# UNITED STATES OF AMERICA
# FEDERAL ENERGY REGULATORY COMMISSION

## Reliability Technical Conference

**Docket No. AD24-10-000**

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For Public Use

**Resource Adequacy and Expected Load Growth**
**Docket No. AD24-10-000**
**Statement of Aftab Khan on Behalf of PJM Interconnection, L.L.C.**

I am pleased to present this statement on behalf of PJM Interconnection, L.L.C. (PJM). I currently serve as Executive Vice President – Operations, Planning & Security for PJM. In this role, I oversee all aspects of PJM's grid operations, transmission planning, cybersecurity, physical security, and business continuity efforts. Prior to holding this position, I served as Senior Vice President of Engineering with Eversource Energy, where I led an organization responsible for transmission and distribution system planning, asset management, engineering, grid modernization, operations technology, and vegetation management. Prior to that role, I worked with GE and was responsible for the Grid Solutions business in North America, and spent 24 years with ABB in a variety of leadership roles providing products, projects, and services to the electric utility industry, including Power Circuit Breakers, Power Transformers, Flexible AC Transmission Solutions (FACTS), and High Voltage DC Transmission Systems (HVDC).

I hold a bachelor's degree in electrical engineering from the University of Alaska, a master's degree in electric power engineering from Rensselaer Polytechnic Institute, and an MBA in operations and finance from Carnegie Mellon University.

**Resource Adequacy in PJM**

The PJM capacity construct has historically worked to attract new development, facilitate the retirement of uneconomic generation, and serve as a platform for the development of new resources including demand response. The resource adequacy mechanism in PJM is designed to develop an investment/retirement price signal based on key inputs which include the topology of the transmission system, the periods of greatest risk on the system, and the relative contribution of different resource types.

In the past, the capacity construct in PJM facilitated in a seamless manner the change out of large portions of the fleet affected by the EPA's Mercury and Air Toxics rule. Under the traditional regulatory paradigm, such changes would have taken years to occur but the market allowed for the change-out of that fleet very quickly. Today, we face a far different situation than existed at the time of the Mercury and Air Toxics rule in 2011. In 2011, load growth was relatively stable and the shale revolution enabled the rapid deployment of new natural gas-fired generation to substitute for the retiring coal generation. Today's challenges are greater and are fundamentally tied to dynamic and unprecedented changes in: (i) resource mix; (ii) load growth; (iii) state and federal policy; and (iv) external forces buffeting progress such as supply chain challenges.

PJM together with our stakeholders and the states continue to expend considerable effort assessing the impacts of market design. PJM intends to continue its focus on working with policymakers to strongly promote the consideration of resource adequacy and related reliability issues in the development and implementation of policy affecting the resources that we rely upon. As one recent example, PJM and certain of its ISO/RTO brethren participated in various EPA rulemakings to incorporate shorter and longer term reliability mechanisms into the EPA's Greenhouse Gas Rule and Good Neighbor Rule.

With respect to resource mix, PJM has previously projected that approximately 40,000 MW of generation will retire between 2022 and 2030, which is approximately 21% of PJM's current 192,000 MW installed generation capacity. This analysis was detailed in PJM's report, *Energy Transition in PJM: Resource Retirements, Replacements & Risks*,[1] which underscores the impact that state and federal policies are having on driving premature retirements in PJM's existing generation fleet at a rate that is outpacing the development of substitute generation with attributes needed for reliability.

PJM currently projects a potential shortfall in generation supply by the end of this decade. This is based on our observation that projects with interconnection service agreements are not constructing fast enough measured against the projected pace of retirements and load growth for reasons including complexities associated with supply chain, financing, and state and local siting. Additionally, the resources comprising the vast majority of the PJM interconnection queue are overwhelmingly intermittent and limited-duration resources. This marks a paradigm shift in *how* electricity is being generated and therefore the operating characteristics of these resources, and is fundamentally different from prior transitions in PJM. Given these differences, PJM will need multiple megawatts of these new resource types to replace one megawatt of retiring thermal generation.[2]

By contrast, in the 2000s, when the proliferation of natural gas supply led to a large-scale migration toward gas-fired generation, the basic mechanics of producing electricity did not fundamentally change from an engineering and system planning perspective. Like nuclear or coal-fired resources, gas-fired resources are fundamentally fuel secure, large, thermal, and centralized rotating resources that have comparable impacts in terms of voltage support, load following, stability, and dispatchability. This made the task of modeling and planning for the impacts of gas-fired resources corollary to the analysis conducted for other large, thermal, and centralized rotating generation facilities in the PJM Region. Yet the resources that comprise the vast majority of PJM's interconnection queue today will generate electricity in a fundamentally different way, in that they are inverter-based, intermittent, non-dispatchable, decentralized, and not fuel secure. The corresponding implications of this basic engineering fact for system planning are profound, and are requiring planning authorities like PJM to continue to adapt to the changing environment through the use of new analytical techniques and the integration of new data sets.

**Load Growth Developments in PJM**

For much of PJM's recent history, load growth has been essentially flat—growth in weather normal summer peak load over the past 10 years (prior to 2024) was approximately 0%. That is no longer the case. PJM's current summer peak load forecast predicts a significant increase in load growth, with the share of total load attributable to data centers (currently 4%) expected to rise to 12% by 2030, and 16% by 2039. While data center development is an important and dramatic component of load growth, it is not the only component that presents resource adequacy and planning challenges. For example, PJM analysis indicates a significant projected increase in electric vehicle penetration and charging infrastructure, which as a load component is currently negligible, but is expected to rise to 11% of total PJM load by 2039. Similarly, PJM analysis also indicates significant and continued growth in rooftop or behind-the-meter solar (and more recently storage), which PJM accounts for as an offset to load. Additionally,

[1] PJM Interconnection, L.L.C., *Energy Transition in PJM: Resource Retirements, Replacements, and Risks* (Feb. 24, 2023), available at: https://www.pjm.com/-/media/library/reports-notices/special-reports/2023/energy-transition-in-pjm-resource-retirements-replacements-and-risks.ashx.

[2] *Id.* at page 1 and page 11, Figure 4.

several states in the PJM region have gas to electric heat conversion decarbonization goals, which will also increase the electricity demand. These factors demonstrate the increasing variance and dynamism of load development in the PJM Region, and they also signal the need for significant investment in new transmission to support this load growth.

The significant increase in data center development and the international race towards development of artificial intelligence (AI) is also straining the existing grid's ability to meet this new demand nationwide, especially given the pace of incremental resource additions. In PJM, it is particularly notable that Loudoun County, Virginia has one of the largest concentrations of data centers in the world.

Forecasting data center load growth in the future is made more difficult by factors including:

- *AI is a rapidly growing and evolving technology.* As a result, the deployment plans for data center support for AI are still in development. As system planners of the electric grid, we are a step removed from those direct design considerations and have to deal with a fairly large bandwidth of potential load growth scenarios.
- *There is widespread competition in the United States for data center development.* Although some areas of the country may not be hospitable to data center development at the local level, there is an increasing trend among state and local officials competing for the construction jobs and specifically the tax revenue that large data centers may be capable of generating. This raises the challenge of forecasting the location within the PJM footprint where data center growth is expected to continue into the future. As one tool to address over-counting or under-counting the impact of projected data center load, PJM is evaluating the use of fixed contractual commitments to provide hard data points for the near-in years of PJM's ten year forecast.
- *There is ongoing work needed to explore operational complexities associated with data center connections to the electric grid.* For example, just as we redispatch generation to address constrained conditions in one part of our grid, additional work is needed to explore with the data center operators the extent to which data centers might add flexibility to their operations given potentially constrained conditions on the electric grid at a given location. This is a design integration issue between our two systems. We are just at the beginning of exploring such operational complexities.

**The Broader Look Forward**

The challenges PJM has described here will require leadership and collaboration across the industry, and cannot be accomplished by PJM alone. Charting the path forward will require balancing considerations such as:

- Meeting our commitment to maintaining and enhancing grid reliability given PJM's resource adequacy challenges and the anticipated load growth by, among other things, constructing needed transmission and generation; while
- Facilitating the implementation of state and federal policies to decarbonize the grid reliably, and sharing information with policymakers about the impact potential policies may have on the grid; while

- Supporting the ability of the nation's grid to support the AI revolution in furtherance of national security and other national strategic interests; while
- Addressing questions about appropriate rate treatment and affordability by considering issues of equity involving how new load is served and potential costs borne by captive end-use customers.

The Commission as the regulator of reliability and economics at the wholesale level has a key role to play, as do the ISOs/RTOs, the states, and other industry stakeholders including customer groups. We at PJM are working through these issues while listening intently to stakeholders and policymakers. We look forward to the feedback and ideas coming out of this Technical Conference as a key data point in our continued deliberations on these important matters.