Data Center Connections Workshop: Powering the Data Revolution

Association of Edison Illuminating Companies
607 14th Street NW, Suite 560
Washington, DC 20005
www.aeic.org

Executive Summary

The Association of Edison Illuminating Companies (AEIC) brought together **utilities leaders, data center developers,** and **industry experts** to tackle the growing challenges of integrating data centers into the grid. The following focal points shaped discussions:

- **Energy Demand Growth.** Rapidly growing and unpredictable data center loads challenge grid reliability, voltage stability, and power quality.
- **Infrastructure Lag.** Existing transmission and distribution systems are bottlenecks for meeting data center demand.
- **Increased Risk.** There can be significant initial and downstream financial impacts to utility companies, especially when plans for large loads do not materialize.
- **Technological Adaptation.** AI computing efficiencies and cooling innovations will shift power demand trends.
- **Concentration.** Data centers are not uniformly constructed across service territories, whereas they tend to concentrate where there is available / affordable land, fiber communication backbones, affordable energy and water use rates, and tax incentives.
- **Financing.** Access to capital to fund utility infrastructure projects is limited.

Actionable Insights:

- **Effective Modeling.** Leveraging AI-driven modeling, forecasting tools, and real-time capacity planning to improve infrastructure readiness.
- **Consistent Procedures.** Establishing standardized interconnection processes across utilities to streamline approvals and reduce delays, while ensuring clear guidance for utilities.
- **Collaborative Planning.** Encouraging proactive engagement between utilities, regulators, and developers to align expectations early in the development process as well as avoid integration and procurement challenges.
- **Grid Enhancing Technologies.** Investing in flexible grid solutions such as demand-response integration, energy orchestration, and dynamic line ratings can help get the most out of existing infrastructure.

Table of Contents

Table of Tables

AEIC Center for Operational Excellence

The mission of AEIC's Center for Operational Excellence is to provide the electricity industry with authoritative information as a basis for their own independent decision-making on local, state, and federal infrastructure investments. The Center facilitates industry projects addressing critical challenges such as supply chain management, grid reliability, electrification, and technological innovation. By fostering collaboration and sharing best practices, AEIC ensures stakeholders are equipped with actionable insights to navigate the dynamic energy landscape. This workshop underscores AEIC's ability to convene diverse perspectives to tackle industry challenges and advance operational excellence.

Data Center Connections Workshop Context

Thirty utility leaders convened for this AEIC-hosted workshop, focused on fostering cross-utility collaboration. The workshop facilitated dialogue among senior managers, strategists, and technical leads to share insights on balancing the demands of data center connections with grid stability, highlight actionable strategies, and address planning challenges through collaborative solutions.

Powering the Data Revolution

This workshop explored strategies to integrate data centers into the Transmission & Distribution (T&D) system in ways that minimize grid strain while upholding long-term reliability and resilience. Discussions centered around both immediate planning and long-range infrastructure needs, framed through the Integrated System Planning (ISP) approach.

Participants shared experiences and strategies to address accelerating data center interconnection requests, grid modernization challenges, and the risks of misalignment between developers and utilities.

Key takeaways from the session include:

- **T&D Infrastructure Lag:** Data centers can be planned and built in a fraction of the time it takes to expand utility infrastructure. In many regions, grid capacity may need to double within the next decade, far outpacing the development timelines for new transmission lines and substations.
- **Planning Uncertainty & Risk Exposure:** Utilities often carry the burden of upfront costs for feasibility studies, system design, and application review, all of which are at risk if projected demand doesn't materialize. This creates pressure to balance responsiveness with prudent investment.
- **Varied Readiness Across Utilities:** While some utilities (e.g., in Virginia and Texas) have years of experience integrating hyperscalers, others are only beginning to confront the scale and pace of these requests, driven by AI, cloud computing, and sustainability commitments from tech firms.
- **Capacity & Resource Constraints:** Internal bandwidth is often strained, with utilities citing shortages in skilled engineers, planners, and grid operators to manage fast-moving, high-stakes interconnection demands.
- Financial Strategies in Development: Cost recovery mechanisms such as milestone-based payments, tiered pricing models, application fees, and long-term usage guarantees are emerging. Some utilities are evaluating the creation of a dedicated "data center asset class" to better structure funding and manage financial exposure.
- **Grid Impacts & Power Quality:** As high-performance computing becomes more prevalent, non-linear loads from data centers can introduce harmonic distortions and reliability concerns. Utilities must stay informed on evolving technologies and incorporate these factors into interconnection and operations planning.
- **Geographic Clustering & Load Distribution:** Data centers tend to cluster where affordable land, fiber connectivity, energy incentives, and tax benefits align. This uneven

growth places significant strain on local infrastructure in certain regions while bypassing others.

- **Environmental & Regional Advantage:** Cold climates offer natural cooling efficiencies, reducing data center energy consumption. Utilities can encourage cleaner integration through tools like clean energy tariffs, co-location with renewable energy sources, and targeted infrastructure development (e.g., fiber optics) to enhance regional competitiveness.

These discussions lay a strong foundation for AEIC's ongoing work to help utilities future-proof their systems, manage risk, and develop sustainable approaches for integrating data centers into the evolving energy landscape.

Gaps / Challenges

The following table outlines the primary challenges identified during the workshop, based on shared utility experiences, developer interactions, and current operational constraints. These issues reflect both immediate pain points and systemic barriers to integrating large data center loads.

Table 1. Key Challenges in Integrating Data Centers into the Grid

#	Gap / Challenge	Description
C1	Unstructured Load Forecasting	Utilities lack standardized methodologies for predicting data center demand growth, leading to under- or over-investment in infrastructure.
C2	Speculative Applications Overloading the Queue	Developers submit multiple site applications without final commitments, creating gridlock in interconnection requests and delaying viable projects.
C3	Slow & Fragmented Interconnection Processes	Each utility has different interconnection rules, causing confusion for developers and making large-scale planning difficult.
C4	Transmission Buildout Bottlenecks	Permitting and regulatory hurdles, along with supply chain constraints and long lead times for infrastructure like transformers and substation equipment (3-4 years), make it nearly impossible for utilities to expand transmission capacity at the pace needed to support new data centers.
C5	Mismatch Between Data Center Energy Needs & Utility Planning	Developers prioritize speed & low cost, while utilities focus on grid stability & long-term investment, creating friction in project execution.
C6	Regional Disparities in Data Center Development	Clusters of data centers in states like Virginia, Texas, and Arizona are overwhelming local grids, while other areas lack adequate infrastructure for growth.
C7	Insufficient Clean Energy Availability	While some developers request 100% renewable energy, utilities don't have the generation mix to support that goal without major investment shifts.
C8	Workforce & Expertise Shortages	The industry faces a shortage of engineers, planners, and grid operators, further delaying project approvals & execution.

#	Gap / Challenge	Description
C9	Evolving AI & High-Performance Computing Loads	AI-based data centers have entirely different energy consumption patterns, requiring new planning tools & flexible infrastructure strategies.
C10	Exponential Energy Demand	Data centers require 7-26% annual generation growth, equivalent to powering hundreds of thousands of homes.
C11	Infrastructure Strain	$2 trillion+ in investments needed by 2030 to upgrade generation, transmission, and distribution networks.
C12	New Financial Models	Standard utility tariffs are insufficient for data centers. Custom rate structures and long-term agreements are needed.
C13	Capacity Constraints	High geographic clustering (e.g., Virginia, Texas) is overloading local grids and transmission corridors.
C14	Risk & Uncertainty	Utilities risk stranded assets if demand forecasts don't materialize, necessitating stronger contractual commitments.
C15	Grid Enhancing Technologies	Utilities can get more use out of existing infrastructure by investing in hardware and software solutions, such as advanced conductors, demand-response integration, energy orchestration, and dynamic line ratings.

Path Forward Opportunities

Building on the identified challenges, the table below summarizes opportunities discussed during the workshop that can help utilities proactively address grid constraints, improve planning processes, and align more effectively with data center developers.

Table 2. Strategic Opportunities for Future-Ready Grid Integration

#	Opportunity	Description
O1	Innovative Planning & Integration	**Scenario Planning:** Model demand over short (2-5 years) and long (5-20 years) horizons. **Dynamic Hosting Capacity:** Use real-time tools to optimize grid planning and reduce connection delays.
O2	Creative Pricing Mechanisms	Develop data center-specific tariffs that reflect their infrastructure costs. Encourage direct investment into renewables and storage.
O3	Collaboration & Partnerships	Form utility-developer consortiums for shared infrastructure investments. Expand public-private partnerships to drive innovative financing.
O4	Leveraging Advanced Technologies	Use AI-driven forecasting, DERMS (Distributed Energy Resource Management Systems), advanced conductors, and demand-response programs to improve grid flexibility.
O5	Localized Green Power Solutions	Promote co-location of renewable energy (SMRs, solar farms, energy storage) with data centers to support grid stability.

#	Opportunity	Description
O6	Workforce Development & Expertise Sharing	Establish training programs and knowledge-sharing platforms to bridge the talent gap and accelerate technical execution.

Conclusion

The insights shared during this workshop offer a critical foundation for shaping utility strategies around data center integration. AEIC will continue to support collaboration across the industry and develop further resources such as case studies, planning tools, and a comprehensive white paper to help utilities anticipate challenges, align investments, and ensure grid resilience in the face of exponential load growth.