Proposal for EEPE 2026 **– From Smelters to Servers: Historical Lessons for Managing Concentrated Electricity Demand**

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Rapid, concentrated growth in electricity demand from data centers raises concerns that investment in generation and transmission capacity will not keep pace. Policymakers, utilities, and industry analysts frequently describe the resulting increase in electricity load as "unprecedented." While the scale and pace of data-center-driven load growth are indeed remarkable, they are not without historical precedent. Drawing on analogues from earlier periods of concentrated industrial demand—such as the aluminum smelting boom powered by the Bonneville and Grand Coulee Dams and the World War II diffusion of large-scale manufacturing facilities—the project will explore how past episodes of industrial transformation generated comparable challenges for energy infrastructure, spatial development, and policy coordination.

The historical record shows that large, concentrated electricity users have periodically reshaped U.S. power systems through both demand- and supply-driven forces. On the demand side, Garin and Rothbaum (2025), for example, document how the federal government's wartime mobilization strategy during World War II led to the deliberate siting of large manufacturing plants in dispersed, often rural areas, creating localized surges in industrial energy demand. This historical setting closely parallels the present moment, in which artificial intelligence and datacenter development are driving sudden, spatially concentrated increases in electricity consumption.

On the supply side, the late 1930s and 1940s saw massive federal investment in hydropower development—exemplified by the Bonneville and Grand Coulee Dams in the Pacific Northwest—that created abundant, low-cost electricity and attracted energy-intensive industries. Aluminum producers such as ALCOA and Kaiser Aluminum deliberately located their smelters near these new hydro resources, capitalizing on the reliable power supply (Severnini, 2014). At their peak, these facilities consumed more than half of the region's total electricity output, representing one of the most concentrated industrial loads in U.S. history. This cluster of wartime and postwar industrial activity not only transformed the regional power landscape but also reshaped urbanization patterns, labor demand, and public-private coordination in energy planning.

As during the 1940s, public and quasi-public entities—then agencies like the War Production Board and Bonneville Power Administration, today state and regional energy commissions—play a central role in coordinating the response. The comparison between these historical and contemporary episodes offers a valuable framework for studying how the power system adapts to new, energy-intensive technological frontiers.

The proposed research will combine archival and quantitative approaches to situate modern data-center-driven demand within the longer history of industrial electricity use. Drawing on newly

assembled datasets that trace hydropower development since the late 19th century (Severnini, 2023), fossil-fueled power plant expansion since the late 1930s (Clay et al., 2025a), and transmission line construction since the 1920s (Clay et al., 2025b), the project will reconstruct the evolution of electricity generation, consumption, and demand across space and time. Historical data from the Federal Power Commission, the Bonneville Power Administration, and the U.S. Bureau of Reclamation will be used to document these dynamics from the 1930s through the 1970s. These records will be matched with modern data from the U.S. Energy Information Administration and Federal Energy Regulatory Commission to enable consistent measurement of the scale and concentration of large industrial customers over more than a century. The empirical strategy will compare episodes characterized by rapid load growth, including wartime industrial mobilization (1940s), postwar aluminum and chemical industry expansion (1950s-1960s), residential and commercial electrification linked to the diffusion of air conditioning (1950s-1970s; Barreca et al., 2016), and the recent acceleration in data center and cloud infrastructure demand (2000s-2020s).

The analysis will quantify both the aggregate increase in electricity demand and the degree of load concentration—defined as the share of total electricity consumed by the largest customers within a region or utility. By doing so, the study will assess whether today's data center boom is exceptional primarily in scale, in concentration, or in its institutional and technological context. Our preliminary evidence suggests that, while aggregate load growth during the mid-20th century exceeded today's rates during certain years, the concentration of electricity demand among a few large industrial customers—aluminum smelters then, data centers now—may follow a similar order of magnitude. This comparison challenges the prevailing narrative that data centers constitute an "unprecedented" strain on the grid and reframes the problem as part of a recurring cycle of industrial and technological transitions that reshape the energy system.

Beyond historical comparison, the project aims to draw policy lessons from past experiences of managing concentrated demand growth. The Bonneville Power Administration's coordination with industrial users during the 1940s and 1950s, for instance, involved long-term contracts, public investment in transmission infrastructure, and cross-subsidization arrangements designed to balance regional development goals with electricity reliability. Understanding how those arrangements evolved—and, in some cases, unraveled—can inform current debates about cost allocation, grid planning, and regional equity in the context of the data center and AI-driven electricity boom. Similarly, insights from Garin and Rothbaum (2025) highlight how government-led industrial investments can have persistent effects on local economic structures, labor markets, and intergenerational mobility—dimensions that may again become relevant as new clusters of datacenter infrastructure reshape local economies.

The broader relevance of this project extends beyond data centers. Similar questions arise in emerging sectors such as hydrogen production, electric vehicle charging (Bailey et al., 2025), and carbon capture—all of which may generate large, geographically concentrated electricity demand. By grounding contemporary policy discussions in historical experience, this research aims to clarify what is genuinely new about today's energy transition, and what reflects enduring structural patterns in U.S. industrial and infrastructure development. The project thus seeks to bridge economic history and modern energy economics, offering a framework for understanding

how successive waves of technological innovation and policy reshape the geography, composition, and governance of the US power system.

References

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