate with existing generation and largely go "off-grid."[27] Yet these

[25] Electricity Explained, U.S. Energy Info. Admin., https://www.eia.gov/energyexplained/electricity/delivery-to-consumers.php ("As the demand for electricity grew . . . utilities began to connect their transmission systems. These connections allowed utilities to share the economic benefits of building large and often jointly owned power plants to serve their combined electricity demand at the lowest possible cost. Interconnection also reduced the amount of extra generating capacity that each utility had to hold to ensure reliable service during times of high and peak demand. Over time, three large, interconnected systems evolved in the United States."). For former retail-industrial synergies, *see infra* Part I.

[26] President Trump claimed that co-location of data centers with off-grid generation was "largely" his idea, but as we explore, data centers and other large loads have been independently pursuing this option. Maeve Alsup, Amazon's data center strategy: "Get back to being grid-tied," Jan. 28, 2025, https://www.latitudemedia.com/news/amazons-data-center-strategy-get-back-to-being-grid-tied/.

[27] Locational flexibility depends on the type of large load. Crypto mining firms primarily consider the cost of electricity and cooling; they do not need close connectivity to users. *See* Lumerin Protocol, Medium, How important is geographic location in today's Bitcoin mining landscape?, Dec. 8, 2022, For the trend toward off-grid generation, *see, e.g.*, https://medium.com/lumerin-blog/how-important-is-geographic-location-in-todays-bitcoin-mining-landscape-a43daf7f974e. Data centers' locational needs vary depending on whether the centers are for training AI models or delivering AI products. Joe Francie, The Ai Power Boom Means Rethinking Data Center Location Strategy, CoreLogic, July 31, 2024, https://www.corelogic.com/intelligence/ai-data-center-location-strategy/ ("Data centers strategically positioned near key user bases, such as manufacturing regions or financial districts, can offer faster, more reliable access to data and services. In some cases, however, data center workloads are not sensitive to latency and therefore, building data center campuses in rural areas is more economical."). Latency refers to delays "between a data packet being sent from a source and its receipt at the destination." Databanks, Network Latency: Understanding and Minimizing Delays in Data Center Environments, June 19, 2024, https://www.databank.com/resources/blogs/network-latency-understanding-and-minimizing-delays-in-data-center-environments/. FERC Transcript, *supra* note 3 (noting the trend toward co-location and behind-the-meter arrangements that are largely disconnected from the grid); JLARC, *supra* note 9, at ii (describing data center location constraints). The need for transmission access noted in the report is not present for truly off-grid centers, although "off-grid" projects so far are primarily proposed at old or operating grid-connected plants. For proposed off-grid projects with newly-built generation; Engine no. 1, *supra* note 13 (noting that Chevron's and GE's natural gas-fired plants are data centers are "not designed

defections, too, have huge implications for the network, as they remove shared capacity and change the amount of electricity flowing through transmission lines. Other utilities also argue that when these companies only partially disconnect from the grid, they are still benefiting from its back-up services and not paying their fair share to the networked system.[28]

The federal government agency tasked with this challenge, FERC, already has a broad mandate from Congress, under which it can generate consistent, integrated, fair approaches to address burgeoning demand.[29] The Federal Power Act of 1935 requires "just and reasonable" rates and terms of service—the very values required to ensure equity on a rapidly transforming grid.[30] But as it stands, FERC has not provided new, comprehensive guiding standards for generation capacity and the transmission in the era of large load, despite grid operators and utilities directly requesting such standards.

FERC has begun to acknowledge the herculean task of updating an old governance system through large load—holding a technical conference on large load co-located with large load, for example and starting a docket to address some interconnection issues.[31] Yet FERC has not yet seized upon the mandate to comprehensively, proactively address the challenges looming before it or to provide a framework for actors in the many electricity governance silos struggling to keep up with burgeoning load. It lacks standards that define different forms of large load and how this load should interconnect with transmission lines and generation connected to these lines.

The state law of rate making—electric utilities' establishment of rates (charges) for electricity that fairly reflect the benefits that customers are receiving from the networked system—must also adapt to reflect new realities, yet it is not moving fast enough.[32]And both FERC and states have skirted a central question underlying all large load governance: how should the *merit* of different forms of load affect the informal queue that is emerging for load to connect to utility service (a state governance question) and to the

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to flow initially through the existing transmission grid"); *supra* note 13 (noting other natural gas-fired co-generation).

[28] Protest of Exelon Corp. and American Electric Power Service Corporation, Docket No. ER24-2172 at 3 (2024).

[29] Federal Power Act, 16 U.S.C. § 824.

[30] 16 U.S.C. § 824(d).

[31] FERC Transcript, *supra* note 3; FERC Orders Action on Co-Location Issues Related to Data Centers Running AI, Feb. 20, 2025, https://www.ferc.gov/news-events/news/ferc-orders-action-co-location-issues-related-data-centers-running-ai.

[32] *See* Peter Freed & Allison Clements, How to reduce large load speculation? Standardize the interconnection process, Utility Dive, Feb. 19, 2025, https://www.utilitydive.com/news/data-center-large-load-interconnection-process-clements/740272/ ("We can haphazardly continue down the path of a fragmented and increasingly untenable approach to large load-side interconnection, or we can take the opportunity to introduce rational standardization to the process.").

larger grid (a federal question). Should commercial AI enterprises receive priority access to the grid if they claim to benefit national security? Can utilities penalize cryptocurrency miners for providing fewer employment opportunities than other energy customers? If so, how should AI data centers that provide short-term construction employment while eliminating more jobs through automation be treated?

The consequences of legal mal-adaptation are grim. We are already seeing them, with companies canceling contracts or scrambling to find new power sources, and retail customers in some regions facing dramatically higher electricity rates.[33] Much of the new load fomenting these problems is not remotely as critical as the industries historically necessary support a world war, but the load is here, like it or not.[34] And the legal system must meet the challenge to ensure that the grid will provide adequate electricity for all who demand it, at a reasonable price, while protecting retail consumers who are currently shouldering cost burdens caused by large load.[35] This Article analyzes these challenges and proposes paths forward. It frames the vastly changed frontier of the law of electricity and then explores high-level solutions for more integrated, consistent, and effective legal approaches. It leaves for future work the many related impacts of massive load growth, such as local land use and revenue challenges, and global environmental impacts.

Part I of the Article contextualizes the U.S. electric grid and frames the current stressors on the networked grid, focusing particularly on largely unprecedented load growth. Part II analyzes the electricity governance system in the context of this growth, and Part III critiques the lack of guiding precedent from FERC on load growth challenges, focusing on the specific obstacles of: 1) interconnecting new generation and load with the transmission grid; and 2) approving modified wholesale electricity rates. Part IV then explores high-level options for paths forward, which fall far short of World War II national mandates but better integrate and comprehensively address networked challenges.

The U.S. electric grid—the backbone of the economy and our quality of life—is at a critical crossroads. The connection of generation and load

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[33] Complaint of Governor Josh Shapiro and the Commonwealth of Pennsylvania, Docket No. EL25 at 14-15 (Dec. 30, 2024), https://pa.gov/content/dam/copapwp-pagov/en/governor/documents/pjm-lawsuit/gov. shapiro and commonwealth of pa complaint(119760108).pdf; George Public Service Commission, Integrated Resource Plan Approval, Apr. 17, 2024; JLARC, *supra* note 9, at v ("A typical residential customer of Dominion Energy could experience generation- and transmission-related costs increasing by an estimated $14 to $37 monthly in constant (or real) dollars by 2040").

[34] *See supra* note 6 for recent load growth numbers; Commonwealth of Virginia Corp. Comm'n, *supra* note 3, at 13 ("The load is here, it is being built now, and we must respond accordingly.").

[35] *See* Eliza Martin & Ari Peskoe, Extracting Profits from the Public: How Utility Ratepayers are Paying for Big Tech's Power 2 (2025).

through a complex web of wires was once the enabler of the booming economy, allowing critical pooling of risk. But it is this sprawling, tightly interconnected network that is now failing the fastest-growing electricity users, triggering increasingly rogue proposals. Any path forward must find a solution that makes the network an asset, not a risk, and that allows a new, energy-hungry industry to find a workable space within this network without sending irreparable shock waves through it.

## I. STRESSORS ON A NETWORKED YET SILOED ELECTRIC GRID

The electric grid of 1910—at the dawn of the commercialization of electricity—had few trappings of a "grid."[36] Electric utilities—firms responsible for building and operating electricity generation, transmission, and distribution lines to carry electricity to customers—built generation very close to the customers served. Chicago alone had nearly 45 utilities in 1907, some of which even competed for customers within one neighborhood or on one streets.[37] This localized, largely disconnected grid rapidly expanded to a highly interconnected maze of wires, with regional webs spanning Eastern North America, Western North America, and Texas.[38]

Framing and pinpointing the maladies of the modern electric grid requires substantial context—an understanding of the original, decentralized state of commercial electricity toward which some large users are again leaning, and the evolution of the modern networked grid.[39] This Part provides this framing and context, exploring the physical and governance-based factors that have shaped the grid and the perfect storm of stressors that threaten to tear apart this network.

### A. The Early Decentralized Grid

Chicago of the early 1900s had a multiplicity of power plants for good reasons. The first commercialized generators and distribution circuits

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[36] SAMUEL INSULL, THE OBLIGATIONS OF MONOPOLY MUST BE ACCEPTED (1910), https://energyhistory.yale.edu/samuel-insull-the-obligations-of-monopoly-must-be-accepted-1910/ (in 1910, observing that electricity now supplied all of the railways in Chicago); Robert L. Bradley, Jr., *The Origins and Development of Electric Power Regulation*, *in* THE END OF A NATURAL MONOPOLY 43, 44 tbl.1 (Peter Z. Grossman & Daniel H. Cole eds., 2003).

[37] JOHN BAUER & PETER COSTELLO, PUBLIC ORGANIZATION OF ELECTRIC POWER 16 (1949); Bradley, *supra* note 36, at 73; Garrick B. Pursley & Hannah J. Wiseman, *Local Energy*, 60 Emory L.J. 878, 886 (2010).

[38] U.S. Energy Info. Admin., *supra* note 50.

[39] *See* FERC Order Rejecting Amendments, *supra* note 8 (describing Talen Energy's FERC-rejected proposal to reduce electricity provided through the networked grid and sell the electricity to Amazon "behind-the-meter"—essentially disconnected from the grid); Chevron, *supra* note 27 (describing proposed off-grid "power foundries" for data centers).

deployed in the 1880s used direct electrical current, which flows in one direction.[40] Its properties were well-understood after decades of experimentation. For example, engineers knew that the electrical power flowing through a wire equaled the product of its voltage and current, which were analogous to the pressure and volume of water flow through a pipe. Energy losses increased linearly with voltage, and higher voltages reduced losses per unit of energy transmitted.[41]

Despite these known benefits, early techniques for increasing direct current (DC) voltage were also inefficient.[42] These limitations necessitated the co-location of electricity generation near its end use. As a result, the first commercial electrical systems were distributed, isolated circuits that lacked the economies of scale needed to facilitate rapid growth.[43]

This localized U.S. electricity system changed dramatically at the advent of the twentieth century. Electrical transformers could efficiently convert alternating current (AC) electricity, which switched direction rapidly to a high voltage. This advance unlocked economies of scale in electrical generation, transmission and distribution which made the modern electrical grid possible.[44]

Although firms demonstrated the feasibility of efficient long-distance transmission with AC in the 1880s in Europe, deploying related AC technologies in the United States required time and a lengthy public debate over their relative merits.[45] Soon, however, high-voltage, AC transmission of electricity became the norm, leading to a highly networked and independent system for generating electricity and delivering it to customers.[46]

### B. Risk Pooling Through a Networked Grid

The local, decentralized grid of the early to mid-1900s was short-lived. Once long-distance transmission via AC proved feasible, electrical generation—at the time dominated by massive hydropower dams—could be connected to distant urban centers, where factories could access both the labor and

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[40] The War of the Currents: AC versus DC Power, U.S. Dept. of Energy, https://www.energy.gov/articles/war-currents-ac-vs-dc-power.
[41] Bradley, *supra* note 36, at 73.
[42] U.S. Dept. of Energy, *supra* note 40.
[43] Bradley, *supra* note 36, at 73.
[44] JILL JONNES, EMPIRES OF LIGHT 92 (2003).
[45] U.S. Dept. of Energy, *supra* note __; JONNES, *supra* note 40, at 92-93.
[46] *Supra* note 41.

materials needed for production.[47] Contrast this with the rapidly emerging large load era, in which many types of "digital foundries" with low labor requirements can locate virtually anywhere with flat ground.[48] The constraints posed by the now-centralized grid have caused a new war of networked versus localized generation, with the digital industry again seeking out 1900s-esque co-located, highly local generation.[49]

This Part explores the dynamics that spurred the transition to a centralized, networked grid. This foreshadows the contrasting forces pushing again toward localization and concerns about the limits of a networked grid in the digital era.

1. Economies of Scale in Generation

As large utilities built transmission within their territories to connect with each other, they created three large "interconnected" regions of wires in North America, which sprawl throughout the United States and Canada, and parts of Mexico.[50]

Large, centralized power plants delivering power over long-distance AC lines to population (load) centers and industry in the United States created substantial economies of scale, although these economies present both a challenge and an opportunity.[51] The electricity system has large fixed costs to fund physical assets, and lower costs associated with operation and maintenance.[52] A utility must build a generating unit; transmission lines to carry electricity to communities; transformers; and distribution lines to deliver electricity to homes, businesses, and industry regardless of whether it is delivering one megawatt (enough to power approximately 300 homes) or

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[47] EUGENE AYERS & CHARLES A. SCARLOTT, ENERGY SOURCES—THE WEALTH OF THE WORLD (1952); Univ. of Texas at Austin Energy Institute, The History and Evolution of the U.S. Electricity Industry 4 (2016), https://energy.utexas.edu/sites/default/files/UTAustin_FCe_History_2016.pdf.

[48] *See supra* note 27.

[49] FERC Transcript, *supra* note 3, at 29-30 (noting that in some respects, network grid operators are welcoming off-grid data center power solutions because they can enhance reliability and avoid exacerbating growing network constraints).

[50] Electricity Explained, U.S. Energy Info. Admin., https://www.eia.gov/energyexplained/electricity/delivery-to-consumers.php ("As the demand for electricity grew . . . utilities began to connect their transmission systems. These connections allowed utilities to share the economic benefits of building large and often jointly owned power plants to serve their combined electricity demand at the lowest possible cost. Interconnection also reduced the amount of extra generating capacity that each utility had to hold to ensure reliable service during times of high and peak demand. Over time, three large, interconnected systems evolved in the United States.").

[51] Univ. of Texas at Austin, *supra* note __, at 3.

[52] Jim Lazar, Regulatory Assistance Project, Electricity Regulation in the U.S.: A Guide 185 (2016), https://www.raponline.org/wp-content/uploads/2023/09/rap-lazar-electricity-regulation-US-june-2016.pdf (noting "fixed assets" in the form of utility infrastructure and differentiating this from the more nebulous term "fixed costs").

one gigawatt (1,000 megawatts, or 300,000 homes) or electricity.[53] Infrastructure costs do increase in a step-wise fashion—above specific thresholds of consumption, new generation and wires are needed—but one power plant and transmission line can serve vastly different numbers of customers.[54]

Early in the development of the networked electrical grid, this cost structure required increasing the use of fixed-cost generation and transmission.[55] To decrease unit (per-kilowatt hour) costs, utilities sought out customers who could use electricity at night when factories closed, and who did not require many additional fixed-cost investments in infrastructure to serve.[56] Nearby factory owners, managers, and eventually their employees, were the ideal customers – and thus the residential market for electricity was born.[57] This new customer base also served as a hedge against the negotiating power of large industrial customers which purchased nearly all of their electricity.

As competing utilities pushed into residential markets, the disruption of public spaces caused by overlapping distribution wires prompted a backlash that threatened to limit the growth of the electric market. Utility magnate Samuel Insull saw this as an opportunity to strike a deal with potential regulators that would eliminate his competitors and gain public acceptance for utility infrastructure needed to deliver residential electric service. Insull toured the country with a soapbox speech aimed at further centralization of the electric utility structure.[58] Insull persuaded states that electric utilities would best operate as monopolies.[59] This would avoid wasteful competition over infrastructure, such as overlapping and unsightly distribution lines as firms fought for customers. Insull also assured the states that utilities would not have the upper hand within such a system.[60] He championed a system of regulated monopolies, in which one utility would gain exclusive access to a territory of customers, in exchange for an obligation to serve all customers who could pay and a regulated rate.[61] All 50 states ultimately adopted this

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[53] Estimates of the number of homes powered by one megawatt of electricity vary widely because homes of different sizes, and with different energy efficiencies and appliances, consume vastly different amounts of electricity. 300 is somewhat low, although some experts put the number as low as 200. *See* What is a Megawatt?, Utilipoint, https://www.nrc.gov/docs/ML1209/ML120960701.pdf.
[54] Lazar, *supra* note 44, at 185.
[55] Univ. of Texas at Austin, *supra* note __, at 3.
[56] COHN, *supra* note 13.
[57] *Id*.
[58] Jonnes, *supra* note 40, at 46-47.
[59] Insull, *supra* note 32.
[60] Stein argues that the regulated monopoly model limits the "structural" power of utilities relative to that of their unregulated Big Tech customers, which have achieved monopolistic scale without regulatory oversight. See Stein, "Shifting Structural Power: The Tech Energy Transition."
[61] Jonnes, *supra* note 40, at 46-47.

model. In the de-regulation craze of the 1990s, some moved away from it, but the regulated monopoly structure still dominates U.S. retail electricity.[62]

Insull's benevolent monopolies proved difficult to manage, with Insull himself buying up numerous generating companies and constructing a pyramid investment scheme.[63] But there were and are some risk-reducing benefits to centralization, both for customers and the utility. Customers avoided the risk of receiving an essential good from a small company that was more vulnerable to bankruptcy risk. Utilities, with the assurance that they would not be undercut by competitors, felt secure in investing in the costly infrastructure needed to serve all customers.[64]

With this security in hand, utilities expanded their service areas, offering services to more customers to the point where the cost to extend service exceeded profits. This left many rural customers unserved, as building distribution lines to limited numbers of far-flung customers is a losing economic proposition. Only governmental intervention in the Franklin D. Roosevelt era led to widespread rural electrification of unprofitable rural electric markets.[65]

2. The Benefits of a Tightly Networked System

As centralized monopolistic utilities grew in the early twentieth century, utilities built generation farther from load centers and began to transmit electricity longer distances to these centers. Utilities also began to purchase more generation from each other rather than building it themselves—particularly back-up generation or "reserves" (physical generating capacity). These reserves were not necessary most of the time and were quite expensive to build solely to support one utility.[66] The sharing of this "spare tire" was far more efficient than building rainy day reserves for each generating plant. As utilities entered agreements to share generation and build transmission that enabled this sharing, formal regional entities called "power pools" emerged.[67] Through power pools, electric utilities contracted with each other to buy and sell electricity when needed, and particularly to share reserve capacity.

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[62] JOHN BAUER & PETER COSTELLO, PUBLIC ORGANIZATION OF ELECTRIC POWER (1949).
[63] Richard D. Cudahy, Insull and Enron: Is There a Parallel? Part 3 at 7-8.
[64] *Id*. at 7.
[65] Univ. of Tex. at Austin, *supra* note __, at 6.
[66] Marissa Hummon et al., Natl. Renewable Energy Lab., Fundamental Drivers of the Cost and Price of Operating Reserves 3 (2013), https://www.nrel.gov/docs/fy13osti/58491.pdf.
[67] ARI PESKOE, KLEINMAN CTR. FOR ENERGY POLY, POWER OVER THE 21ST CENTURY GRID (2018), https://kleinmanenergy.upenn.edu/research/publications/power-over-the-twenty-first-century-electric-grid/.

Utilities expanded transmission connections with each other until transmission-level links reached the point of reducing profits for both. Indeed, if a utility built out too much transmission, it risked providing pathways for competitors to undercut the utility's wholesale power prices.[68] As with rural electrification, governmental intervention was necessary in World War II, when a surge in demand for electricity to power the war machine required the massive expansion and interconnection of more transmission lines to service generation and load.[69]

C. The Breakdown of Centralization, Networking, and Retail-Industrial Synergies

Many of the dynamics that originally led utilities to build new, centralized generation for large load and to interconnect with each other have faded since the dawn of twenty first century. After utilities grew to meet the surging demand of the early 1900s, a veritable web of wires and generation plants emerged, and this web became relatively stable. Unlike the early days of utilities rushing to build new infrastructure and transmission to keep up with demand, supply and demand rested in a relatively balanced state after World War II and the post-war expansion, with occasional disruptions.[70] But the old model also persists, with many large load customers still seeking out, and receiving, power from utilities.

This subpart explores two trends that are moving in starkly different directions: first, the defection of some large load customers from the networked grid with centralized generation, and second, the continued reliance of many large load customers on traditional, networked utility service.

1. Declining Incentives for New Generation

Within the balanced web of wires interconnecting utilities to the point of mutual economic benefit, and relatively even supply and demand, utilities were able to keep per-unit (kilowatt-hour) costs of electricity relatively low To meet relatively slow load growth, utilities could simply incrementally build cheap generation or purchase it from an increasingly competitive generation market.[71] The benefits of substantially expanding generation to

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[68] *See, e.g.* Otter Tail Power Co. v. United States, 410 U.S. 366 (1973) (showing a utility's reluctance to allow competitors to access its transmission lines).
[69] *Supra* notes 13-14.
[70] Limited natural gas supply to the Northeast was one such disruption, solved in part by federal eminent domain for and regulation of interstate natural gas pipelines to expand access to gas. Alexandra Klass & Danielle Meinhardt, *Transporting Oil and Gas: U.S. Infrastructure Challenges*, 100 IOWA L. REV. 947 (2015).
[71] *See* FERC Order No. 888 (1996) (requiring open access to the grid to enhance competition); Power Sector Evolution, U.S. Envtl. Protection Agency,

serve both industrial and residential customers became slimmer. And regardless of any remaining benefits of complementary industrial and residential load, the opportunity to find new residential customer bases to complement industrial load shrank; most people already had access to electricity.[72]

Fast forward to the 2020s, when load growth began to surge.[73] Synergies between industrial large load, generation to serve that load, and residential customers are decidedly lacking for the modern data industry, which employs relatively few people and can run all of the time, thus not needing a complementary residential load.[74] And given substantial transmission constraints in some regions, new generation capacity, although desperately needed, is a headache—not a boon—for some utilities.[75]

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https://www.epa.gov/power-sector/power-sector-evolution (noting declining costs in renewable and natural gas generation); Kennedy Maize, *What is the Future of Independent Power?,* POWER MAG (Jan. 3, 2018), https://www.powermag.com/what-is-the-future-of-independent-power/ (noting the flourishing of independent power producers); Univ. of Texas at Austin, *supra* note __, at 5 (noting cheap natural gas and solar and the struggle to finance larger, more expensive generation such as coal and nuclear, in part because "[t]oday [in 2016], the ability to add new generation capacity in smaller sized increments can be attractive to utilities in an era of low load growth").

[72] U. of Texas at Austin, *supra* note __, at 6 ("At the time of FDR's death in 1945, an estimated 90% of rural farms were electrified.").

[73] *See supra* note 6.

[74] Joint Legislative Audit and Review Comm'n, *supra* note 26 (describing relatively modest employment in data centers with the exception of the construction phase, and relatively flexible locations).

[75] For the challenge of a constrained, aging, and inadequate U.S. transmission grid, *see, e.g.*, U.S. Dept. of Energy, Natl. Transmission Needs Study (2023), https://www.energy.gov/sites/default/files/2023-12/National Transmission Needs Study - Final_2023.12.1.pdf; Ari Peskoe, *Is the Utility Transmission Syndicate Forever?* 42 ENERGY L.J. 1 (2021). Despite growing disincentives to build centralized generation for large load, the retail rate structure under which many utilities operate still pushes some utilities toward generation development and the construction of local transmission lines that benefit their service territory. This is because one method of increasing utility profits is to increase electric rates; utilities raise rates, in turn, by building more infrastructure and requesting a rate increase to cover the costs of this construction. This phenomenon is coined the "Averch-Johnson effect," in which utilities have incentives to *overbuild* infrastructure to increase profits, since profits emerge from higher rates charged for new infrastructure. Peskoe, *supra* note 75 (describing utilities' construction of localized generation to increase profits and avoid competition within their service areas); H. Averch & L.L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1053 (1952). Although rate-based incentives spur some utility construction of generation and transmission, many studies have questioned the power of the Averch-Johnson effect, and some have demonstrated that it does not apply when utilities experience increasing returns to scale. W. Davis Dechert, *Has the Averch-Johnson Effect Been Theoretically Justified?* 8 J. Econ. Dynamics and Control 1, 2-3 (1984) (citing the literature arguing that the Averch-Johnson effect is not empirically proven in some utility settings and asserting that even in the model itself, the effect does not apply for rate-regulated utilities with increasing returns to scale).

Utilities that face transmission constraints and other impediments to constructing new generation can make profits by increasing the units of electricity (kilowatt-hours) of electricity that they sell to existing customers from under-utilized fixed assets, or assets that can produce more electricity with minor modifications rather than major new builds. Until recently, many utilities have seen load increase relatively gradually with customers' purchases of electrical vehicles and the electrification of homes. Electrification has only just begun to tax utility infrastructure, and only in limited regions, as its pace has risen.[76] Using existing capacity to generate and sell more units of electricity, or building small generating units incrementally—but not in a surge scenario—is sometimes an easier avenue to maintain profits and reduce risk than is rapidly building new generation to meet large load.[77]

We do not mean to overstate utility disincentives for rapid utility build-out of large new generation. Some utilities, such as Georgia Power and Dominion Energy in Virginia, are welcoming large loads and building massive amounts of capacity to meet large load demands. But it is also important to emphasize notable defections from the utility model. Many utilities are hesitant to build out millions of dollars of new capacity based on demand projections. Table 1 in IV shows utilities that service large load requiring that load to pay for its own capacity or purchase its own electricity, for example, with the utility simply arranging for the distribution of electricity to the load.

Beyond some utilities remaining hesitant to serve large load under their traditional service models, the highly-capitalized data industry does not require a large, monopolistic utility to provide a financially secure source of power. This is perhaps best evidenced by ventures such as Microsoft's proposal to re-start an expensive nuclear unit at the former Three Mile Island site and purchase all of the power from the unit.[78]

2. Networking Constraints

Just as utilities and grid operators have difficulty providing the new generation and wires that large loads need, many large load operators find only limited benefits—or even net costs—not only in traditional service from electric utilities, but also the networked grid as a whole. Historically, utilities benefited from interconnected transmission lines to share back-up capacity—generation primarily only needed during periods of peak demand. These peaks emerged in large part from the residential and commercial sectors—as people in homes and businesses turned on more heating and cooling, for

[76] North Am. Electric Reliability Corp., *supra* note 6.
[77] U. of Tex. at Austin, *supra* note __ at 5.
[78] Crownhart, *supra* note __.

example, during seasonal high and low temperatures. Large loads, in contrast, exhibit less peaky behavior; they run around the clock.[79] They produce little need for peak-related pooling of generation capacity.

Large loads do receive some grid benefits, as utilities objecting to their presence have argued—demanding that these loads pay for their fair share of benefits.[80] Even facilities that generate their own electricity sometimes receive back-up power from the grid when their generation fails, although many large loads are simply installing a second, independent back-up.[81]

Attempts by utilities or large load to even partially connect to the grid have often met opposition rather than accommodation, thus further fueling a move back toward localized generation. New generation faces lengthy waits—several years—to interconnect to networked transmission lines.[82] Attempts to modify grid interconnection agreements for existing generation—generation that proposes to reduce its electricity to the networked grid and instead supply large load located next to it—meet skepticism. Other utilities on the network have opposed reduction in the capacity available to the network as a whole.[83] In short, sharing electricity with others on a network is not a benefit to new large loads; it is an impediment.

Facing high barriers and a frenetic rush to remain competitive in rapidly-growing fields such as AI, data companies have increasingly sought their own solutions—planning facilities to co-locate with existing generation and proposing to use all of that generation for their own purposes.[84] Alternatively, they have sought to re-power retired facilities or build their own generation and, once again, connect directly to it.[85] This secession from the networked grid is understandable.

### 3. Persistence of the Network: Rising Demand for Utility Power

Despite the weakening of synergies between large load and utilities, many data companies have still sought service from utilities,[86] and many utilities have eagerly offered it. The allure of utility-provided energy arises in part

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[79] *See, e.g.*, Commonwealth of Virginia Corp. Comm'n, *supra* note 3, at 226 (noting a data center that built an on-site natural gas generator that runs "24/7").
[80] Protest of Exelon Corp. and American Electric Power Corp., *supra* note 28.
[81] *See* FERC Order Rejecting Amendments, *supra* note 10 (describing back-up measures installed by Amazon to avoid drawing power from the grid during interruptions in service from the co-located nuclear unit).
[82] *See supra* note 24, *infra* note 137 and accompanying text.
[83] Protest of Exelon and American Electric Power Corp., *supra* note 28.
[84] *See, e.g.*, xx three mile; Chevron, xxx
[85] *See supra* note 27.
[86] Satchwell et al., *supra* note **Error! Bookmark not defined.** (examining numerous utility r ate and service changes in response to large load requests).

because utilities have long been in the business of acquiring and delivering electricity. Permitting hurdles to building new generation and transmission are high, and utilities have experience navigating those hurdles—albeit still facing a slower pace of construction than they historically did.[87]

In the majority of U.S. states, where retail utility service is regulated and rates are designed to cover utilities' cost of services, some utilities, too, are motivated to build new generation and offer it to large loads because new generation means that the utility can request rate increases from state utility commission.[88] Further, although large load customers have deep pockets, if they can benefit by spreading the costs of new generation capacity among a larger pool of consumers through utility service, they will seize this opportunity, as evidenced in states such as Georgia and Virginia. [89]

In short, while some large loads are going it alone, many are still connecting to the grid, often posing challenges for other customers, rather than synergies. PJM, the regional grid operator in the Mid-Atlantic and parts of the Midwest, has planned for new transmission lines to help support generation for large loads such as data centers amassed in Northern Virginia.[90] The Georgia Public Utility Commission approved a rate increase for Georgia Power to build new natural gas-fired and solar generation, approximately eighty percent of which would support large load.[91] Later, however, the Commission issued a state-wide rule in an effort to cause large load to shoulder more of the burden of rate increase that it causes.[92] The Georgia

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[87] *See* FERC Transcript, *supra* note __, at (noting permitting limitations); Matthew Eisenson et al., Columbia Law School Sabin Cetner for Climate Change Law, Opposition to Renewable Energy Facilities in the United States (2024), https://climate.law.columbia.edu/content/opposition-renewable-energy-facilities-united-states-june-2024-edition.

[88] *See supra* note 72 discussion the Averch-Johnson effect but also economists' skepticism of the widespread pevalence of this effect.

[89] Georgia Power's 2023 Integrated Resource Plan Update supports Georgia's extraordinary economic growth, Georgia Power, Oct. 27, 2023, https://www.georgiapower.com/news-hub/company-news/georgia-power-2023-integrated-resource-plan-update-supports-georgia-extraordinary-economic-growth.html ("Georgia Power today filed an update to its Integrated Resource Plan (IRP) that sets forth a flexible, comprehensive plan to support the state's extraordinary economic growth . . . .Georgia, long recognized as a top state in the country in which to do business, is attracting extraordinary customer growth.").

[90] PJM Reviews Initial Project Selections, Preliminary Short List of 2024 RTEP Window 1 Proposals, PJM Insides Lines, Nov. 7, 2024, https://insidelines.pjm.com/pjm-reviews-initial-project-selections-preliminary-short-list-of-2024-rtep-window-1-proposals/; FERC Transcript, *supra* note __, at 33 (describing the RTEP for data centers).

[91] Assoc. Press, Utility regulators approve plan for Geogia Power to add new generating capacity, Apr. 16, 2024, https://www.wabe.org/utility-regulators-approve-plan-for-georgia-power-to-add-new-generating-capacity/.

[92] Georgia Pub. Svc. Comm'n, PSC Approves Rule to Allow New Power Usage Terms for Data Centers (2025), https://psc.ga.gov/site/assets/files/8617/media_advisory_data_centers_rule_1-23-2025.pdf.

Legislature also voted for a two-year pause on tax exemptions for data centers, but the governor vetoed the bill.[93]

The pushback in Georgia resembles reactions in many other states, where the digital industry has encountered walls.[94] Some utilities and grid operators have balked at the prospect of investing in massive amounts of generation and transmission—unprecedented since the World War II era. But elsewhere, as in Virginia, large load is booming, and concerns about rising residential costs are paramount. Yet little state action has emerged.[95]

Despite modern trends away from centralized generation and the networked grid—and some persistence of the old, utility-centric service model to serve modern, large load—there is hope that in seeking rapid, creative solutions to build massive amounts of new electricity generation, large load operators could create some positive spillover effects. For large loads that connect to the network, one benefit is the ability to dramatically reduce demand to support system reliability.[96] Because most large loads have their own back-up generation, they cut off their demand from the networked grid when needed (although grid operators argue that certain loads—those involving national defense—should not take this risk, in the event that on-site back-up generation fails).[97] Further, large loads could potentially spur the construction of enough generation to benefit non-industrial customers, and a transmission grid expansion that will support the interconnection of this generation. But the governance system that grew alongside the physical electricity system framed in this Part is largely impeding these potential benefits, as we explore in Part II.

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[93] Jeff Amy, Georgia lawmakers vowed to restrain tax breaks. But the governor's veto saved a data-center break, ASSOC. PRESS, May 8, 2024, https://apnews.com/article/georgia-kemp-veto-tax-breaks-data-centers-ee11e95f3a5ac9f6e9019401c35c2e88.

[94] *See, e.g.*, Citizens Action Coalition, CAC Calls for Data Center Moratorium, Oct. 15, 2024, https://www.citact.org/news/cac-calls-data-center-moratorium; JLARC, *supra* note 8, at 88 (2024). https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf ("noting that "energy rates for all users are likely to increase due to extensive energy demand from data centers and that "[i]f the General Assembly wishes to slow down the data center industry's growth in Virginia because it determines that energy concerns outweigh the industry's economic benefits, it could allow the sales tax exemption [for data centers] to expire in 2035").

[95] JLARC, *supra* note 9, at 5 (noting rising customer costs due to the sheer expansion in demand for generation capacity).

[96] For an analysis of the ability of large loads to use flexible demand—reducing demand during key periods—see TYLER H. NORRIS, TIM PROFETA, DALIA PATINO-ECHEVERRI, AND ADAM COWIE-HASKELL, DUKE NICHOLAS INSTITUTE, RETHINKING LOAD GROWTH: ASSESSING THE POTENTIAL FOR INTEGRATION OF LARGE FLEXIBLE LOADS IN US POWER SYSTEMS (2025), https://nicholasinstitute.duke.edu/publications/rethinking-load-growth.

[97] FERC Transcript, *supra* note __, at 36.

## II. ELECTRICITY GOVERNANCE: NON-DISCRIMINATORY, JUST AND REASONABLE RATES AND THE OBLIGATION TO SERVE

The laws that emerged to govern the sprawling U.S. electric grid are as complex as the physical network itself. A foundational understanding of these laws is essential to critique their failure in the context of rapidly growing load that is defecting from the grid. This Part constructs this foundation and its failure to adapt to modern grid demands.

The electric utilities that pool generation resources, purchasing electricity from each other through a network of interconnected transmission lines, face both state and federal regulation, as framed here. Digital industries attempting to go-it-alone through co-located generation face the same regulations, as most co-located generation still has some interconnection—even if small—with the networked grid.[98]

### D. State Regulation: Retail Rates and Infrastructure Approval

States are centrally responsible for regulating electric utilities' provision of retail electricity to loads of all sizes, including large loads. The vast majority of states are "non-restructured" (non-competitive), meaning that states treat electric utilities as natural monopolies—the approach originally advocated by Samuel Insull.[99] The states designate one utility to serve a designated geographic area called a service area or territory.[100] This is the only company allowed to distribute electricity to customers within this area. In exchange for the benefit of the monopoly, the state regulates: 1) the utility's investments in generation, transmission, and distribution infrastructure, ensuring that expenditures are prudent and not wasteful; 2) the retail rates that the utility may charge its customers; and 3) the terms of service that the utility must offer its customers, such as billing procedures and the notice required before disconnection for a failure to pay.[101] Utilities are obligated to serve *all* paying customers within their service territory.[102]

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[98] *See* Order Rejecting Amendments, *supra* note 3 (noting Talen Energy's interconnection despite providing most of its electricity to Amazon behind the meter); FERC Transcript, *supra* note __, at 31 (noting that PJM can deny behind-the-meter co-located load for reliability reasons).

[99] Electricity Markets – 101, Natl. Governors Assn., https://www.nga.org/electricity-markets/ (observing that "thirteen states have fully restructured their electricity markets").

[100] *See, e.g.*, Fl. Pub. Svc. Comm'n, Statistics of the Florida Electric Utility Industry 4 (2022), https://www.floridapsc.com/pscfiles/website-files/PDF/Publications/Reports/ElectricGas/Statistics/2021.pdf (showing service areas).

[101] PacifiCorp v. Public Service Comm'n of Wyo., 103 P.3d 862, 871 (Wyo. 2004) (describing rate regulation and prudency requirements).

[102] *See, e.g.*, Harley Grice v. Vt. Electric Power Co., 184 Vt. 132, 140 (2008) (noting that an electric utility—a public service corporation—is "obligated to serve the public"); PPL EnergyPlus, LLC v. Hanna, 977 F.Supp.2d 372, 383 (D. N.J. 2013) (noting electric utilities' "obligation to serve all customers").

a. Infrastructure Approval

Unlike most competitive industries, in which firms make investments based on internal risk calculations—states dictate the infrastructure in which utilities may invest.[103] This is because utilities have captive customers—consumers of electricity who have no choice but to have their electricity transmission and distributed to them by one utility. In many states, consumers may not even choose which generator produces the electricity distributed by the utility.[104] Customers are also required to pay a state-approved rate charged by the utility to cover the utility's cost of providing service. States therefore want to ensure that the consumers do not pay for unnecessarily costly infrastructure.[105]

As the digital industry proposes to purchase large amounts of electricity from utilities, utilities are approaching states with requests for approval of new generation and, in some cases, transmission and distribution infrastructure.[106] States are struggling to determine how much infrastructure is necessary and prudent. When utilities build physical assets with long-term useful lives (and long-term depreciation), and kilowatt-hour consumption goes down because customers leave, this creates stranded infrastructure costs for the utility. These "stranded" costs typically must be shouldered by the utility's remaining customers.

Some federal regulators, states, and utilities worry that the digital industry—a relatively mobile industry that can shop around for low electricity rates—may be pushing for too much infrastructure build-out based on exaggerated expectations for business (and electricity use), or on false promises that they will stay in a service territory for the long term.[107]

These types of concerns are highlighted by actions such as those taken by Georgia Power, a utility for which 80 percent of its new load is projected to be from data centers. Utilities in states like Georgia periodically submit "integrated resource plans" (IRPs) detailing projected future load and how they will meet it. In 2023, Georgia Power filed an "updated" IRP outside of

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[103] Lazar, *supra* note __, at 31.
[104] U.S. Energy Info. Admin., Can electric utility customers choose their electricity supplier? (observing that "[i]n 2022, retail choice was available for all utility customers served by IOUs in the District of Columbia and 13 states").
[105] PacifiCorp, 103 P.3d at 871.
[106] *See supra* note 75; Commonwealth of Va. State Corp. Comm'n, *supra* note 3, at 11-12 (describing the challenge of approving new generation to fulfill large load requests while maintaining state green energy mandates).
[107] *See, e.g.*, FERC Transcript, *supra* note 8, at 20 (comments of Commissioner Chang expressing concerns about boom and bust cycles in load); Commonwealth of Va. State Corp. Comm'n, *supra* note 3, at 9 (emphasizing the "load forecasting risk and the stranded cost risk").

the normal IRP cycle to address extraordinary customer growth"—namely, "projected growth of approximately 6,600 MW through 2031, up from approximately 400 MW previously forecasted in the 2022 IRP."[108] This plan included new contracts for power purchases from natural gas-fired power plants, construction of new solar resources, and construction of new natural gas-fired plants.[109] Even large load customers suggested that this filing overstated load growth, with companies such as Microsoft questioning Georgia Power's "load forecasting method, which includes large load projects that are considering but have not ultimately selected Georgia as a location and/or GPC [Georgia Power Corporation] as a service provider."[110]

Worries about over-stated future load are not new, but they are heightened given the pace at which is occurring and, perhaps, its recent and rapid ascent. Load loss has always been a risk for utilities, which experience regional trends, not national averages. Individual customers can move to other utility service areas, or service areas can experience substantial population declines, as has occurred in many rural areas. While utilities tend to single out the data industry as being speculative and mobile,[111] much of the actual load lost in rural areas over the past decades has been traditional industry that has fled offshore.[112] After decades of slow or no growth in demand, and local declines in demand, utilities and regulators are suspicious of growth itself. And regulators became accustomed to focusing on containing costs for customers rather than accommodating burgeoning load.

Beyond concerns about exaggerated need for load and transmission, those in charge of accommodating new load worry that new load will raise costs for other customers.[113] As foreshadowed in Part I, the synergies between industrial and residential load growth present in the early 1900s are not present for data industries, which operate all hours of the day, thus using electricity when residential customers also need it—not complementing their load.

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[108] Georgia Power's 2023 Integrated Resource Plan Update supports Georgia's extraordinary economic growth, Georgia Power, Oct. 27, 2023, https://www.georgiapower.com/news-hub/company-news/georgia-power-2023-integrated-resource-plan-update-supports-georgia-extraordinary-economic-growth.html

[109] *Id*.

[110] Before the George Public Service Commission, Microsoft Comments on Georgia Power's 2023 Integrated Resource Plan Update, Apr. 1, 2024.

[111] FERC Order Rejecting Proposed Rate, *supra* note 10.

[112] S. Devaraj et al.. *Rural Job Loss to Offshoring and Automation*, *in* RURAL FAMILIES AND COMMUNITIES IN THE UNITED STATES 89 (Jennifer E. Glick et al., eds., 2020).

[113] Commonwealth of Virginia State Corp. Comm'n, *supra* note 3, at 9-10 (emphasizing as a major question for load growth "what and how can we be protecting our customers or taking risk-mitigating measures to protect ourselves from volatility or high prices" and that "the first question is, what is the fair allocation as we seek to serve these data center customers"?); FERC Transcript, *supra* note 3, at 41 (emphasizing questions around the "equitable nature of cost allocation").

b. Ratemaking

States' assessment of the prudency of new infrastructure is directly linked to states' setting of the price (rates) that utilities may charge electricity customers. Specifically, states regulate utility rates through "cost-of-service" ratemaking.[114] If the utility operates similar to its operations in previous years—in an efficient manner—and is permitted to charge the rate set by the state, the utility is likely to recover its capital and operating costs and be able to provide a rate of return to its investors.[115] To calculate rates, states typically look at a representative, recent "test year" that shows the utility's typical costs; add new costs projected by the utility (such as new infrastructure); and subtract non-representative, unusual costs from the test year.[116] States then calculate a percentage rate of return on investment that the utility will need to provide to customers and establish a total revenue requirement that the utility will need.[117] Finally, states estimate the number of customers and the kilowatt-hours of electricity that they consume, and set a per-kilowatt hour charge (rate). When one multiplies the per-kilowatt-hour rate by the total kilowatt-hours consumed, this is supposed to produce the total revenue needed by the utility.

This rate setting process shows how more load can often improve utility customers' well-being. The more kilowatt-hours consumed, the lower the potential rate, as costs will be spread out among more customers. However, when load gets too high, and substantial capital investments are rapidly needed, states and utilities worry more about whether the projections for more kilowatt-hours consumed (which will cover the cost of new capital) are accurate and guaranteed for the long term, as noted in the "stranded cost" discussion above.[118]

Another complex aspect of the retail ratemaking process is the allocation of the total revenue requirement to rates charged of different types of customers.[119] Cost of service ratemaking, in which states approve rates designed to cover the costs that utilities incur while serving customers, is supposed to reflect the costs imposed on the system by different classes of customers.[120] Customers with highly variable load, for example, tend to create higher costs for utilities, as utilities must build or contract for back-up generation or other flexible resources to ramp generation up or down quickly as customers' loads rapidly change.[121] Based on the differences among types

[114] Lazar, *supra* note __, at 5.
[115] *Id*.
[116] *Id*. at 50.
[117] *Id*. at 28.
[118] *See supra* note 107 and accompanying text.
[119] Lazar, *supra* note __, at 28.
[120] *Id*. at 176.
[121] *Id*. at 139.

of customers, states set different rates that utilities may charge different classes of customers; they typically divide up the rates among industrial, commercial, and residential classes.[122] These classes also sometimes have subcategories, such as larger or smaller industrial customers.

As explored in Part III, the allocation of rates among classes of customers is increasingly contentious as the data industry expands. Some utilities have argued that large loads impose more costs and should therefore have their own (higher) rate that other customers should not shoulder; some large loads disagree.[123] Several utilities have approved higher rates for large loads, and Georgia's Public Service Commission approved a rule in 2025 that allows utilities to charge higher rates for all large load 100 MW and above.[124]

Approvals of higher chargers for certain classes of electricity customers, such as large load, can predictably encounter legal hurdles. In all fifty states, two key legal elements constrain retail ratemaking by state public utility commissions:[125] rates must be "just and reasonable" and "nondiscriminatory." Just and reasonable rates are those that are fair (just) for both electricity consumers and utilities that provide electricity. They must not be unduly high for consumers (implicating both "fairness" and reasonableness), yet they also must not be so low that they make it financially infeasible for utilities to provide the service that they are obligated to offer. Utilities argue that if they cannot charge higher rates to accommodate large load, they will not recoup their costs, whereas large load, while wanting to pay its share, does not want to over pay.

Nondiscriminatory rates, in turn, are those that avoid treating different classes of customers differently absent justification for differential treatment. Some utilities and states have argued that higher retail rates for large load are justified because of the higher costs that the load imposes in the system.[126] But in the federal wholesale context, this argument has failed, as we explore below.

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[122] *Id*.

[123] Basin Electric, *supra* note __. *See also* Satchwell et al., *supra* note 9 (surveying utilities' approaches to unique rates or fees for large load); Commonwealth of Va. State Corporation Comm'n, *supra* note __ , at 31 ("With Dominion Energy, data centers also pay certain pre-connection costs, connection costs, and additional facility costs . . . . [S]ince 2020, residential customers' share of transmission costs have declined by 10 percent, while data centers and other customers' allocation have increased by 10 percent").

[124] Georgia Pub. Svc. Comm'n, PSC Approves Rule to Allow New Power Usage Terms for Data Centers (2025), https://psc.ga.gov/site/assets/files/8617/media_advisory_data_centers_rule_1-23-2025.pdf.

[125] These are alternately called public service commissions, corporations commissions, commerce commissions, or railroad commissions, depending on the state.

[126] *See supra* note 113.

4. Federal Regulation: Wholesale Rates, Capacity Investments, and Transmission Interconnection

While states regulate the rates that electric utilities may charge their retail customers, FERC governs three critical aspects of large load. First, FERC governs the planning for and operation of the transmission system—the backbone of the grid. This includes planning the lines, determining who may interconnect with and use the lines, designing the rates for the users of lines, and allocating those rates among different users. Second, FERC regulates the reliability of the grid, which includes planning for how much physical generation capacity and other infrastructure must be available to meet near-term and future needs of utilities that serve retail customers. And finally, FERC regulate the rates that utilities charge when buying wholesale electricity from each other or from independent generators. In this sense, FERC serves as the primary gatekeeper for most new digital industry energy acquisition.

All of this regulation occurs under the broadly-worded Federal Power Act of 1935, which gives FERC jurisdiction over "the transmission of electric energy in interstate commerce and . . . the sale of electric energy at wholesale in interstate commerce," but not to "any other sale of electric energy" (retail sales) or "facilities used for the generation of electric energy" or "facilities used in local distribution" or wholly intrastate transmission.[127] Few transmission lines are deemed wholly intrastate, as even within-state lines eventually connect to out-of-state lines, with the exception of Alaska, Hawaii, and Texas.[128]

a. Transmission Governance

Transmission lines are the most critical component of the grid, also called the "bulk power system." While states regulate utilities' provision of electricity to retail customers, FERC regulates the entire system of getting wholesale electricity to utilities, including the generation and transmission lines necessary to deliver that electricity. On a networked grid, power does not flow without the "highways" (physical wires) necessary for its transport. As we explore in Part I, transmission constraints, which are blocking new generation, are a larger driver of large loads' defection from the networked grid.

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[127] Federal Power Act §201(b)(1).

[128] ERCOT, Federal Energy Reg, Commn., https://www.ferc.gov/industries-data/electric/electric-power-markets/ercot ("The transmission grid that the ERCOT independent system operator administers is located solely within the state of Texas and is not synchronously interconnected to the rest of the United States.").

Private utilities build the bulk of transmission lines on the North American grid.[129] Some independent companies called "merchant" transmission companies and some federally-owned power authorities also build and operate these lines. At FERC's (and some states') urging, although private, investor-owned utilities still *own* the bulk of U.S. transmission lines, many of them have handed operational control of the transmission lines to private non-profit organizations called regional transmission organizations (RTOs) or independent system operators (ISOs).[130] FERC governs these RTOs and ISOs (simply called "RTOs" throughout the rest of the Article). Two-thirds of electricity customers in the United States are served by utilities within the service territory of an RTO.[131] Outside of RTO territories, private utilities that own transmission also plan for new transmission and operate the transmission lines.[132]

RTOs and other grid operators are central players in large load governance because they do much of FERC's transmission governance work, including planning for transmission lines that may be needed to support large load, reliability, and state policies for clean energy; determining which generation may interconnect with or disconnect from the grid, and when; and establishing how much generation capacity and other infrastructure is needed to provide a reliable supply of utilities and other grid users.[133]

In the realm of transmission planning to carry the electricity needed by large loads, some RTOs are taking an active role. PJM—the midwestern and mid-Atlantic RTO that serves more electricity users than any other grid RTO—has already ramped up planning for new transmission lines to support the concentration of load centers in Northern Virginia.[134]

Once transmission lines are planned for and (if the stars align, constructed), detailed procedures apply to new generator interconnection. RTOs and other grid operators require that generators proposing to interconnect with transmission complete detailed, expensive studies to examine how their proposed new flow of electricity will impact the grid and whether it will pose reliability concerns.[135] If the flow will contribute to congestion and other problems, the generator proposing to interconnect must pay for the necessary upgrades to alleviate those problems. RTOs and other grid operators conduct

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[129] Peskoe, Transmission Syndicate' Transmission, American Electric Power, https://www.aep.com/about/businesses/transmission/ ("We own the nation's largest electricity transmission system — 40,000-miles — with more 765-kilovolt extra-high voltage transmission lines than all other U.S. transmission systems combined.").
[130] FERC Order No. 888, FERC Order No. 2000.
[131] The IRC: Shaping Our Energy Future, ISO/RTO Council, https://isorto.org/.
[132] Klass et al., *supra* note __, at 1058.
[133] Klass et al., *supra* note __, at 1057-1059.
[134] *Supra* note 76.
[135] NERC Reliability Standard FAC-002-2.

similar studies for generator disconnections—a growing issue as generators propose to defect from the grid to serve more lucrative co-located large load.[136]

Beyond conducting studies, generators in the queue must demonstrate an actual commitment to interconnecting if approved, through payments, proof that they control the generation site where they propose to build, and other measures. As new generators have lined up to serve large load users and other customers that have contracted for generation—primarily clean generation—many queues have become unreasonably long. In 2022, the PJM queue peaked at over 2,700[137] generators and energy storage companies. PJM placed a moratorium on new interconnection approvals while sorting out the mess, and in November of 2022 FERC approved new PJM interconnection rules.[138] The pace of interconnection remains slow, however. After adding 5,000 MW of generating capacity in 2023, new additions had only reached 2,000 MW as of September of 2024.[139]

These figures do not reflect lower effective load carrying capacities (ELCC) of renewables compared to conventional generation. When these factors are applied, the 2024 figures for PJM represent only "a few hundred megawatts"[140] of peak load. The same applies to PJM's entire interconnection queue - while LBNL estimated that PJM's total active interconnection queue at the end of 2023 had reached 287 gigawatts of nameplate capacity, this represented less than 200 gigawatts of peak load carrying capacity.[141] In other words, PJM process interconnection requests much, much faster and at a sustained rate if projected peak loads materialize.

Large load customers and utilities serving large load, scrambling to connect their generation to the grid and willing to pay for upgrades, are trying to find ways to "jump" the queue, but are not yet succeeding.

Beyond governing the interconnection of new generation, RTOs and other grid operators have a role in approving the interconnection of new *load*—or at least planning for it. Large loads served by utilities are within the province

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[136] Explaining Power Plant Retirements in PJM, https://learn.pjm.com/three-priorities/planning-for-the-future/explaining-power-plant-retirements.aspx.
[137] Aaron Bryant et al., White & Case, FERC Approves PJM Generator Interconnection Queue Reforms, Dec. 8, 2022, https://www.whitecase.com/insight-alert/ferc-approves-pjm-generator-interconnection-queue-reforms.
[138] PJM Interconnection, L.L.C., 181 FERC ¶ 61,182 (2022).
[139]https://www.utilitydive.com/news/pjm-interconnection-capacity-online-construction-shortfall-vc-renewables/728145/?t
[140]https://www.utilitydive.com/news/pjm-interconnection-capacity-online-construction-shortfall-vc-renewables/728145/?t
[141] Rand et al., "Characteristics of Power Plants Seeking Transmission Interconnection As of the End of 2023," 14.

of state regulation preserved by the Federal Power Act.[142] But utilities report their projected loads to grid operators—since grid operators plan for new capacity and transmission lines needed to serve these utilities.[143] Additionally, large loads that co-locate with existing generators affect these generators' interconnection agreements with the grid operator, since the generators propose to offer less energy to the grid and more to the single load. And finally, because large load impacts the reliability of the grid as a whole, some grid operators include it in their system impact studies.

Not all grid operators have policies for governing new large load interconnection—yet another gap in the governance system, which we highlight in Part IV. Some have limited policies. New York's regional grid operator, NY ISO, has three paragraphs somewhat vaguely addressing large load interconnection, and system impact studies needed for this load, within their transmission regulations (called a "tariff").[144]

b. Capacity Mandates for a Networked Grid

Another key component of reliability is ensuring that enough physical *generating* infrastructure will be available to meet all load—today, tomorrow, and three or five years from now. A variety of generating units and services are necessary to fulfill this tall reliability mandate, as load varies throughout the day (e.g., in hot climates, load typically peaks in the early afternoon as air conditioning use spikes) and during different seasons. Grid operators must maintain different types of generation to meet this load, including baseload plants—those that run nearly all of the time to meet the base level of constant demand—and various types of reserves, such as peaker plants that can turn on during periods of high demand. Grid operators also deploy "ancillary services"—very last-minute changes to generation output, or services such as rerouting the flow of electricity in congested wires—to address instantaneous changes in supply or load. Finally, grid operators supply "reactive power"—resources necessary to address changes in voltage, which can negatively impact the entire system, and "blackstart services"—electricity that would be necessary to get the entire grid back up and running in the event of a total, grid-wide blackout.

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[142] 16 U.S.C. 824d (FERC lacks jurisdiction over "any other sale of electric energy"—non-wholesale sales).

[143] FERC Transcript, *supra* note __, at 27-28 (noting that PJM relies "on a significant amount of interaction and coordination with our transmission owners because these [large load] requests typically come in through our transmission owner interconnection request processes. And so, our load forecasting team spends quite a bit of time vetting, frankly, what is coming in through our transmission owners").

[144] FERC Transcript, *supra* note __, at 63; NY ISO Open Access Transmission Tariff at 2150-2151, https://nyisoviewer.etariff.biz/ViewerDocLibrary/MasterTariffs/9FullTariffNYISOOATT.pdf.

All of these services are increasingly critical as large amounts of load come online. As we explore in Part III, for large loads that co-locate with generation to get power from it, but the generation remains connected to the grid, other utilities argue that these large loads are receiving ancillary and black start services from the grid but may not be paying their fair sure.

Grid operators typically plan for and acquire capacity by conducting detailed studies of projected future load, population changes, and other factors, and then requiring utilities to acquire capacity based on these projects. Several RTOs address capacity requirements through auctions. They assign each load serving entity (typically a utility) a requirement to acquire a specific amount of capacity to meet projected load and additional capacity as a buffer for unexpected load changes. These entities must purchase this capacity in an auction, self-build their capacity, or both.

Rapidly rising load and other factors, such as the need for generation during extreme weather events, and the challenge of connecting new generation to over-crowded transmission lines, have caused some auctions to spiral out of control. In July of 2024, PJM—the grid operator that serves the largest electricity market in the United States—ran a capacity auction that resulted in $14.7 billion in bids by load serving entities.[145] Electricity customers will ultimately bear this cost. Governor Shapiro of Pennsylvania has sued, arguing that this auction will unacceptably harm customers.[146] The governor and the commonwealth have reached a settlement to cap auction prices as load continues to grow and other stressors hammer the grid.[147]

c. Wholesale Ratemaking

The cost of the generation capacity built to ensure a reliable supply of electricity—even as demand rapidly rises—is borne by utilities, through wholesale rates, and ultimately utility customers, through retail rates. There are growing concerns that non-large-load customers may be bearing—or will

[145] Ehtan Howland, PJM capacity prices hit record highs, sending build signal to generators, UTIL. DIVE, July 31, 2024, https://www.utilitydive.com/news/pjm-interconnection-capacity-auction-vistra-constellation/722872/?t

[146] Complaint of Governor Josh Shapiro and the Commonwealth of Pennsylvania, Docket No. EL25 at 14-15 (Dec. 30, 2024), https://pa.gov/content/dam/copapwp-pagov/en/governor/documents/pjm-lawsuit/gov. shapiro and commonwealth of pa complaint(119760108).pdf (observing that "[e]lectrification and rapidly growing interest in generative AI and associated data centers have upended a 30-year trend of relatively flat load forecasts" and critiquing PJM's design and operation of its capacity market).

[147] Commonwealth of PA, Governor Josh Shapiro Reaches Agreement with PJM, Jan 28, 2025, https://www.pa.gov/governor/newsroom/2025-press-releases/gov-shapiro-agreement-pjm-prevent-price-hikes-save-consumers-ove.html.

ultimately bear—the costs of the substantial increase in capacity required for large load.[148]

A variety of utilities serve U.S. electricity customers—investor-owned utilities with publicly traded stocks, municipal (local government-owned) utilities, federal (government-owned) power utilities, and electric cooperatives. Whenever any of these types of utilities are selling or buying electricity that will later be sold retail—electricity that is wholesale, or a "sale for resale"—FERC jurisdiction applies (with the exception of federal power authorities).[149]

For the most part, FERC allows wholesale rates to be set in the competitive market, through auctions or contracts between utilities or between utilities and generators. However, in areas where FERC deems there to be inadequate competition for generation, FERC still regulates wholesale rates, through the same cost-of-service approach described for retail ratemaking. As explored in Part III, FERC has rejected some proposed wholesale rates charged by utilities facing new, large loads from digital customers. This creates uncertainty for utilities attempting to make new generation investments to serve these customers, and for the digital industry firms deciding how much to invest in a given geographic area.

The complexity of the networked grid and its governance system—which focuses centrally on capacity and planning for transmission lines to which capacity can interconnect—is expanding with the rapid growth of large load. As commissioners of our federal electricity regulator, FERC, have acknowledged, the governance system has not yet caught up.[150] The following Part emphasizes the technical and regulatory gaps in this out-of-date governance system.

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[148] *See supra* note 94.

[149] *See, e.g.*, Bonneville Power Admin., How two FERC orders revolutionized the power utility industry, Dec. 20, 2024, https://www.bpa.gov/about/newsroom/news-articles/20241219-how-two-ferc-orders-revolutionized-the-power-utility-industry ("As a federal power marketing administration, BPA is not subject to FERC's jurisdiction . . . .").

[150] 189 FERC ¶ 61,078, *supra* note 3, dissent at 3 (expressing deep concern regarding what Commissioner Phillips views as FERC's failure to "demonstrate regulatory leadership and flexibility"); FERC Transcript, *supra* note 3, at 19-20 (comments of Commissioner Chang, asking "are there near-term solutions that we must take on now because the load is already being built, versus are there longer term solutions that we need to really examine, such as developing new grid codes that will support new sets of customers"); *id.* at 20 (comments of Commissioner Chang: "Maybe our OATT [open access transmission tariff] has been around since before deregulation, is it time to relook at some of the rules that we have to accommodate new types of customers?"); *id*. at 14-15 (comments of Commissioner Rosner: "I think it's really, really important for the Commission to make sure that we [get] the transmission rate design, and electricity market rules right").

## III. THE TECHNICAL AND GOVERNANCE FAILURES OF THE MODERN ELECTRIC GRID

As we explore in Part I, electricity is an unusual good, and the difficulty of effectively governing this good grows as the physical system changes. There is only one way to transport electricity—through wires—and the quantity of the good supplied must constantly and exactly match the quantity of the good consumed.[151] Absent each electricity user supplying their own electricity—the expensive approach historically used—electricity suppliers and customers are unavoidably intertwined. Increases or decreases in generation and load (demand) necessarily impact all grid suppliers and users. This is the case from the neighborhood level to the national level. But the realities of the interdependency of networked electricity supply and use are now starker than ever. The rise of a capital-rich digital industry, poised for massive growth and hungry for nearly unprecedented amounts of electricity, places new strains on this system.

The failure of the modern networked grid to rapidly and adequately accommodate rising demands for energy is evident throughout the United States. We analyze several of the most prominent examples of this failure in this Part, highlighting the challenges of interconnecting new supply and load and accommodating new load without producing inequities for existing electricity consumers. As this Part explores, federal energy regulators, regional grid operators, and state utility commissions are scrambling to update this governance system, but they are not in all cases moving fast enough.[152] Good governance of the new large-load grid requires a uniform analytical framework for electricity governance in the era of large load—an effort we take up in this Part—and the clear policy pathways for filling this gap, explored in Part IV.

The current governance approach—in which FERC, transmission operators, and state regulators make patchwork, case-by-case decisions without a guiding framework—threatens to further impede the growth of burgeoning industries and generate regional inequalities in electricity service and costs.[153]

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[151] ALEXANDRA VON MEIER, ELECTRIC POWER SYSTEMS: A CONCEPTUAL INTRODUCTION 299 (2024).

[152] *Cf.* Commonwealth of Virginia Corp. Commn., *supra* note 3, at 12 ("[W]e cannot lose sight of the urgency of the moment . . . . Taking years to perfect our [regulatory] approach is not an option.").

[153] *See, e.g.*, FERC Docket ER24-2172 (October 2024) Pennsylvania Governor Josh Shapiro re the impacts of large electrical off-takers, co-located at generating facilities etc. under

### A. New Load, New Supply, and Insufficient Transmission Capacity: The Challenge of Transmission Interconnection

The primary physical and financial challenge of rapidly adding massive amounts of new load to the grid is the challenge of transmission. The amount of transmission lines connecting electric utilities' generating units to each other (for shared generation reserves) and to customers is limited due to cost—transmission lines cost millions of dollars per mile to build. Other primary barriers to transmission include public opposition to the aesthetic and environmental impacts of new wires, and anti-competitive behavior by utilities.[154]

Even when ambitious firms propose to take on the financial risk of building new wires that would connect new generation to load across large areas, arguments over which users should shoulder which costs of the new wires abound.[155] States control the siting (location) of the wires—even interstate lines—and often deny siting certificates due to public opposition to ugly infrastructure.[156] And many large utilities only build transmission within their own service territories, avoiding new regional wires that would allow other utilities and generators to access customers, thus increasing competition.[157] This section highlights transmission constraints as a key impediment to large load and uses the Talen Energy case study to highlight these challenges.

#### 1. Transmission Constraints

The United States has too few transmission lines to accommodate new generation—even without the recent load surge—and new users who want to draw electricity from the grid are constrained in two ways. The wires have physical constraints on the quantity of electricity that can flow through the wires. Wires are rated for specific capacities, and too much electricity

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ER24-2172 et al. (arguing against a governance solution that involves "a patchwork of different rules for different utilities in Pennsylvania"); Freed & Clements, *supra* note 40 (criticizing the "fragmented" approach to large load).

[154] Peskoe, *supra* note __; Wilson & Klass, *supra* note __; NECEC Transmission LLC v. Bureau of Parks and Lands, 281 A.3d 618 (Me. 2022) (preliminarily enjoining a Maine voter initiative that blocked a transmission line to carry hydroelectric power from Quebec to Massachusetts),

[155] *See, e.g.*, Illinois Commerce Commn. v. FERC (7th Cir. 2009); Illinois Commerce Commn. v. FERC (2014) (inadequate FERC numbers to demonstrate even allocation of benefits of new transmission lines and therefore inadequate support for "postage stamp" rates that would have charged all line users the same increased fee to cover the costs of the new transmission lines).

[156] *Supra* note 154.

[157] Peskoe, *supra* note __.

flowing through wires causes congestion similar to that on a highway.[158] Congestion can also interfere with the functioning of the grid, requiring special technologies that can re-route flow to less crowded wires.[159]

Facing constraints on the amount of electricity that transmission lines can carry, new users have limited options. They can try to locate in areas with ample generation and ample room in the wires to transport electricity. Data center requirements depend upon their primary use: training AI models and mining cryptocurrency requires more energy, but proximity to end users via a low-latency internet connections is less critical. Conversely, consumer-facing services like e-commerce and hosting of already-trained AI models may prioritize low latency over energy availability. Companies with mixed needs, like financial institutions that want secure, long-term data storage along with fast customer-facing services may split their usage between data centers with attributes that best suit each application.[160]

Digital loads with relatively broad flexibility may spring for traditional electricity service in the relatively rare areas with excess electricity waiting to be "absorbed" by new users. Indeed, utilities such as Black Hills Energy in Wyoming are advertising their services to large loads, offering renewable energy, special tariffs for large loads, and a separate "interruptible" tariff for "blockchain" users that do not need steady power.[161]

In the event that the digital industry and its large loads cannot find areas with *both* ample generation and physical space in existing transmission lines—as is the case in much of the United States—they have three remaining options. First, they can attempt to find areas with adequate transmission capacity but limited generation capacity and purchase electricity from a retail utility. Data center operators in Georgia are primarily following this approach. They are working with a vertically integrated utility—Georgia Power—to interconnect large amounts of new load. Georgia Power, in turn, is building new generation to service that load.[162]

A second approach is to contract for new generation and new transmission—an expensive proposition. This does not appear to be the path most commonly followed for data center operators. Despite their deep pockets—and even their willingness to contract for restarting nuclear power plants to the tune of billions of dollars—they have not yet extensively invested in transmission

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[158] Aaron Larson, Electric Transmission Grid Problems and Solutions, POWER Mag., Aug. 30, 2020, https://www.powermag.com/electric-transmission-grid-problems-and-solutions/.
[159] Grid-Enhancing Technologies Improve Existing Power Lines, U.S. Dept. of Energy, https://www.energy.gov/oe/grid-enhancing-technologies-improve-existing-power-lines.
[160] CBRE, Hungry Like the Wolf: Data centers and new power-intensive tech, Oct. 31, 2023, https://www.cbre.com/insights/podcasts/2023-ep41-hungry-like-the-wolf
[161] The advantages of building in Wyoming, Black Hills Energy, https://www.blackhillsenergy.com/services/data-centers/advantages-building-wyoming.
[162] *Supra* note 91.

projects. This may be due to the numerous types of hurdles to new transmission lines noted above—not just cost, but also strong public opposition and a regulatory morass, in which states frequently block proposals for new transmission lines. Even those lines that are approved take years—even decades—to build.[163] Data companies, grasping for quick supply to maintain a competitive edge in a rapidly changing industry—do not have the leisure of time. Data center development timelines are typically under three years.[164]

Desperate for any energy—even if not immediate—some data companies are, however, investing in transmission infrastructure and considering entering the transmission business. Global investors, betting generally on the business of transmission to serve new load, are also partnering with utilities to invest in new transmission in areas of data center growth, such as Ohio.[165]

The final solution for data companies—and one that many are pursuing—is to go off-grid (or mostly off-grid) and self-supply generation by physically locating data centers next to existing or new generation, an approach called "co-location."[166] This is an increasingly popular path, but a fraught one. This return to decentralization is the strongest indicator of the constraints posed by the highly networked grid—a grid that cannot rapidly supply large amounts of new electricity to those who need it. Data companies often view the costly yet relatively quick approach of going it alone—building their own generation or contracting for it, and directly consuming the electricity—as the most feasible approach.[167]

Even co-located generation, however, is encountering hurdles, because some data companies have sought to locate near *existing* generation that is currently connected to the networked grid, or recently was.[168] One or several existing electric utilities, with an obligation to serve existing customers, invested in

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[163] Commonwealth of Virginia Corp. Commn., *supra* note 3, at 18 (noting the challenge of data centers wishing to connect to the grid within one to three years, new generation projects taking two to eight years, and "transmission takes even longer than that").

[164] Commonwealth of Virginia Corp. Commn., *supra* note 3, at 18 (noting that data center loads can "come onto the system within one to three years' timeframe").

[165] PSP, KKR and PSP Investments Acquire Minority Stake in Two American Electric Power Transmission Companies, https://www.investpsp.com/en/news/kkr-and-psp-investments-acquire-minority-stake-in-two-american-electric-power-transmission-companies/?ref=/en/news/.

[166] *Supra* note 28.

[167] Commonwealth of Virginia Corp. Commn., *supra* note 3, at 196-97 (noting that Google prefers co-location with newly built generation not to avoid generation or transmission costs but rather due to the need for "speed to market" and the constrained generation resources available on the network, such as PJM's network).

[168] FERC Order Rejecting Amendment, *supra* note __; Casey Crownhart, Why Microsoft made a deal to help restart Three Mile Island, MIT Tech. Rev., Sept. 26, 2024, https://www.technologyreview.com/2024/09/26/1104516/three-mile-island-microsoft/.

this generation with the expectation that it would be available for their customers.[169] Grid operators allowed the generation to be interconnected to constrained transmission lines with the expectation that the generation would flow through those transmission lines, contributing to the constant and delicate balance of electricity required to allow the grid to function properly. Proposals to withdraw this infusion of electricity from the wires threaten to upend this delicate physical balance, as well as the vested interests of utilities and their customers.[170] The case study highlighted in Section III.B. shows the challenges posed by this approach—when data center operators propose to take existing generation largely off-grid and use the electricity themselves.

Alternatively, some data companies are proposing to revive mothballed plants, such as nuclear reactors that closed for financial reasons, or self-build generation that is not connected to the grid.[171] But even these approaches have implications for the networked grid. Due to supply chain constraints, there is only so much new generation to go around.[172] When data centers contract for new, off-grid supply or propose to revive old plants, they are competing with utilities that serve other customers that would otherwise benefit from this new supply.

As we highlight in Part III, large, entrenched utilities serving existing customers have made this very argument about co-location of data centers with generation. They argue that there is simply not enough capacity to go around, and that, due to regulatory bottlenecks in building new generation capacity and transmission, there will be problematic scarcity. These utilities argue for a first-come, first-served approach, in which existing utilities and customers should have priority access to this scarce supply over new large load.[173] This, of course, is purely an economic problem of supply and demand (with strong equity implications baked in). But in the absence of changes to these stubborn regulatory bottlenecks, the question of load priority is a real one that must be addressed.

2. A Lack of Uniform Interconnection Standards

Amidst these burgeoning, albeit constrained, options for large loads connecting to the grid, there are no uniform load interconnection standards at the state or federal levels. At the state level, utilities must approve large loads' requests to be served, and most are using simple first-request, first -

[169] *See, e.g.*, *infra* note 257 (noting state-subsidized nuclear plants now proposing to largely defect from the grid to serve load).
[170] FERC Order Rejecting Amendment, *supra* note __.
[171] *See, e.g.*, *supra* note 78 and accompanying text.
[172] Commonwealth of Virginia Corp. Commn., *supra* note 3, at 18 (emphasizing supply chain issues).
[173] *See infra* text accompanying note 187.

served (if at all) principles.[174] In the western United States, the process for large load to enter a utility's queue is as informal as someone from the large load customer calling the utility and suggesting indicating that they will be requesting service.[175] (Large load customers often propose multiple potential locations for one source of load as they shop around for electricity rates, permitting, and tax and other incentives, therefore often making the same request of multiple utilities.)

A proposed bill in Utah would set out some uniform interconnection procedures for large load requests made to utilities. The bill specifies uniform content for large load service requests, including "information sufficient to demonstrate the financial capability to complete the project, proposed service commencement data at least three years after the request, and other information.[176] The bill also specifies utility procedures after receiving interconnection requests, including the completion of a feasibility study, notification of denial or approval of the requested service within fifteen days after completion of the study, and notification of any system upgrades or improvements necessary to accommodate the request, among other steps.[177]

Transmission operators following federal regulation by FERC must approve modified generation interconnections that result from large loads—including co-located generation-load requests. The only federal load interconnection standards to-date come from the North American Electric Reliability Corporation, NERC, and they are quite vague, lacking specificity in terms of modern large load issues. NERC is a private entity overseen (with a light touch) by FERC, and it issues mandatory reliability standards that all generators and transmission operators associated with the "bulk power" (non-retail) electricity system must follow. NERC has interconnection standards that apply to *all* entities interconnecting generation, transmission, or "electricity end-user Facilities" to the bulk power system, but these do not provide the sorts of uniform details that will be needed to create an orderly, predictable process for large loads associated with the networked grid.[178]

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[174] Elevate Energy Consulting, *supra* note xx, at 11.

[175] Elevate Energy, *supra* note xx, at 11 ("One IAG member highlighted that even a speculative phone call regarding load interconnection is subsequently treated as a formal request and the utility will conduct cursory studies to explore the potential interconnection.").

[176] 01-17 14:15 Electric Utility Amendments, 2025 General Session at 3, https://le.utah.gov/Session/2025/bills/introduced/SB0132.pdf.

[177] *Id*. at 4.

[178] NERC FAC-002, https://www.nerc.com/pa/Stand/Reliability%20Standards/FAC-002-2.pdf ("Each Transmission owner, each Distribution Provider, and each Load-Serving Entity [typically a utility] seeking to interconnect new transmission Facilities or electricity end-user Facilities, or to materially modify existing interconnection of transmission Facilities or electricity end-user Facilities, shall coordinate and cooperate on studies with its Transmission Planner or Planning Coordinator"); NERC FAC-001,

FERC has initiated a proceeding directing grid operator PJM to either change its tariff (rates and terms of service) for interconnecting users or show why its existing tariff is "just and reasonable," making it clear that FERC does not view the existing tariff as just and reasonable. This proceeding will also fold in proposed tariff revisions from large utilities that address large load.[179]

Beyond this minor progress or proposed progress, the interconnection process is largely haphazard, lacking uniform guidance. As Peter Freed and Allison Clements observe, "Moving up or down the list of loads being studied can seem arbitrary or come down to other factors like how high an economic development priority the project is for the state."[180]

The following case study highlights how this haphazard interconnection process plays. It also pinpoints the substance of the network, transmission-based challenges associated with co-located large loads that attempt to go mostly off-grid, taking existing generation with them.

3. The Talen Energy Interconnection Failure

Amazon's struggle to acquire hundreds of megawatts of new electricity for a data center shines a stark spotlight on the interconnection challenges facing new load. In 2021, Susquehanna Nuclear, LLC—a division of Talen Energy—informed its transmission grid operator, the RTO PJM, that it planned to increase the sale of electricity from its nuclear power plant to "large data center loads" (Amazon), which has already co-located next to the nuclear plant and were already using power from the plant.[181] Talen proposed that these loads would be "behind the meter," meaning that electricity from the nuclear plant would flow directly to the data centers, not through the networked grid.[182] The loads have their own back-up units in the event of a loss of power from the Talen plant.[183] The nuclear plant and data centers would not wholly disconnect from the grid, however; it is not clear, for example, that the data centers would wholly avoid drawing back-up power

https://www.nerc.com/pa/Stand/Reliability%20Standards/FAC-001-3.pdf ("Each Transmission Owner's Facility interconnection requirements shall address interconnection requirements for . . . end-user Facilities").

[179] 190 FERC ¶ 61,115 Order Instituting Proceeding under Section 206 of the Federal Power Act and Consolidating with Other Proceedings, Feb. 20, 2025, https://www.ferc.gov/media/e-1-el25-49-000; 190 FERC ¶ 61,109, Order Rejecting Tariff Revisions, Feb. 20, 2025, https://www.ferc.gov/media/e-8-er24-2888-001; FERC Orders Action on Co-Location Issues Related to Data Centers Running AI, Feb. 20. 2025, https://www.ferc.gov/news-events/news/ferc-orders-action-co-location-issues-related-data-centers-running-ai (summarizing FERC's actions and orders).

[180] Freed & Clements, *supra* note __.

[181] FERC Order Rejecting Amendments, *supra* note 4, at 5.

[182] *Id*.

[183] *Id*. at 21.

from the grid when and if the nuclear plant had to temporarily shut down for maintenance or temporarily decrease its megawatt-hours of output.[184]

PJM proceeded to study the impact of this proposed behind-the-meter arrangement. The arrangement would require Talen Energy to reduce the amount of electricity flowing into the networked grid from its two nuclear units—a total reduction of 322 megawatts, or the equivalent of the electricity used by approximately 95,000 homes.[185] This electricity would instead flow directly to large co-located data centers. This change required modification to Talen's interconnection service agreement (ISA) with PJM.[186] ISAs include commitments to interconnect specific amounts of capacity that will be available to the networked grid—capacity that other grid users could benefit from. By reducing the capacity available to dispatch (flow into) the grid, Talen was changing the services that it provided to the grid.

a. Reducing Capacity Available to the Network

A fundamental concern of utilities opposing the interconnection of new, large co-located load like the Talen-Amazon arrangement is that the data industry is "stealing" existing capacity that would otherwise be available to the other, existing users on the grid. This is, at its core, merely a supply and demand argument. Existing users think that they should have the superior claim to capacity supply. Indeed, Exelon and American Electric Power, in opposing PJM's approval of Talen Energy's amended ISA, bluntly state that their argument is an economic one, and that they view themselves as more important market players due to their obligations to existing customers:

> The number of expecting, non-conforming ISAs [interconnection service agreements] that . . . [Talen's] filing anticipates could have a profound effect on the market. Should large quantities of load rush to co-locate with generation . . . PJM capacity markets will have *steadily decreasing volume* as the capacity resources flee to serve load that uses and benefits from—but does not pay for—the transmission system and the ancillary services that keep the system running. This will harm existing customers. Given the challenges in interconnection, siting, and approval of both generation and transmission, replacement capacity will take years to develop. The *inevitable consequence will be scarcity* resulting in rising energy and capacity prices . . . . ."[187]

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[184] *Id*. at 10-11.
[185] *Id*. at 1.
[186] *Id*. at 4-5.
[187] Protest of Exelon Corporation and American Electric Power Service Corporation, *supra* note 28, at 3 (emphasis added).

Utilities have some reasonable arguments for the stance that they should have higher priority in the queue for scarce new generation capacity given their existing customer base. Utilities have a regulatory, state-based obligation to serve customers, and they made historic investments in this capacity. If capacity partially funded by utilities flees for the greener, more lucrative pastures of serving large load, how should utilities be compensated for the loss of future benefit from this load? Proper rate design can cover this compensation issue, but if there simply is not enough capacity to go around, rate design and more formal priority-based queues for new load will be necessary.

Utilities to some degree acknowledge that large loads could enter the grid if they paid their fair share, with AEP and Exelon stating that new large load is taking capacity off the grid while failing to pay for the "transmission system and the ancillary services that keep the system running."[188] But other aspects of AEP's and Exelon's argument suggest that no amount of money would satisfy these entrenched utilities and persuade them of the merits of new large load, given the high regulatory obstacles to getting new generation and transmission built and grid connected.

Those responsible for grid governance have so far allowed this capacity to be taken offline and assumed that capacity markets will fill the gap for network-connected customers. For example, PJM guidance states that co-located customer facilities such as data centers may elect for a designation of "Behind the Meter Generation," but that this amount of electricity no longer counts as capacity provided to the network from the co-located generator.[189] But FERC blocked the proposed exit of grid-connected generation to serve large load, in the case of Talen, citing insufficient justifications by PJM for allowing Talen's nuclear unit to revise its interconnection agreement with PJM and to reduce the amount of electricity flowing to the grid.

b. Using Network Services Without Paying?

In addition to changing the amount of electricity available to the users on PJM's vast network, Talen Energy's proposal also involved issues of *load* interconnection. Amazon—the existing load—was proposing to use the nuclear plant's existing interconnection to *draw* additional electricity from the nuclear units, and, potentially, back-up electricity from the grid. Talen and Amazon indicated that they would be almost entirely "islanded" from the grid, providing their own backup electricity rather than relying on the grid, but other network users were skeptical of this promise.[190] They pointed to a

[188] *Id*.
[189] PJM, PJM Guidance on Co-Located Load 1-2 (2024), https://www.pjm.com/-/media/DotCom/markets-ops/rpm/rpm-auction-info/pjm-guidance-on-co-located-load.ashx
[190] *Id*. at 7, 10-11.

past incident in which Talen's nuclear units temporarily stopped generating electricity, yet the data centers continued using electricity, suggesting they were relying on the grid and should be pay for its services.[191]

Rejecting contentions that Talen and Amazon retained some network services for which they should pay, Talen and PJM argued that in the revisions to the ISA, they had ensured that the large load would not draw any back-up power from the grid. They pointed to a variety of technologies installed to wholly "island" the load from the grid and supply backup power.[192]

Prior to approving Talen's ISA—an approval that FERC rejected—PJM had issued brief guidance for co-located large load, which was reflected in the ISA. PJM's guidance proposes a seemingly simple solution to the issue of proving grid disconnection, stating that generators such as Talen could designate themselves as "Behind the Meter Generation Facilities" (BTMG) and avoid claims that they owed money for network benefits.[193] The consumption of electricity (in megawatts by the large load connected to the BTMG must be measured, as must the output of the BTMG.[194] If the large load facility uses more megawatts than the output of the BTMG connected to the load, then PJM will assume that this additional electricity came from the grid and will charge the large load facility for the new usage, at the same price charged of other users at that general location.[195] This was the solution largely adopted in PJM's approval of the Susquehanna modified interconnection agreement, which FERC ultimately rejected. Talen Energy appealed FERC's order in January 2025.[196]

### B. Allocating the Costs of New Load

Beyond the challenges of transmission interconnection, another major facet of electricity governance for the large load era is determining the costs and benefits that large load, whether grid-connected or not—causes for the system. Identifying these costs allows states (for retail electricity and some transmission rates) and grid operators (for transmission rates, with FERC approval) to set appropriate rates for large loads that avoid passing large load costs to other consumers. Better large load rates will also incorporate the

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[191] *Id*. at 11.
[192] *Id*.
[193] PJM, PJM Guidance on Co-Located Load 1-2 (2024), https://www.pjm.com/-/media/DotCom/markets-ops/rpm/rpm-auction-info/pjm-guidance-on-co-located-load.ashx. Different prices are charged at different "nodes" on the transmission grid.
[194] *Id*. at 2.
[195] *Id*.
[196] Reuters, *Talen goes to court over FERC's Amazon co-located data center rejection*, Jan. 28, 2025, https://www.reuters.com/legal/talen-goes-court-over-fercs-amazon-co-located-data-center-rejection-2025-01-28/.

*value* of large load to the network, such as reducing demand during peak periods.

The project of identifying large loads' cost and benefits to the system and setting rates is a difficult one, though. Fixed costs dominate the business of generating, transmitting, and distributing electricity. Early in the process of electricity commercialization, additional load was beneficial—even encouraged. If a utility was building a large power plant and wires to serve industrial load, adding residential customers to this system—customers that could benefit from the same power plant and wires—benefited everyone, as more customers shared the same fixed costs. But the rapid addition of large amounts of load, as demanded by the energy-hungry data industry—is changing this picture, with some utilities viewing the addition of customers as creating *diseconomies* of scale.[197]

Regardless of the overall efficiency and welfare effects of expanded load and grid infrastructure, the *distribution* of the costs of new infrastructure—covered through higher rates charged by utilities—raises powerful equity issues. Non-industrial customers worry that they are shouldering an undue portion of the new costs caused by large load, and growing evidence suggests that indeed, they are. The Commonwealth of Virginia estimates that customers of Dominion Energy could see *monthly* bills increase by $15 to $37 in real dollars by 2040, and Eliza Martin and Ari Peskoe document numerous incidences of cost shifting from an analysis of numerous utility rate cases for large load.[198]

Beyond current cost shifting problems, utilities that see opportunity (and earnings) in serving new load worry that the load may be temporary—leaving them with stranded costs, meaning new infrastructure built to serve customers that the exit the utilities' service territory.[199] The remaining customers are shouldered with the burden of these costs.

This section explores the complex dynamics of the costs of new load and the legal battles that are emerging around these costs, focusing on customers' legitimate concerns about uneven allocation of costs through utility rate structures. It argues for more use of rates and fees that pass fixed costs directly to large load customers—making large load customers pay directly for generation capacity, establishing exit fees, and passing utilities' new generation or electricity purchase costs directly to large loads, among other mechanisms. At the same time, it highlights the importance of enabling and encouraging large loads to offer grid benefits by reducing demand during

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[197] *See supra* Part I.
[198] Commonwealth of Va., *supra* note 42, at 5; Martin & Peskoe, *supra* note __.
[199] *See infra* Part III; Commonwealth of Virginia Corp. Commn., *supra* note __, at 9.

peak demand periods, thus lessening the need for expensive reserve capacity.[200]

Utilities' and customers' opposition to new rate structures to finance infrastructure for large load is one of the primary hurdles slowing load growth. This opposition is not unfounded, but an equitable path through it is needed for the grid to meet its ongoing mandate to provide adequate, reliable energy for all customers—old and new.

1. Parallels to Natural Gas Pipeline Rates

The challenge of allocating rates among customer classes—rates that cover the cost of new generation and transmission constructed for large load—lies in the two-way nature of the benefits and costs of new infrastructure. Although large load directly "causes" the need for the new generation and transmission, aspects of this new infrastructure may benefit existing customers, in which case they should cover some of its costs.[201] To-date, however, there appear to be few collateral benefits of newly-built generation for large load, with Virginia customers' rates poised to skyrocket simply due to the sheer demand for load.

These same types of challenges arise in the context of interstate natural gas pipelines, for which FERC has applied a strict principle—not deployed in the electricity context—stating that existing pipeline customers should not have to shoulder *any* new costs imposed by new users.[202] In one example, in *Antero Resources Corp*., a producer of natural gas sought "firm" capacity in a natural gas pipeline that had existing customers.[203] "Firm" capacity is a guarantee that the producer will be able to ship gas through the pipeline whenever it needs to do so.[204] To guarantee this capacity, the pipeline built four new compressor stations to more efficiently "push" more gas through the pipeline, and it charged the producer a higher rate than other pipeline users.[205] Yet these compressors, installed on an existing pipeline, are more efficient and likely benefit all users. FERC justified charging the producer the highest rate based on its long-used principle that existing pipeline users, through rates, should not pay for costs imposed by new users.

This strict principle against cross-subsidization of new users by existing users is absent in electricity and electricity transmission rates. Rather, rates must

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[200] *See supra* note 95.
[201] *See, e.g.*, *supra* note 27 (describing a new geothermal plant built to power a data center and benefit other customers).
[202] Antero Resources Corp. v. FERC, No. 24-1076 at 6 (Dec. 16, 2024), https://www.ferc.gov/media/antero-resources-corp-et-al-v-ferc. (describing the incremental pricing principle).
[203] *Id*. at 14.
[204] *Id*. at 4.
[205] *Id*. at 15.

only be "just and reasonable" and "nondiscriminatory," and FERC has not interpreted these principles to wholly prohibit cross-subsidization.[206] As noted in Part II, "nondiscriminatory" simply means that a utility may only charge different classes different rates if it demonstrates that those classes impose different costs on the utility system.

For transmission line rates, federal courts consistently require that rates charged of utilities using the lines be "roughly commensurate" with the costs that those utilities impose on the lines, or, synonymously, the benefits that the utilities receive from the lines such as reduced losses of electricity during transmission, enhanced reliability from shared reserves, and lower costs due to reserve sharing.[207]

Numerous utilities have developed creative methods to attempt to require large load to cover its full costs.[208] The best methods, as we explore further in Part IV, are those that charge large load fixed rates for the fixed costs that they impose, thus better ensuring that dollar-for-dollar, large loads cover the cost of new generation. Other utilities do not require large load to directly cover its costs, but they impose exit fees in the event that utilities build generation and transmission for large load and then it skips town, leaving the utility's customers with stranded costs. In addition to the utility-by-utility approaches described in Part IV, some states have imposed state-wide requirements designed to match the costs that large load imposes on the system with the rates that large load pays. Georgia has approved utilities' per-unit higher rates to cover the costs of "upstream" generation, transmission, and distribution built to serve large load centers.[209]A proposed bill in Utah would require that all large load contracts with qualified electric utilities shall "ensure that all large load incremental costs are allocated to and paid by the large load customer."[210] Other attempts to mandate higher rates for large load have failed, however, as reflected in the following Basin Electric case study.

2. The Basin Electric Cost Allocation Failure

The challenges of equitably allocating costs among customer classes came to the fore in the Basin Electric Power Cooperative order issued by FERC in 2024.[211] Basin Electric Power Cooperative is a member-owned utility (a cooperative business structure) that sells wholesale electricity to other electric cooperatives that generate and transmit (or solely transmit) electricity

[206] Federal Power Act, 16 U.S.C. § 824d.
[207] Illinois Commerce Commission v. Fed. Energy Reg. Commn. (2013).
[208] Satchwell et al., *supra* note **Error! Bookmark not defined.**; *supra* note 107 (describing D ominion's special fixed fees for large load).
[209] *Supra* note 78.
[210] 03-01 20:08, Electric Utility Amendments at 8, https://le.utah.gov/Session/2025/bills/introduced/SB0132S02.pdf.
[211] FERC Order Rejecting Proposed Rate, *supra* note 7.

to retail customers in nine Midwestern and Western states.[212] Basin Electric is therefore regulated by FERC, as it sells electricity to other providers, and these providers then re-sell the electricity retail.[213]

Many of Basin's wholesale customers—retail electricity cooperatives, municipal providers of electricity, and the like—have faced demands to serve new large loads from crypto mining companies. Basin accordingly proposed to modify its wholesale rates charged to the utilities that would be serving these loads, and the utilities would pass on these rates to their retail customers.[214] Specifically, Basin Electric proposed two new rates—one Crypto Block Chain Rate Schedule and one Large Load Rate Schedule for other non-crypto large users (many in the digital industry). Basin proposed to *not* charge its utility customers the Crypto Block Chain Rate unless they had more than 25 megawatts of crypto-based load.[215] But any crypto load that exceeded this cap would be subject to the Crypto Rate Schedule.

Basin Electric attempted to justify these differential rates through cost causation, arguing that the uncertain nature of crypto-load, in particular, and its high mobility led to large administrative costs for planning for and implementing load, and potentially covering stranded costs.[216] Large loads objected, arguing that they were not in fact very mobile, did not impose many new infrastructure costs on the grid, and offered valuable demand response services to the grid (reducing large amounts of load during peak demand) that should be reflected in their rates.[217] FERC concluded that there was insufficient evidence of higher costs caused by large loads, with too much speculation about the likely mobility of crypto mining firms and the stranded costs that they would leave behind.[218] Basin Electric had therefore failed to demonstrate that treating large loads differently from others was "just and reasonable" and "not unduly discriminatory or preferential."[219]

FERC was correct to question broad assumptions about higher large load costs—particularly future stranded costs from firms projected to exit Basin Electric's territory—without solid data proving such costs. But its decision leaves many open questions. How much evidence will be enough to show that large load does in fact impose larger costs? How will utilities muster this evidence? Although utilities have long served large loads, there may be real differences in crypto and data center load that utilities have not yet encountered, making it more difficult to accurately project costs. How will

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[212] *Id*. at 1-2; About Us, Basin Electric Power Coop., https://www.basinelectric.com/.
[213] Federal Power Act, 16 U.S.C. § 824d (FERC authority over sales for resale).
[214] FERC Order Rejecting Proposed Rate, *supra* note 7, at 4-5.
[215] One district served by Basin Electric had a 27 MW cap. *Id*. at 6.
[216] *Id*. at 8.
[217] *Id*. at 16-17.
[218] *Id*. at 38.
[219] *Id*. at 38-39.

utilities also incorporate in rates the system benefits provided by grid-connected large load, such as the ability to quickly reduce a large quantity of demand (through "demand response") during periods of system-wide peak demand? We explore potential solutions to this challenge in the data collection and rate making discussions in Part IV.

The FERC decisions to-date reject proposed solutions for interconnecting large load and setting rates that accurately reflect the costs that this load imposes on the grid, thus leaving utilities and the large load they propose to supply hanging in the balance. At the same time, the decisions fail to identify any solutions—rejecting revised interconnections and crypto rate standards with no indication of alternative approaches. These decisions, along with failed efforts to reach consensus within grid governance processes,[220] leave a gaping hole in modern grid governance. Part IV synthesizes the major unresolved issues that must evolve into a comprehensive framework for large load governance and suggests pathways within this framework.

## IV. PATHWAYS FORWARD: GOVERNANCE FOR NEW GRID DEMANDS

The challenge of large loads demands a new governance framework – one built upon orders issued by FERC, revised interconnection agreements crafted by transmission grid operators and approved by FERC, and other formal and less formal guidance that controls and shapes the behavior of all grid users, existing and new. As it stands, utilities and transmission operators are struggling to accommodate burgeoning crypto mining, data centers, hydrogen electrolyzers, and other novel, large energy users. They are operating with no uniform governance standards for going off-grid through co-location, changing interconnection agreements, modifying transmission rates, or tailoring new wholesale or retail electricity rates. This "anti-framework" presents real threats to grid reliability and the growth of the U.S. economy.

Generators with co-located large load argue that updating standards for grid interconnection could improve grid reliability by, for example, requiring additional protection schemes that minimize the negative impact of a co-generation outage on the transmission grid.[221] Yet current interconnection standards deny co-located users the option to establish back-up power and other contingencies for the loss of cogeneration. On the other side of the coin, existing utilities argue that without a guiding framework, such co-located loads still benefit from the network's services without paying their fair share,

[220] Bressler, *supra* note __ (noting an "impasse" after PJM attempted to find stakeholder consensus on large load policy issues).
[221] FERC Order Rejecting Amendments, *supra* note 4.

and remove generation capacity necessary to support the reliability of the entire network. This Part synthesizes this guiding framework and constructs the foundation for large load governance.

There is some merit in leaving some uncertainty and "mud," rather than crystals, in the law as new industries emerge and new risks and opportunities become clearer, with ample room for adaptation.[222] But grid operators and utilities are already demanding guidance—citing the need for certainty.[223] Further, large load is not entirely new, and grid governance needs to step up to the plate, creating something between crystals and mud to enable the massive transition afoot while ensuring that all users have access to adequate, reliable, equitably priced energy. This Part argues for pathways focused on improved collection and use of data—an effort that will be critical to guide an initial governing framework and subsequent adaptation with lessons learned. It also proposes substantive pathways for transmission access and cost allocation.

### A. Improving Data Collection, Dissemination, and Modeling

A central component of modern grid governance to address large load bottlenecks—and the systemwide impacts of large load—is better collection, publicization, and use of data. As we explore here, informational conflict has dominated some of the highest-profile large load decisions. Decisions about whether to allow the interconnection of new generation to serve load, allow modified interconnection to allow co-located generation to "defect" from the grid, and to set distinct rates for large load all centrally depend on information regarding the impacts of large load on the grid. FERC and other entities responsible for approving or rejecting transmission interconnection requests, rates, and planning and construction of new transmission lines and capacity need a uniform approach to: 1) the specific types of data that matter; 2) how the data should be collected and publicized for those who make grid decisions; and 3) how the data will be consistently used in different types of decisions, such as decisions to allow a higher wholesale rate for utilities that serve large load, or decisions to approve modified interconnection requests.

This section explores these needs in the context of two types of data central to the modern electricity grid: the challenge of projecting load and its

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[222] Carol Rose, *Crystals and Mud in Property Law*, 40 STAN. L. REV. 577, 580 (1987-88) (describing "mud" as "the burring of clear and distinct property rules with the muddy doctrines of 'maybe or maybe not' and crystals as trying to "clear up the blur with new crystalline rules"); Amy Stein, *Reconsidering Regulatory Uncertainty: Making a Case for Energy Storage*, 41 FL. ST. U. L. REV. 698 (2014) (arguing that there were benefits in relatively loose and uncertain law when commercial energy storage was first emerging),

[223] FERC Transcript, *supra* note __, at 66.

location, and the difficulty of understanding how large load, including co-located "behind-the-meter" load uses grid services and impacts grid reliability.

1. Projecting Load

One of the most critical changes to electricity governance at the federal, regional, and state levels is to develop a uniform system for collecting and recording large load requests. This is important to avoid over- and under-projections of the amount of new generation capacity and transmission necessary to serve load, misprojections of the necessary location of these additions, and associated impacts on consumers and the reliability of the network.

a. The Need for Better Load Data

A centralized, uniformly-reported information center for projected load is essential for all governmental and non-governmental entities associated with the grid. Utilities need this data to plan for the construction of the proper amount of generation capacity and transmission. States need this data for their own capacity planning through integrated resource plans, and for their approval of utility rates to cover the costs of new generation and transmission infrastructure. Regional grid operators, in turn, need the data for transmission planning, interconnection approvals, and capacity markets and similar programs run to ensure that generation will match load and ensure a reliable grid. Finally, FERC needs this information for its approvals and rejections of regional grid operators' interconnection decisions, utilities' wholesale rates, and utilities' and regional grid operators' transmission plans for critical new transmission lines—for large load, clean energy generation, and reliability—under FERC Order No. 1920.

A modern challenge highlighted in FERC's large-load technical conference is transmission grid operators' lack of "visibility" into the amount of load that will need to be served and its location.[224] There has been some "double counting" by regional grid operators, in which one large load operator—considering locating in, for example, five different electricity service areas—speaks with five different utilities that will potentially serve that load.[225] These utilities might all report this same projected load to the grid operator, leading the grid operator to assume larger needs than actually exist. As another grid operator noted, "[I]n many cases, these [proposed] data centers are showing up in multiple places, so in reality I could have many members

[224] FERC Transcript, *supra* note __, at 113.
[225] *Id*. at 30.

[utilities] submitting loads that are all the same. So how do we have more clarity around that to understand what the actual true load is?"[226]

Other inaccuracies in load projection—whether over- or under-counting—involve the difficulty of projecting the quantity of load, even if the proposed load centers are known and not double counted. FERC commissioners and other experts have expressed concerns that there is over-optimism surrounding the number of data centers that will actually be built, or how long built loads will last. Some "digital foundries" will produce more popular services and goods than others, and there will be inevitable bankruptcies and market corrections. This could lead to boom and bust cycles, in which utilities or data companies build or contract for existing capacity, only to abandon that capacity within a relatively short time frame. [227]

A related concern is accurate projection of the *location* of load, as transmission lines must be planned and built to serve load. Generation capacity—if not co-located with load—is more flexible. It can be constructed anywhere, but only if transmission lines connect capacity to load. And constructing capacity closer to load can also increase efficiencies, as transmission lines lose electricity as it flows over long distances. As a result, generation capacity decisions, too, are location dependent.

Basin Electric attempted to incentivize relatively even geographic allocation of large load by allowing a certain quantity of large load to locate within each of its designated service areas without paying higher rates.[228] But above a defined threshold of added capacity, Basin Electric proposed higher rates for large load—specifically crypto mining—because it believed that this load might abandon the service territory quickly, leaving stranded costs.[229]

The importance of avoiding over-or- under-projection of load and its location through more uniform, centralized, and comprehensive data collection cascades through the entire electricity governance system. Regional grid operators, states, and utilities all have formalized processes to plan for the need for new transmission and capacity. FERC mandates transmission planning by all transmission operators with interstate lines; the federal government and several states have programs to incentivize new transmission; and utilities are actively seeking state permission to charge consumers new, higher rates to cover the costs of new transmission.

The construction of more transmission to serve new large load could benefit all consumers, especially if this construction led to inter-regional lines that carried new, cheaper wind and solar energy to consumers. Interregional

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[226] *Id*. at 26.
[227] *Id*. at 19.
[228] Order Rejecting Proposed Rate Schedules, *supra* note 6, at 6.
[229] *Id*. at 7.

transmission could also reduce the risk of stranded assets by increasing the capacity to share generation resources across regions. This could partially mitigate the consequences of uncertainty regarding the specific locations of new large loads. But utilities tend to favor constructing *localized* transmission, and overbuilding of localized transmission to serve large load—load that did not materialize or quickly fled the service territory—will leave other consumers with stranded costs.[230]

For generation capacity, the federal government steers the process of regional planning for adequate capacity—setting default "reserve margins" that essentially require grid operators to ensure that there will be excess generation available above the peak demand amount.[231] Grid operators then run auctions or lead other processes through which utilities must secure specific amounts of generation. With assumptions of high load, capacity auctions can balloon out of control, as shown by the grid operator's PJM's $14.7 billion auction in 2024.[232] States, too, might over-project capacity needs in their long-term plans, and this could lead them to approve too much generation, again potentially leading to stranded costs.

Building too little capacity based on under-projections of load could also negatively impact all consumers—in the worst case, leading to grid reliability issues, including blackouts, in scenarios where load exceeded generation, or exceeded the capacity of transmission lines to deliver generation. Under- and over-projections could also impede effective planning for transmission lines to transport electricity from added capacity.

A system requiring reporting by operators projecting large load, which centralized and made accessible this data, could benefit federal, regional, and state regulators and operators. It could help these entities avoid the overbuilding or underbuilding of generation and transmission and associated impacts for consumers.

b. Policy Pathways

We recommend a policy pathway through which all large loads report planned load, the amount of load, and potential locations of the planned load to FERC, for entry in a national database accessible to all grid users and consumers. Each unique *quantity* of projected load—say, one 30-megawatt data center—should have its own identifier (anonymized to protect competitive planning) such that if the load operator is considering locating

[230] Peskoe, *supra* note __.
[231] Macey et al., *Grid Reliability in the Electric Era*; North Am. Electric Reliability Corp., M-1 Reserve Margin.
[232] Robertson, *supra* note 6.

the load in several locations, it will not appear as additional load in each location.

Another potential pathway would involve regional grid operators collecting and publicizing this data, since they already receive utility data on load requests. but this might involve duplicative effort. For example, developers might report to multiple grid operators if they were planning one large load facility to be potentially located on either side of grid operator boundaries. With uniquely assigned numbers for planned projects, however, grid operators could simply delete duplicate numbers or flag that one facility was planned for multiple potential locations.

### 2. Quantifying System Impacts

Beyond better projecting load growth to avoid stranded costs or reliability issues, federal, regional, and state governance entities need to collect more uniform and accurate data about the impacts of large load on the electricity system. These will include data showing how large load will negatively or positively impact grid reliability, and whether collocated load is truly disconnected from the grid or still benefits from it, and therefore how much that load should pay through rate. This section highlights this need and potential pathways toward better quantification.

#### a. The Need for System Impacts Data

The cases highlighted in Part III showed the difficulty of approving new rates or the interconnection of large load—or its defection from the grid—without a full understanding of its system-wide impacts. In the case of the Susquehanna nuclear plant, FERC rejected PJM's proposal to allow more electricity to be pulled from the grid—delivered to Amazon in lieu of other customers. FERC sided with other utilities' argument that Amazon, although proposing to go "off grid" or "behind the meter" entirely, had actually demonstrated that it would not draw upon valuable grid "ancillary" services such as last-minute backup power or, in the case of a systemwide blackout, "black start" services allowing the electricity delivery system to start up again.[233] In the case of Basin Electric, FERC determined that Basin—proposing higher rates for unpredictable load, to cover the cost of serving that load—had inadequately demonstrated the costs that such load imposed on the system.[234]

Better data about the extent to which co-located behind-the-meter load does or does not benefit from system resources, and the impacts of all large load

[233] Protest of Exelon and AEP Corp., *supra* note __, at 8.
[234] FERC Order Rejecting Proposed Rate, *supra* note 7, at 38.

on the system, will enable better governance of interconnection and rates. Interconnection and ratemaking are driven by the impacts of load on the system. For interconnection, if new generation to serve load (or a modified interconnection that pulls generation off of the grid) will increase transmission generation or threaten reliability with too little infusion of electricity, the generation typically must pay for the grid upgrades needed to address these impacts before it can interconnect. And for both wholesale and retail rates, utilities may only "discriminate" in rates—charging more for one class of customer than another—if they can demonstrate that the class paying higher rates is in fact have greater impacts on the system.

b. Policy Pathways

Data reporting on the system impacts of large load will be more complex than reporting projected load. The entities that need this data—regional transmission operators and FERC, in particular—need to agree on the types of data critical to interconnection, transmission planning, reliability actions, and transmission and wholesale electricity rates. Based on the cases so far, these data should likely include: 1) specific equipment and operations that will fully "island" load tied to grid-connected generation; 2) information about the types of grid services that partially islanded load will likely continue to receive from the grid, if any, such as ancillary services and the types of services received; and 3) information about the capacity that the load has proposed to disconnect from the grid, if it is co-locating and islanding.

The information needed for setting transmission rates (the rates charged of utilities and generators that use transmission lines) and wholesale rates is more complex. As shown by the Basin Electric case, to prove that large loads—specifically crypto currency—imposed more costs on the system, Basin Electric relied on assumptions about the mobility of crypto (as opposed to other large loads with what it then viewed as secure federal funding, such as grants for hydrogen electrolyzers).[235] Basin cited to scant employment needs and the ease of constructing crypto mining in any location with electricity, while crypto mining companies argued that local permitting hurdles and community benefits contracts that they had entered into with local governments made them less mobile. [236] Continued collection and compilation of this information will support more accurate assessments.

3. Modeling

Beyond collecting and disseminating better data on projected loads and the costs and benefits of loads on the system, modeling that uses this data will be critical. Numerous grid operators, regulators, and grid users have stressed the

[235] FERC Order Rejecting Proposed Rate, *supra* note 7, at 9-10.
[236] *Id*. at 7.

need for better models that will help more realistically project load growth in the short and long term and identify actual system impacts of large loads over time, thus refining rate design and cost allocation among classes of customers.[237] The ability to simulate with confidence the complex behavior of new loads and generation is now essential not only to grid planning, but to the equitable resolution of disputes over the costs and benefits of expanding the grid.

Similar efforts beyond the large load context demonstrate the value of this type of modeling. For example, California funded work on grid modeling software to speed up the assessment of the capacity of electricity distribution circuits.[238] The aim was to better assess requests to host additional behind-the-meter solar photovoltaic (PV) installations without triggering costly grid upgrades. This information was made public so that PV developers could understand where to direct their efforts.

A parallel approach to modeling large load and the transmission system might reduce shot-in-the-dark interconnection requests and transmission queues, and also preemptively resolve some of the conflicts over what types of interconnections and where will trigger significant costs to existing customers. ARPA-E and the National Science Foundation have also supported the development of advanced transmission grid modeling software being tested by SPP, which can reduce time required to model certain interconnection impacts from over a month to less than one week.[239]

### B. Streamlining Generation Capacity and Interconnection Regulation to Address Scarcity

Policies for improved data collection, dissemination, and modeling will be critical to a new large load governance regime that is currently highly uncertain, piecemeal, and in need of adaptation as lessons are learned. But substantive policies will be equally critical to address the core technical and governance challenges explored in Part III—inadequate transmission capacity, and uncertain principles for regulating large load capacity, including co-located load.

The clearest answer to the challenge of large load lies in the simple dynamics of economic supply and demand. Utilities such as Exelon and AEP have stated this succinctly and directly in their objections to the addition of new

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[237] Commonwealth of Virginia Corp. Commn., *supra* note __, at 19, 81; Before the George Public Service Commission, Microsoft Comments on Georgia Power's 2023 Integrated Resource Plan Update, *supra* note 106; FERC Technical Conference, *supra* note 3.

[238] Natl. Renewable Energy Lab., Modeling Distributed Generation in California (2024), https://www.energy.ca.gov/sites/default/files/2024-07/CEC-200-2024-011.pdf.

[239] https://www.canarymedia.com/articles/transmission/new-software-can-find-more-room-for-clean-energy-on-transmission-grid.

large load. There is not enough generation or transmission to satisfy new, large load—we are in a "scarcity" situation.[240] New, large load is taking *existing* capacity off the grid—or, in Exelon's and AEP's words—existing generators are fleeing to "serve load that uses and benefits them."[241] This new load—the wealthy data industry—is willing to pay more than are other utilities that serve customers with limited resources, so this new load is winning out in markets.

Large load is also building it own new generation or paying utilities to build, but there is only so much new generation to go around. As experts in Virginia have observed, the sheer increase in demand is leading to higher customer rates, even if the costs of new large load are technically passed directly to that load.[242]

With the emergence of a new, powerful industry demanding existing and new generation, we need new generation and transmission, and we need it fast. Yet the regulatory bottleneck for transmission interconnection and renewable energy construction is hindering the market. (Many large loads demand renewable energy, in particular, due to commitments to investors.[243]) More than 400 solar energy and battery providers—new generation—are stuck in PJM's interconnection queue, waiting for the very sort of interconnection agreement that Susquehanna already has and unsuccessfully attempted to revise.[244] PJM has revised its interconnection standards, and FERC has approved them, but interconnections are still moving at a snail's pace.[245]

New transmission lines to carry ample generation (particularly "clean" generation) to users is mired in regulatory and legal challenges because states control the siting of these lines—even interstate ones.[246] Numerous interstate lines have been rejected or delayed by years, even decades. And local governments are increasingly denying new generating plants, with the

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[240] Protest of Exelon Corporation and American Electric Power Service Corporation, *supra* note __, at 3.
[241] *Id*.
[242] JLARC, *supra* note xx.
[243] *See, e.g.*, See how we're working to drive sustainability across our operations, Google, https://sustainability.google/operating-sustainably/ (goal of net-zero emissions by 2030); Climate, Meta, https://sustainability.atmeta.com/climate/ (same commitment); Microsoft will be carbon negative by 2030, Microsoft, https://blogs.microsoft.com/blog/2020/01/16/microsoft-will-be-carbon-negative-by-2030/.
[244] PJM Queue Scope Evaluator, https://queuescope.pjm.com/queuescope/pages/public/evaluator.jsf; Morgan Meaker, *The Big-Tech Clean Energy Crunch is Here*, WIRED, June 3, 2024, https://www.wired.com/story/big-tech-datacenter-energy-power-grid/ (discussing Amazon's contract for half of the wind power from an 880-megawatt wind farm in Scotland).
[245] *Supra* note 117 and accompanying text.
[246] *Supra* note 123; Klass & Wilson, *supra* note __.

number of moratoria or rejections of solar farms—the fastest growing source of new generation—growing by the day.[247]

There are ready yet controversial solutions to these problems. For interconnection, ERCOT, the grid operator in Texas, appears to have the most promising approach. ERCOT allows new generators to interconnect but grants the interconnection on the condition that it may need to be modified in the future if grid reliability issues emerge, such as too much congestion caused by new, additional electricity flowing through wires. For transmission siting, Congress has increased some federal authority over siting, but federal agencies have been slow to exercise this authority, and states continue to resist it.[248] For generation, a limited number of states like Michigan and New York have modified local authority to ban new solar or wind farms, but the majority of states still leave control in municipal hands.[249]

A growing mountain of proposed federal and state legislation, law review articles, and white papers have argued for these types of solutions to the regulatory bottleneck holding up the construction and interconnection of new grid capacity, but solutions are very slow in coming.[250] Even if these solutions were adopted and successfully implemented, however, increasing generation and transmission supply to address scarce capacity will not be enough.

The complexities of the electric grid mean that a vast expansion of capacity must be carefully implemented. Because the input of electricity into shared wires must exactly and continuously match the electrons drawn from the wires, numerous protections must be in place to ensure that the new capacity will harmonize with existing grid operations. For example, if co-located, marginally grid-connected load emerges as the predominant solution for the data industry, new mechanisms must be implemented to ensure that if that load loses power, there is back-up on-site energy in place, or there are

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[247] MATTHEW EISENSON ET AL., COLUMBIA LAW SCHOOL, OPPOSITION TO RENEWABLE ENERGY FACILITIES IN THE UNITED STATES: JUNE 2024 EDITION (2024), https://scholarship.law.columbia.edu/cgi/viewcontent.cgi?article=1227&context=sabin_climate_change.

[248] National Interest Electric Transmission Corridor Designation Process, U.S. Dept. of Energy, https://www.energy.gov/gdo/national-interest-electric-transmission-corridor-designation-process.

[249] Mich. Public Act 233 (2023); N.Y. Pub. L. § 138. We do not advocate here, necessarily, for full preemption. For alternatives, *see* Hannah Wiseman, Kaitlyn Spangler, and Jennifer Baka, *Renegotiating the Energy Transition* (submitted draft) (arguing for community benefits agreements that move renewable energy generation projects forward while more effectively addressing community concerns).

[250] Klass & Wilson, *supra* note __; Klass et al., Grid Reliability Through Clean Energy, *supra* note __; Alexandra Klass, The Electric Grid at a Crossroads: A Regional Approach to Siting, U.C. Davis L. Rev.; U.S. Dept. of Energy, Transmission Siting and Permitting Efforts, https://www.energy.gov/gdo/transmission-siting-and-permitting-efforts.

adequate grid resources to fulfill the back-up need. Currently, FERC-approved standards for grid operators—called "Open Access Transmission Tariffs—*prevent* these very type of back-up resources, but they are the resources needed to enable co-location of load with new capacity.[251] FERC should prioritize guidance for updated tariffs to be proposed by grip operators and approved by the agency.

Updated transmission interconnection standards are needed to enable new capacity, both grid-connected and islanded. But massive amounts of new transmission capacity will not realistically be built now. The following section explores policy pathways for enabling large load interconnection in a world of scarce transmission capacity.

### C. Governing Large Load Interconnection, Transmission Rates, and Energy Rates

Beyond modifying the availability of transmission and processes for connecting new generation to transmission, FERC and states must quickly update standards for connecting *load* with generation and transmission; for charging large load for its impacts on the transmission system; and charging large load, and utilities that serve load, for the electricity they purchase. This Part constructs proposed policy pathways for these issues.

#### 1. Transmission Interconnection and Rates

The first and perhaps most important issue for large load governance is to determine whether co-located large load—one of the more common models of electricity solutions currently followed by the data industry—needs a new status within interconnection standards. As it stands, large co-located loads are attempting to modify existing interconnections by adding language to standard agreements, and this is not working, as explored in Part III.

A key argument of existing utilities objecting to modified interconnection to accommodate large load is that co-located loads are not "networked load," yet they are also not loads that arrange for and rely entirely on their own generation and transmission ("point-to-point transmission users"). They are something in between. The objecting utilities suggest that large loads are pretending that they are wholly independent, yet they have not proven that they eschew entirely the benefits of the networked grids. Simply by existing *behind* a generator—such as a nuclear plant connected to the grid—these loads are benefiting from that generator's grid connection. A nuclear plant needs electricity from the grid to operate properly, for example, or to start up after going offline.

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[251] FERC Transcript, *supra* note __, at 33.

A second critical grid interconnection issue is the need for updated, uniform interconnection standards by: 1) states, for utilities receiving large load service requests, and 2) FERC, for transmission operators receiving requests from co-located load and generation and similar requests. These uniform interconnection standards must substantially expand upon preliminary steps such as those proposed in Utah. They must set out the specific information to be provided by each large load, including information—such as a listing of all of the locations at which the load may locate—that will help avoid double counting. They must specify the studies that the utility or grid operator must complete, updating existing interconnection study requirements to address issues such as the estimated duration of the load within the service area. These interconnection standards must also determine how the order of service will be determined. This will include: 1) addressing the less speculative requests first, as is occurring in the generation queue context by prioritizing "build-ready" projects; and 2) potentially promoting or demoting loads in the queue based on their merit to society.

This latter proposal regarding merit will introduce complexity and may be infeasible, but it is worth considering. Some grid operators and experts argue that large loads may need designation with respect to their societal importance—e.g., a data center supporting sports gambling as opposed to national air defense.[252] The purpose of this designation would be multifaceted. First, utilities receiving requests for grid-connected service, and transmission grid operators receiving generation requests from utilities could (and likely should) maintain formal load interconnection queues, as others have also proposed.[253] Priority status in these queues could depend, in part, on a set of factors designated by Congress and state legislatures that identified the societal importance of load. Designating priority status would be incredibly challenging—many AI applications produce moderate jobs during construction and some employment during their operation but may ultimately displace thousands of jobs. And data centers for sports betting support a massive, growing economic sector, but one that can lead to problematic gambling addiction and other proven drawbacks of casinos and similar industries.

Although challenging, setting uniform criteria to establish priorities for load interconnection based on merit could enhance predictability and transparency in a process where, as Peter Freed and Allison Clements observe, merit decisions such as assumed economic value of the load *are* being made, without consistency."[254]

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[252] FERC Transcript, *supra* note __, at 36.
[253] Freed & Clements, *supra* note __.
[254] *Id*.

Another, somewhat less controversial reason for establishing a "merit order" for large load would be for FERC to determine whether the load must maintain a grid connection. Even large with premium self-generation may require a back-up source of support from the network as a failsafe—particularly for loads deemed essential for traditional national security support such as air defense. Defining any load as essential for national security is a fraught exercise, though, as demonstrated by unsupported assertions in President Trump's executive order that the asserted "energy emergency" of the United States jeopardizes national security and justifies military construction of fossil fuel-fired power.

Finally, designating some large loads as more critical than others is necessary to determine whether these loads should be able to participate in demand response programs. "Demand response" involves grid-connected resources reducing their individual demand during periods of grid-wide peak demand, thus reducing the need for expensive peak generation units to come online. Demand response participants can either bid directly into the retail market—contracting with their utility to reduce demand when the utility is struggling to supply load—or into grid-wide wholesale markets run by RTOs.[255] Large loads that are critical to society likely should not be eligible to participate in any form of demand response market.

Some states already follow the policy of designating some loads as "critical resources"; for example, in Texas, natural gas pipelines that have electric compressors to push gas through pipelines are not allowed to reduce their energy use voluntarily during shortages, are last in line for forced "curtailment" (reducing in energy supply) during grid emergencies.[256] This is because these pipelines supply fuel to the power plants that are most needed during electricity generation shortages. Similar designations are needed for critical large loads.

Given the importance of determining which load must be grid connected, what services it should receive or provide to the grid, and how much it should pay for grid services (through transmission rates), FERC needs to rapidly issue guidance to grid operators to modify their interconnection rules. Indeed, some experts have asserted that "Commission leadership is desperately needed" and that states are looking "to FERC for [its] leadership" on grid interconnection/disconnection and transmission rate issues.[257]

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[255] FERC Order No. 719.

[256] Tex. Railroad Commn. Rule 3.65 (2021).

[257] FERC Transcript, *supra* note __, at 67 (Statement of Stacey Burbure, FERC and RTO Strategy and Policy, American Electric Power); *id*. at 155 (Statement of Sarah Moskowitz, Executive Director, Citizens Utility Board of Illinois, referring to issues associated with state-subsidized nuclear being pulled off grid to serve a single large load).

FERC must develop clear definitions of the major types of large load the risks and benefits that it poses for a networked grid. Specifically, FERC must identify facilities that should classify themselves as large load to be included in a national database for the purposes of FERC-regulated transmission and capacity planning, and state-regulated utility planning. Large load should be defined by a minimum threshold quantity of electricity that can be drawn from generation. Further, FERC should define different large load "profiles"—meaning how and when these loads use electricity—to determine how they should be regulated when interconnecting, and to plan for needed transmission expansions if they are grid connected. FERC should consider defining the three major types of large load profiles as follows:

> "**Interruptible**," with periods of peak demand: Some large load, such as crypto mining, does not need to run constantly but exhibits some "peak" behavior. When it is running, however, it uses large quantities of electricity. These types of load can provide valuable wholesale demand response services to the grid by reducing load (and thus reduce demand from wholesale generators, which supply electricity to the grid) when there is inadequate generation. Alternatively, these companies should be allowed to avoid connecting to the grid and to self-supply generation,[258] as this would obviate the need for large quantities of peak generation to serve them and reduce the need for demand response services on the networked grid.
>
> **"Baseload," non-interruptible demand:** Some large load must run all of the time because it is critical to the functioning of our government and economy, such as data centers that support national defense.[259] The electricity flowing to these loads must flow all of the time, and it cannot be interrupted during periods of peak demand. Just as baseload generation runs all of the time, baseload electricity users need electricity all of the time. These loads should likely be required to be grid-connected; relying solely on back-up generation may be too risky. These large loads should also be prohibited from participating in wholesale or retail demand response programs, in which they would reduce electricity demand from the grid and self-supply with

[258] Martin and Peskoe, "Extracting Profits from the Public: How Utility Ratepayers Are Paying for Big Tech's Power," 27.
[259] *See* FERC Transcript, *supra* note __, at 57 (noting differences between "national security load" and sports "betting load"); *id.* at 44 (noting data centers for the North American Air Defense System).

back-up generation. Again, the self-supply would pose too large of a risk to society in the event that the on-site generation failed.[260]

**"Baseload," interruptible demand**: Some large loads ideally run all of the time or most of the time. These include, for example, AI facilities that do not support critical functions, or data centers for activities such as sports betting. Because they do not serve critical functions in society, the flow of electricity from the grid to these loads could be temporarily interrupted if needed, particularly if these facilities (as nearly all do) have back-up generation that they could deploy. Similar to interruptible loads, these large loads likely need not be grid-connected, and they could opt into demand response agreements.

Even if FERC does not designate the loads that may or may not wholly disconnect from the grid, some large loads are choosing to disconnect anyway. There are four primary ways in which large loads are receiving electricity from generators or the larger grid or both, and FERC should specify these four categories and develop interconnection standards for them, which grid operators should then implement within their interconnection rules. We define these four categories as including large load that co-locates with existing generation, for which the generation disconnects from the grid; large loads that co-locate with existing generation that remains grid-connected; large loads that build their own, co-located generation that they also connect to the grid; and large loads that build their own, co-located generation that is off grid. We define policy pathways for these categories below.

1. **Existing generation, wholly grid-disconnected:** Some large loads have co-located with existing generation facilities that currently provide electricity to the networked grid. It is conceivable that some large loads, which have deep pockets, will persuade generators to wholly disconnect from the grid and provide all electricity to the large co-located load. Here, FERC already has procedures. Grid operators, following FERC rules, receive deactivation notices from generators.[261] They assess whether the retirement of the generating unit will interrupt grid reliability. If it will, the grid operator may delay or prevent the unit from retiring.

[260] *See, e.g.*, FERC Transcript, *supra* note __, at 74 (Stu Bresler of PJM, noting "there could be significant limitations as to when they could run that back-up generation, given permitting limitations, environmental limitations, all that sort of thing").
[261] PJM Inside Lines, What Happens When and Owner Wants to Close Its Plant?, https://insidelines.pjm.com/what-happens-when-an-owner-wants-to-close-its-power-plant/.

These procedures for reviewing proposed grid disconnections typically apply to units that are retiring due to financial distress, such as coal-fired power plants now outcompeted by cheap natural gas, solar, and wind generation. But FERC will likely need to update rules to allow units that are retiring for greener financial pastures (higher payment from co-located large loads) to pay their way off of the grid. Just as new generation requesting new interconnection must pay for system upgrades necessary to accommodate the new generation and ensure reliability, units retiring to serve co-located large load should have the option to provide similar system upgrades to ensure ongoing reliability despite the unit's grid departure. Indeed, wealthy large loads are likely more than willing to pay these system upgrade costs if it gives them direct access to already-running generation.

2. **Existing co-located generation, partially grid-connected**: As we analyze in Part III through the Talen case study, some large loads have co-located with existing, grid-connected generation, such as nuclear power plants, and have proposed to use just some of the generation for themselves. This means that the generation is reducing the flow of electricity to the shared grid. Rather than terminating its interconnection agreement with the grid operator, this generation must modify its interconnection agreement. This is the regulatory arrangement that requires the most regulatory work. FERC should identify and regulate two subcategories of this form of generation:

   *Retaining network services*: Large load co-located with generation that remains grid-connected may sometimes draw valuable services from that generation---services that flow from the larger grid. For example, if some of the capacity at the generating plant stopped working, and the load's back-up generators also failed, the load (through the connected generator) could draw additional electricity from the grid. And in the event of a large blackout and the need for "black start"—starting up all generating units at the same time, and re-starting the flow of power—this load would also benefit. Even if the load could rely on its back-up generating units during a blackout, it would eventually want access to the co-located generating unit and the benefits that that unit receives from the larger grid. For this arrangement, FERC should provide a new uniform interconnection agreement procedure that specifies the network services that the large load (or the co-located generating unit) must pay for, thus ensuring that the large load or the generating unit pay their fair share for network services.

PJM's behind-the-meter-generation approach discussed in Part III, which simply measures the difference between large load's receipt of energy from the co-located generated and from the grid, seems sensible.[262] FERC should re-consider its rejection of this approach in the Talen Energy case.

*Disclaiming network services*: Large load co-located with grid-connected generation sometimes disclaims any network support. This was the case for the Talen-Amazon arrangement discussed in Part III. Amazon claimed that it drew *no* services from the grid to which Talen, the generator, was connected. Rather, Amazon had its own back-up generation and the capacity to island from the grid. Thus, in the event that the co-located generating unit went down, rather than drawing additional electricity from the grid, Amazon asserted that it supplied its own power. Other utilities disagreed, arguing that during a Talen outage, Amazon kept operating and did not rely wholly on back-up generation. FERC should provide guidance for what "islanding" really means and should specify the types of equipment that large loads must install to prove that they can wholly disconnect from co-located generation and the grid.

**3., 4. New co-located generation, wholly or partially grid-disconnected.** Many of the same issues that we raise for existing generation apply to new generation built by large load—generation that either partially connects to the grid or is wholly off-grid. For partially connected generation, FERC and grid operators should apply many of the same interconnection standards for partially-connected *existing* generation. The grid interconnection agreement between the grid operator and the co-located generator should include proof of physical equipment that allows islanding and means of measuring any back-up services drawn from the grid, thus ensuring that the generator or its co-located large load pay for these grid services through transmission rates.

Grid operators will, as with the reduction of grid-provided electricity from generators, need to conduct system impact studies—in this case, due to the infusion of some new electricity into the grid and the use of some grid services. These system impact studies, and the interconnection of the new generation itself, should likely be expedited, as the new generation will infuse less electricity into the grid and use fewer grid services. This is because the bulk of electricity from the new generating plant flows directly to the large load.

[262] *Supra* notes 193-195.

For wholly off-grid newly-built generation, FERC may lack jurisdiction. With no physical connection between the interstate transmission grid and the generating facility, there is no Federal Power Act transmission hook for jurisdiction. This is also not a wholesale sale of electricity—there is no sale, followed by a re-sale. Some states will still regulate this transaction, though. In Florida, when an industrial facility attempted to contract directly with co-located, off-grid generation, the Florida Public Service Commission designated the generation as a state-regulated "public utility," and the Florida Supreme Court agreed.[263] States should likely maintain a light regulatory touch here, given that large loads should be able to choose their own level of risk with respect to the reliability of off-grid co-located generation. The exception, once again, will be large loads deemed critical to society. Here, careful oversight is required, and as we note above, these loads should likely not be permitted to be wholly grid-disconnected in the first place.

Co-location of large load and generation—either existing or new—is a trend due to network constraints, but many large loads still seek traditional electricity service from utilities that serve many customers.[264] We explore the rate-based issues that arise in this context in the following section.

2. Energy Rates: Wholesale and Retail

For the many large loads that seek electricity from utilities, new rate designs are essential to ensure that loads pay for the costs that they cause for utility. As we explore in Part II, FERC regulates the wholesale rates for electricity (typically called "energy" rates) that generators and utilities charge when they sell electricity to other utilities. States regulate the rates that utilities charge when they supply retail electricity to customers, including large load customers. The changes needed in setting wholesale and retail rates are the same. FERC and state utility commissions must better quantify and define the benefits that large loads provide to the system and the costs that they impose on it. And large loads must shoulder these costs.

Two considerations are critical here: first, how rates or other fees should be designed so that loads actually pay for the costs that they cause, and second, rate allocation—the extent to which large loads should pay higher rates as compared to other customer classes.

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[263] PW Ventures, Inc. v. Nichols, 533 So.2d 281 (1988).
[264] *See, e.g.*,

For rate design, many of the costs caused by large loads are not variable, and they are therefore not best covered through rates that utilities charge for each kilowatt-hour of electricity consumed. Rather, large loads impose risks on utilities (and on generators that provide wholesale electricity to utilities). There are risks that the loads will make plans to build within a utility's territory and not follow through, or build but then quickly leave, with a trail of stranded costs discussed in Part II. Large loads also place higher administrative burdens on retail utilities and wholesale generators, requiring them to project short- and long-term loads in more detail; plan for more generation, transmission, or distribution; and study and address impacts on the system as a whole. Additionally, utilities and generators must have better grid support services in the event of a sudden increase or decrease in demand from large loads, or sudden outages that affect system voltage.[265] These types of costs are to a large degree fixed and should be covered by fixed fees, not rates that vary by the quantity of electricity consumed.

The larger issue of overall rising demand causing higher customer prices—as in Virginia—is more difficult and cannot solely be solved through rate design. Rather, improved generation interconnection queues that allow cheaper, clean generation to come online more quickly, and building more regional and inter-regional transmission lines to give customers wider access to cheap pools of generation, will be critical.[266] (So, too, will ongoing improvements in data center energy efficiency and flexibility—the ability to reduce load from data centers during peak demand.[267])

Although rising demand is one driver of higher electricity rates for all customers, better rate design is an important first step to avoid passing large load costs to other customers. Many utilities are already employing a variety of fixed fees or non-traditional fees, as we briefly summarize and recommend in Table 1. These examples were initially identified by Lawrence Berkeley National Laboratory's (LBNL) survey of Electricity Rate Designs for Large Loads, and we researched the tariffs and settlement agreements identified by LBNL. In Table 1 we include examples that we believe will best cover the

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[265] Lawrence Berkeley Natl. Lab., *supra* note __ at 2; FERC Transcript, *supra* note __, at 72 (noting the potential for "instantaneous loss of load" and "instantaneous changes up and down the system").

[266] U.S. Department of Energy, Grid Deployment Office, The National Transmission Planning Study Executive Summary 2 (2024), https://www.energy.gov/sites/default/files/2024-10/NationalTransmissionPlanningStudy-ExecutiveSummary.pdf ("Approximately $1.60 to $1.80 is saved for every dollar spent on transmission.")

[267] EPRI Initiative, Optimize Data Center Operational Flexibility to Help Strengthen the Grid; U.S. Dept. of Energy, Recommendations on Powering Artificial Intelligence and Data Center Infrastructure (2024); Tyler H. Norris et al., Duke Nicholas Institute for Energy, Environment, and Sustainability, Rethinking Load Growth: Assessing the Potential for Integration of Large Flexible Loads in US Power Systems (2024).

costs imposed by large loads on utilities and generators serving utilities, and avoid passing these costs to other consumers.

**Table 1. Examples of Retail Rates and Policies for Large Loads**

| Risk or benefit addressed | Sample rate or policy |
|---|---|
| *Risks* | |
| Stranded costs | --Monthly demand charge: load must pay "minimum specified percentage" of "forecasted maximum demand" or of highest previous bill during 11 mos.[268]<br>--Requirements that large loads directly pay for capacity through minimum charges ($/kilowatt consumed) or upfront payments[269]<br>--Requirements that above a specific load threshold, utilities will purchase power, not build capacity[270]<br>--Long-term energy supply contracts for large loads to avoid stranded costs (5 to 20 years)[271]<br>--Exit fees—e.g., payment equaling three years of minimum charges previously paid by large loads[272] |
| Demand exceeding projected load | --Fee if usage exceeds contracted threshold[273]<br>--Requirement for back-up power generation (for example, in the event that load exceeds contracted amount and threatens grid stability)[274] |

[268] Lawrence Berkeley Natl. Lab., *supra* note __ at 4 (Indiana Michigan Power); Submission of Unopposed Settlement Agreement and Unopposed Motion for Acceptance of Out of Time Filing, Nov. 22, 2024, at 2; In the Matter of the Application of Ohio Power Company for New Tariffs Related to Data Centers and Mobile Data Centers, Joint Stipulation and Recommendation (2024) at 6, https://dis.puc.state.oh.us/ViewImage.aspx?CMID=A1001001A24J23B55758I01206.

[269] Lawrence Berkeley Natl. Lab., *supra* note __ at 6 (Indiana Michigan Power) (Ohio Power—minimum charges; Montana-Dakota—upfront payments); Submission of Unopposed Settlement, *supra* note 268, at 2-3.

[270] Lawrence Berkeley Natl. Lab., *supra* note __ at 6 (Black Hills Energy); Black Hills Energy Large Power Contract Service Rate Schedule LPCS

[271] Lawrence Berkeley Natl. Lab., *supra* note __ at 8 (Nevada Clean Energy Transition Tariff, approval pending at time of publication, 15-year term; Indiana Michigan Power 12-year term; Portland General Electric 5- to 20-year term).

[272] Lawrence Berkeley Natl. Lab., *supra* note __ at 9 (Indiana Michigan Power)

[273] Ohio Power, under its Data Center Tariff settlement agreement, is allowed to "suspend service" if load "exceeds its contract capacity" by a certain amount. Lawrence Berkeley Natl. Lab., *supra* note __ at 6. We recommend a fee instead, as suspension would seem to incentivize defection of large load from the network. This impact can likely be priced rather than wholly prohibited.

[274] Lawrence Berkeley Natl. Lab., *supra* note __ at 7 (Black Hills Energy); Large Power Contract Service, *supra* note __, at 1.

| **Risk or benefit addressed** | **Sample rate or policy** |
|---|---|
| Bill non-payment if large load is financially distressed | --Requirement that data centers prove minimum credit rating[275]<br>--Requirement for deposit or performance guarantee letter—"large power")[276]<br>--Proof of collateral—industrial or data center loads[277] |
| Planning costs for capacity, voltage support | Direct payment for "cost of full planning studies"[278] |
| *Benefits* | |
| Demand response to reduce peak demand | "High Density Contracted Demand Response Rate"—specific payments for reduced demand offered by large load[279] |

For wholesale ratemaking for generators and associations of generators that serve utilities, which in turn serve large load, FERC should follow these state examples. It must better specify the data that will justify higher rates and must be more open to departures from traditional cost-of-service wholesale ratemaking, allowing mechanisms such as demand charges and fixed fees to ensure that large loads pay their fair share of costs and avoid shifting them to other customers.

We do not purport to offer all of the policy pathways for large load governance here, but we hope that this framework will guide future regulatory efforts and further academic inquiry into superior pathways as large load continues to grow.

A final critical consideration in large load governance is access to the governance process. This is critical in light of extensive equity concerns, including that large loads (among other factors) may be contributing to rising costs for all consumers and compromising overall grid reliability if not carefully accommodated. The following section outlines key considerations for access to and participation in large load governance.

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[275] Lawrence Berkeley Natl. Lab., *supra* note __ at 4 (Indiana Michigan); In the Matter of the Verified Petition of Indiana Michigan Power, *supra* note __, at 5.
[276] Lawrence Berkeley Natl. Lab., *supra* note __ at 5 (Black Hills Energy); Large Power Contract Service, *supra* note __, at 3.
[277] Lawrence Berkeley Natl. Lab., *supra* note __ at 5 (Indiana Michigan Power and Ohio Power); In the Matter of the Verified Petition of Indiana Michigan Power, *supra* note __, at 3; Ohio Power Co., *supra* note 268, at 6.
[278] Lawrence Berkeley Natl. Lab., *supra* note __ at 5 (Indiana Michigan Power).
[279] Lawrence Berkeley Natl. Lab., *supra* note __ at 5 (Montana-Dakota Utilities); Montana-Dakota Utilities Co., High Density Contracted Demand Response Rate 45, https://www.montana-dakota.com/wp-content/uploads/PDFs/Rates-Tariffs/SouthDakota/Electric/SDElectric45.pdf.

### D. Infusing Energy Democracy into Large Load Governance

A growing literature documents the importance of balancing the necessarily technocratic, engineering-based foundations of grid governance with deliberative, participatory features. It would be immensely costly to provide the general public with enough resources to fully understand and engage in complex debates about maintaining frequency and voltage in a grid of interconnected resources. But as we have highlighted, decisions about integrating large load into this technically complex grid are value-laden. They involve explicit or implicit assumptions about existing versus new users and their priority, about the societal value of different types of load—such as crypto mining versus hydrogen electrolyzers, and about the electricity consumers who should bear the cost of increasingly scarce capacity.

These types of values demand some degree of deliberative or participatory governance—a system in which members of the public have meaningful opportunities to discuss and debate, not merely comment on, these weighty decisions.[280] And this discussion must influence, even if not ultimately change, RTOs' and FERCs' substantive governance decisions.

Debates about the adequacy of public participation in large load governance have already arisen and will expand. In the Talen Energy interconnection case, the utilities opposing Talen's proposal to expand its provision of electricity to large loads argued that PJM, in approving the interconnection, was adopting PJM guidance on co-located load.[281] This guidance, in turn, emerged after a failed effort at PJM to develop consensus-driven, stakeholder principles for co-located load. And the guidance has never been finalized.[282] In other words, utility stakeholders argued that following engagement that resulted in conflict, PJM charted its own course and was imposing that course through interconnection agreements.

In the case involving higher proposed rates for utilities that serve crypto, Basin Energy, in contrast, argued that Basin Energy had wholly engaged its stakeholders, since Basin Energy is a cooperative governed by its own members. Basin and others arguing in favor of the rates asserted that nearly all of Basin's stakeholders agreed to the crypto mining and large load rates that FERC rejected.[283]

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[280] Shelley Welton, *Grasping for Energy Democracy*, 116 MICH. L. REV. 581 (2018); Shelley Welton & Joel Eisen, *Clean Energy Justice: Charting an Emerging Agenda*, 43 HARV. ENVTL. L. REV. 308 (2019).
[281] Protest of AEP and Exelon Corp., *supra* note __, at 20.
[282] *Id*.
[283] Order Rejecting Proposed Rates, *supra* note__, at 23.

FERC, regional operators developing more formal guidance and FERC-approved rules, and state public utility and service commissions must consistently and extensively engage stakeholders in future proceedings. Although many public stakeholders will not have the technical knowledge necessary to engage in some of the conversation, these stakeholders will provide important understanding of the public's primary concerns, and the results sought by the public as large load increases. These entities must deploy the types of participatory tools that extend beyond the "inform-defend" model of engagement—holding focus groups, conducting surveys, "mapping" stakeholders to ensure that all important groups are invited to the process, and developing mechanisms for meaningful consideration of input, such as comment and response. Technical planners and policymakers alone cannot effectively govern the massive issue of large load. The public will provide the essential results-oriented perspective that must guide and provide vision for the governance road ahead.

As it stands, entities who wish to participate in FERC proceedings must intervene, which is a complex and expensive process. While FERC's Office of Public Participation is unlikely to fare well as federal political forces continue to swing dramatically, moving toward even limited notice-and comment processes would enhance participatory options.

These solutions—better data and modeling, improved transmission construction and interconnection policy, new rate structures for large load, and enhanced public participation in large load governance—construct a broad foundation for more nuanced developments that must emerge. Table 2 summarizes some of the key components of this foundation.

**Table 2. Governance Changes Needed to Address Large Load**

| | |
|---|---|
| Data collection, dissemination, and use | Develop centralized FERC database with large load interconnection requests, megawatts of load capacity, potential locations |
| | Require unique identifier codes for each proposed large load facility inputted within centralized database |
| | Model systemic impacts—see California approach to distributed generation |
| Transmission expansion and improved large load interconnection | Implement a comprehensive suite of existing transmission grid expansion proposals (large load adds urgency) |
| | Develop a new federal interconnection standard for large loads and means of efficiently modifying this standard for different load configurations. Implement priority standards for the queue, such as elevating "build ready" requests to the front, and consider further ordering based on societal merit of load.<br><br>States: designate similar uniform interconnection standards for utilities receiving large load requests. |
| | Define behind-the meter and interconnected generation; enable and encourage onsite back-up generation and other |

| | |
|---|---|
| | services that reduce the need for grid services on already-congested grids |
| | Define large loads and define different load profiles that necessitate different interconnection standards—co-located with existing generation that is partially grid-connected, co-located with existing generation wholly off-grid; or new co-location (grid connected or off grid). For partially grid-connected, specify technologies needed for islanding and proof of back-up power sufficiency. |
| | Set merit-based standards for load: designate load that cannot enter arrangements to rely wholly on back-up power if co-located generation fails. |
| Rate design and amounts | Use systemic impacts data to support separate energy and transmission rates for large load, incorporating negative impacts and grid services such as demand response |
| | Implement innovative structures to directly cover differential costs of large load, such as fixed demand or exit fees (see Table 1) |
| | Encourage or mandate more flexible and efficient large load |
| Energy democracy | Include rate payers, members of environmental NGOs, and other non-expert stakeholders in technical information sessions and regulatory decisions; move toward notice-and-comment or other procedures that do not require formal intervention |

U.S. energy governance to adapt to a rapidly-changing grid is only the beginning of the large-load project. As digital firms rush to build new capacity and meet net-zero commitments, empirical analysis of the systemic environmental impacts of large load growth and the impacts on rates shouldered by other customers is critical. So, too, is consideration of the potentially expansive justice-based implications if firms with low labor needs continue to move to localized, co-located generation and load independent of the transmission grid. This ability to build anywhere could introduce new burdens and benefits in far-flung communities. But getting the energy governance right is a critical first step because the digital industry is building large loads now, impacting other consumers' rates and introducing some degree of chaos into an energy system accustomed to relatively flat growth. The physical growth of the grid will not pause as the governance system races to catch up.

## CONCLUSION

It is not yet clear whether the U.S. digital industry will produce the globally transformative results and economic growth projected by some experts. Indeed, some of the products from digital foundries have been decidedly

underwhelming, as evidenced by the inability of generative AI to produce a quality legal analysis with accurate (or even real) citations. Nor is it clear that large load will grow as expansively as it is projected to. Yet as we have highlighted here—and grid operators and utilities have stated—substantial growth already has occurred, and is placing real pressures on the fragile network of the modern U.S. electric grid.

The era of large load—regardless of how big this load ultimately becomes—is upon us, and it raises numerous questions that demand further analysis. Should utilities' "duty to serve" all load continue, or, given the environmental and social impacts of building seemingly endless capacity, should we more directly debate the merits of different types of load? And given the limitations of the network and the digital industry's need for generation now, how far will grid defections proceed; are we truly returning to a 1900s-style localized grid? As digital companies build more co-located natural gas generation, are commitments to net-zero energy eroding?

Large load opens up a Pandora's Box, but also a world of opportunity. As grid operators have observed, the digital industry, with seemingly unlimited wealth, could lead the grid toward the places that many policymakers hope it will go—toward cleaner energy interconnected by long-distance transmission lines that improve reliability. Yet without better governance, large load could also steer us toward darker places.

We have focused on the electricity governance aspects of large load here given grid regulators' immediate mandate to accommodate this load—and the lag so far in the emergence of guiding principles. But we hope that volumes of future literature will explore the many questions that we leave untouched here. In this new electric era dominated by large, wealthy digital customers and other populous classes of customers concerned about rising energy costs, we must get this governance right. Better large load governance will enable an industry that many deem essential to ongoing U.S. global competitiveness, and it will ensure that this industry benefits other electricity consumers.