Data Centers: Moving Fast and Breaking Things August 12, 2025

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Important Terms and Concepts

► Wholesale vs. Retail



Generator Reseller

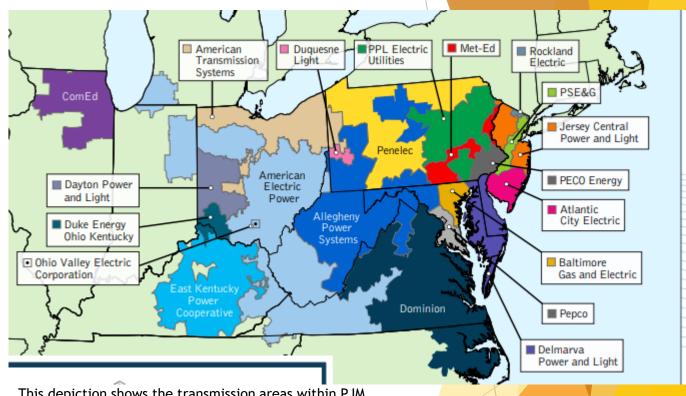
i.e., electricity utility companies, competitive power providers and electricity marketers

Generation -Transmission -Distribution



Regional Transmission Organizations (RTOs)

- Regional Transmission Organizations (RTOs) or Independent System Operators (ISOs) are grid operators in certain regions
- Operational control, but not ownership, of transmission assets
- Dispatch generation, operate transmission lines, and operate energy markets
- All the transmission owners in Ohio are part of PJM Interconnection, LLC
- PJM operates several markets for generation that Buckeye participates in including:
 - Energy Markets (day ahead and real time)
 - Capacity Markets
 - **Ancillary Services Markets**
- PJM tariffs, agreements, and manuals set out extensive rules for operating in the marketplace.

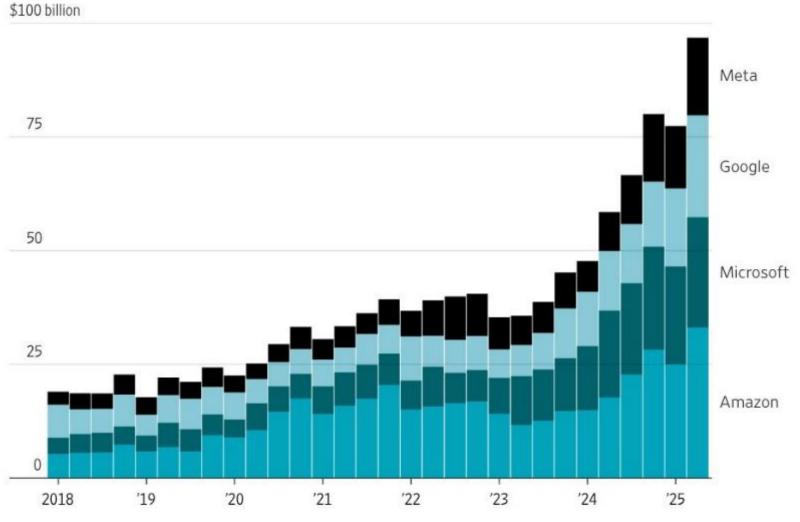


This depiction shows the transmission areas within PJM.



Data Center Investment

Capital expenditures, quarterly



Note: Data are for calendar quarters and include finance leases.

Source: the companies



Data Center Expansion and Grid Impacts

- Data center load expansion is presently the single most significant driver of electric load growth in Ohio, PJM and the US generally
- In Ohio and other areas of the country, the demand for electricity is growing faster than the available capacity.
- OpenAI's ChatGPT requires 2.9 watt-hours for a request—nearly ten times more power than a typical Google search
- Uncertainty about this potential load growth



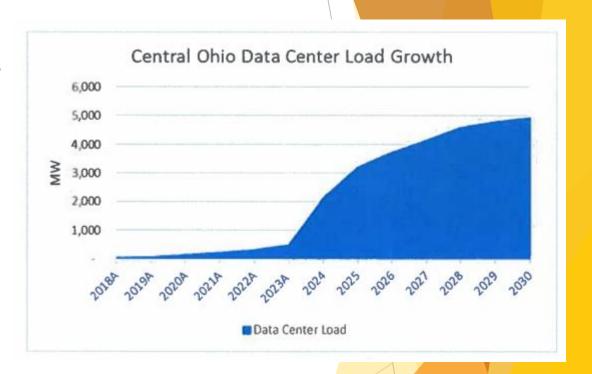
"Just a few years ago, a large-scale industrial manufacturing facility might require 100 megawatts (MW) of electricity - enough to power about 100,000 homes. A facility that size would typically be one-of-a-kind in a region and would be a major source of economic activity for the area. Now, it is common for a single data center to require three times to up to 15 times this amount of power for a single site."

- Ben Fowke, Interim CEO, AEP Ohio



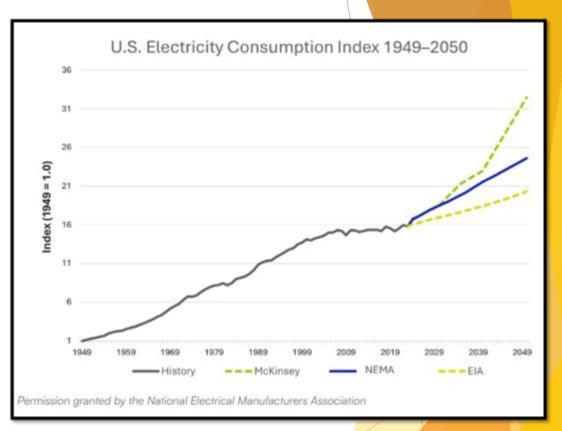
Data Center Growth in Ohio

- Central Ohio is experiencing massive data center load growth
- AEP Ohio's transmission grid capacity for central Ohio is 10,000 MW
 - Existing peak demand in Central Ohio is 4,000 MW
 - As of July 2025, AEP Ohio has signed Electric Service Agreements with 5,000 MW of data centers that are expected to come on-line by 2030
- AEP Ohio stated that it has 30,000 MW of data center load interested in locating in central Ohio
 - > 50 customers at over 90 sites
- The total load for the entire state of Ohio is approx. 29,000 MW
 - > 30,000 MW is approx. 3x the size of NYC
- Because Central Ohio lacks generation, this will require billions in investment in new transmission, likely a 765 kV line, which could take 7-10 years to build



Comparison to Pre-2023 Load Growth

- Traditional large loads maxed out at 500 MW (Ormet Smelting Plant)
 - Once in a generation load with 700+ jobs
- Hyperscale data centers can be 1,500MW each
 - Typically, only around 25 permanent jobs
- Flat load growth over the last 20 years expected to increase dramatically by 2040



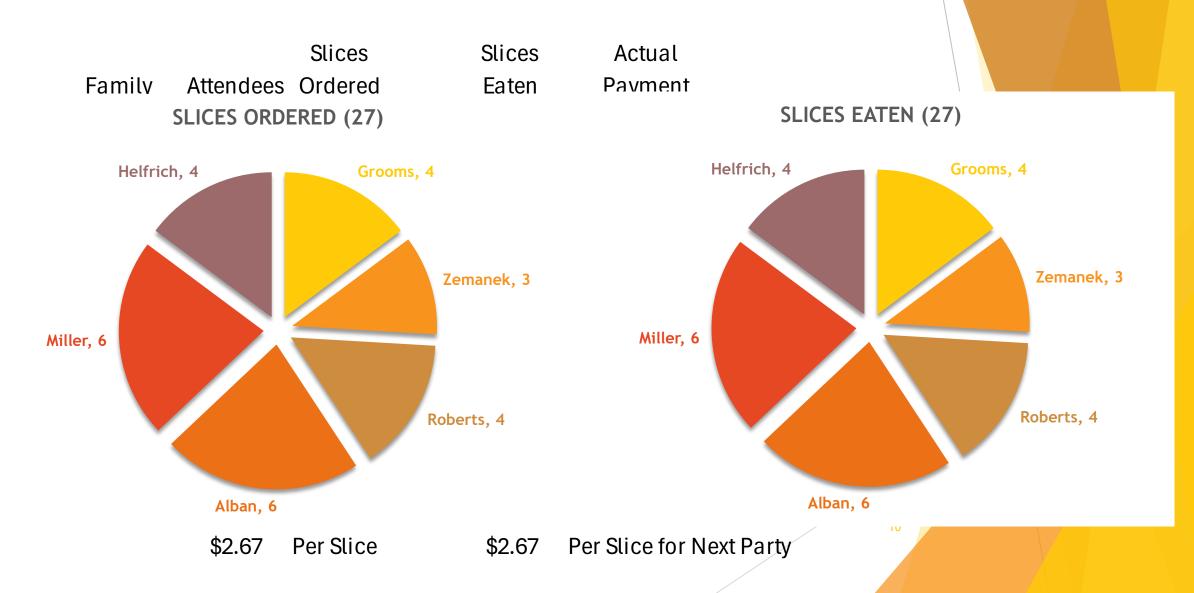
Data Center Expansion and Grid Impacts

- Impacts to affordability and reliability
- ► Transmission: massive investments required to build transmission to provided power needed
 - Potential for cost shifting if data center loads don't show up as expected
- Generation: exacerbates existing electric demand and supply imbalance creating reliability concerns
- Distribution/Retail: massive investments in transmission and generation supply shortages will ultimately be paid for by end users
 - Potential for cost shifting at the distribution level
- Utilities, regulators, and legislatures are addressing data center issues at all levels



Impacts to Transmission - Affordability

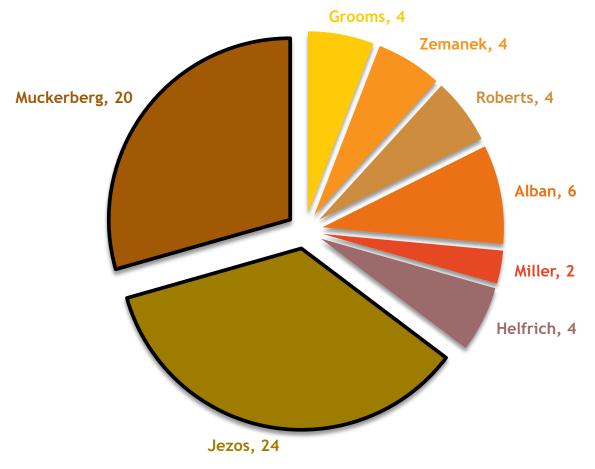
- ► Transmission Rate Making:
 - Revenue Requirement the value of a transmission owner's assets times a federally-approved rate of return, plus the costs to operate those assets.
 - Billing Units the amount of peak electrical demand served by those assets.
 - Revenue Requirement / Billing Units = Rate
- **Examples:**

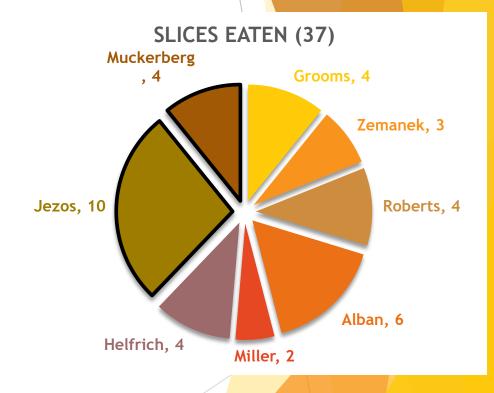


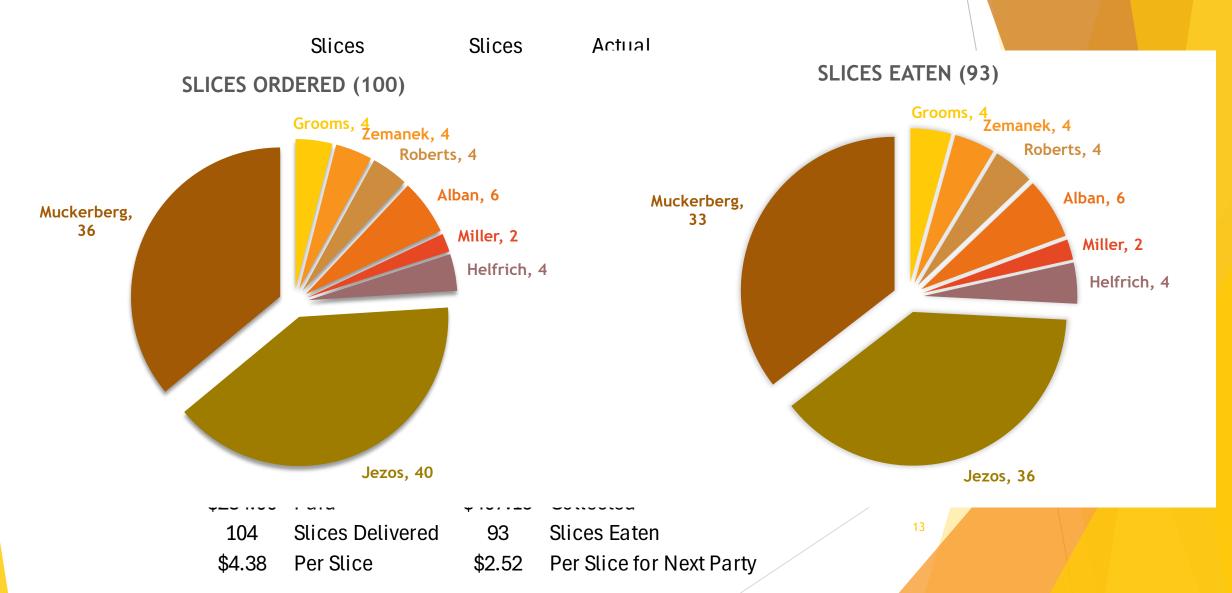




SLICES ORDERED (68)







AEP Rebuilds a Transmission Line New Pizza Delivery Car

Auto Plant in Youngstown Closes

~

Last Minute Cancellation, Fewer Slices Eaten

Revenue Requirement

Demand

$$\downarrow$$

Rate \uparrow

Slices Eaten

Total Cost of Pizza

Slices Eaten

 \downarrow

Cost per Slice \uparrow

Steel Mill in Middletown Increases Production Extra Hungry Guest

Serving a New Data Center New Guest Placing a Huge Pizza Order

Transmission Impacts - Summary

- Massive load growth places strain on transmission system, especially where there is no generation nearby
- Significant upgrades will be required to bring power to areas experiencing load growth
 - > PJM has approved >\$10 Billion in transmission upgrades to accommodate >10,000 MW of data center load in Virginia
- These costs are recovered from wholesale transmission customers (Buckeye, AMP, and the IOUs) based on the highest demand on the system during a single hour each year, or 1 CP
- If load shows up as planned for, and is captured in the 1 CP, transmission rates could decrease, however...
- If large data centers use less than what they've requested, or are not captured in the 1 CP, transmission rates will increase

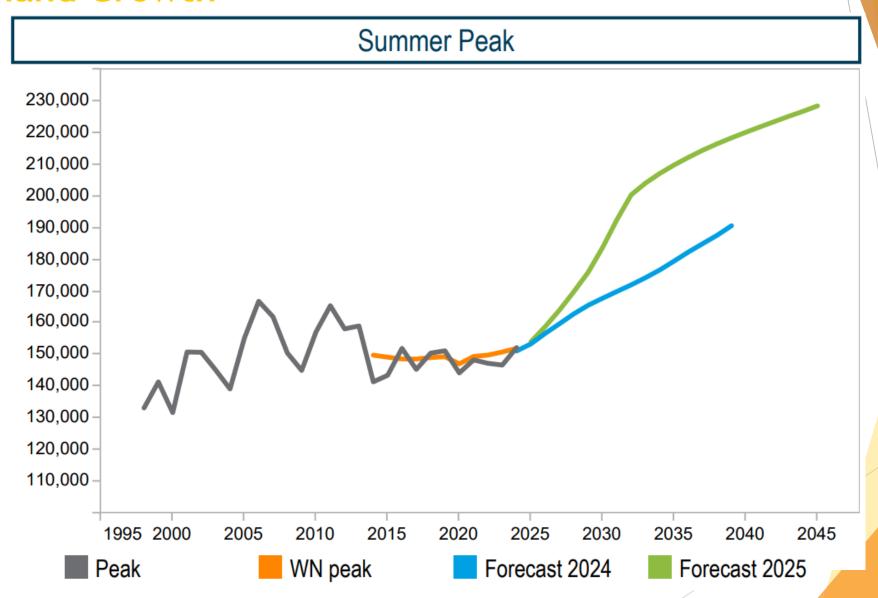


Generation - Resource Adequacy



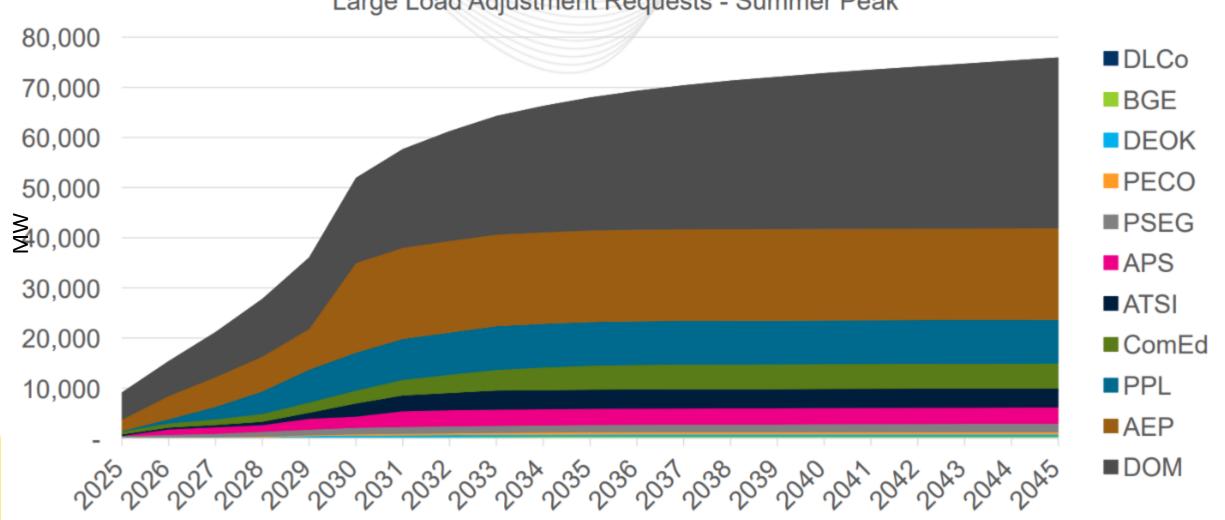


Demand Growth

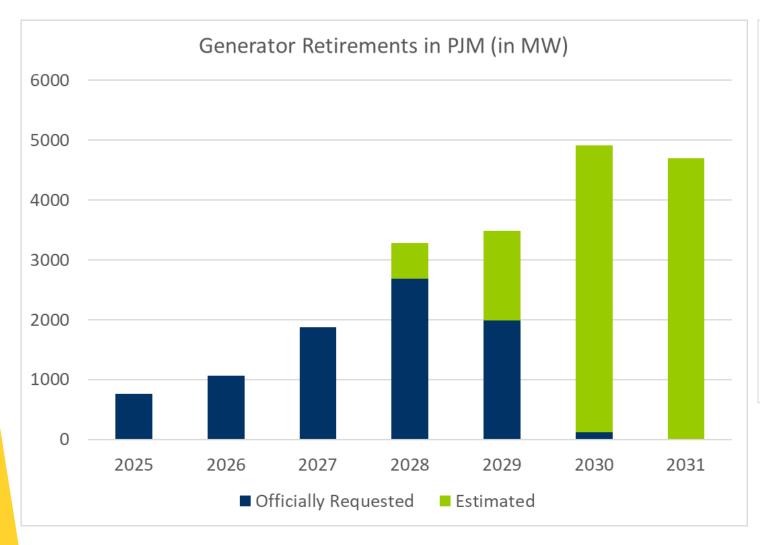


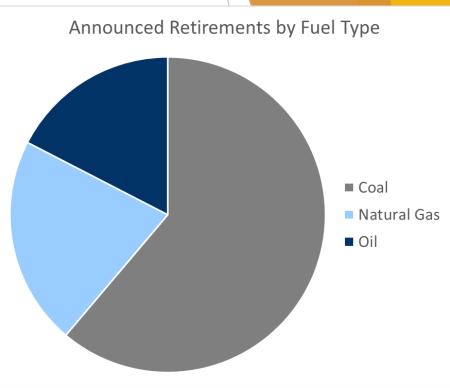
Demand Growth - Driven by Data Centers

Large Load Adjustment Requests - Summer Peak



Generation Retirements



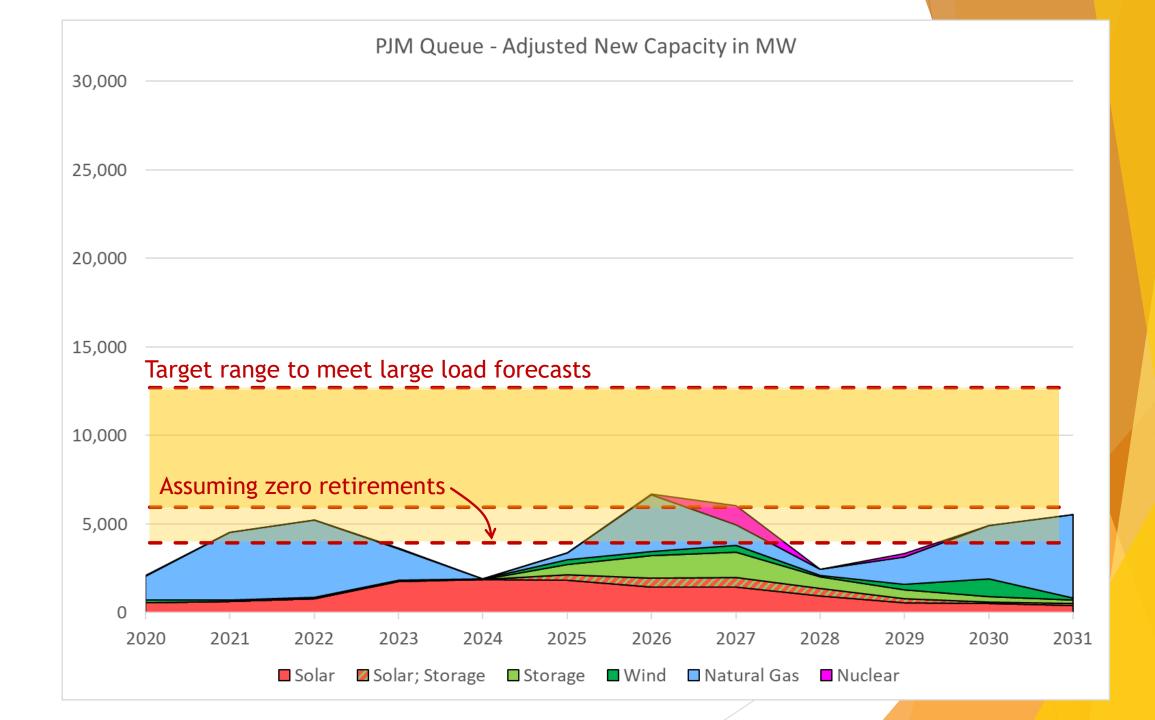


Generator Retirements

- Estimates over next 5-10 years:
 - ▶ Demand Growth: 4,000 8,000 MW/year
 - ► Generator retirements: 2,000-5,000 MW/year

► To match the above, we'll need <u>6,000 - 13,000 MW/year</u> in new generation capacity

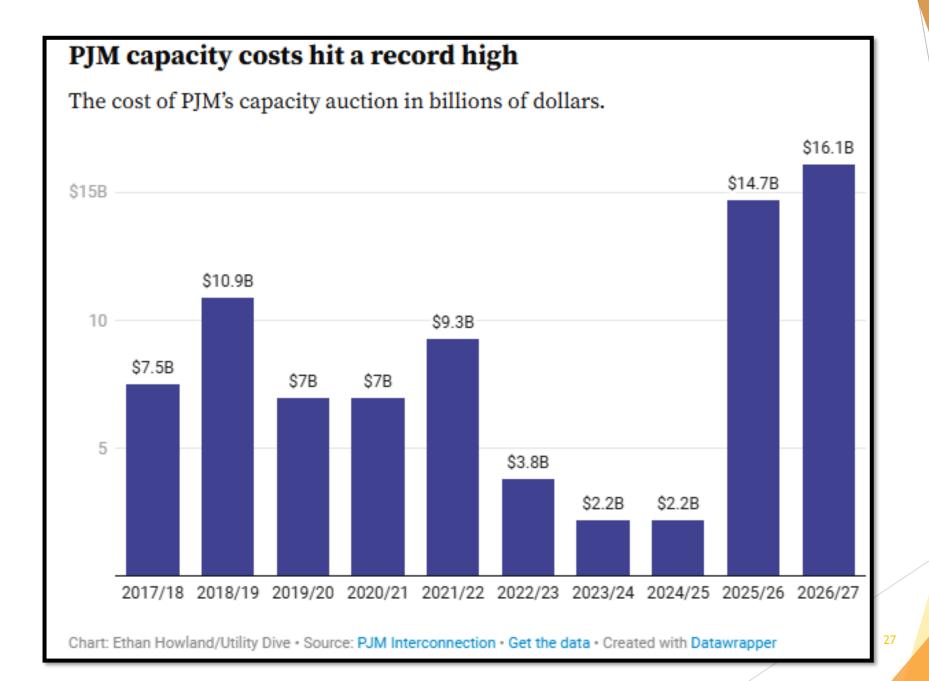




Can we not retire generators?

- In spite of its flaws, PJM market is sending higher price signals
- Current federal EPA has been supportive of eliminating or delaying implementation of rules that target fossil fuel plants
- ► RMR (Reliability Must Run) agreements with PJM
- ► 202(c) orders from DOE





White House activities

EPA Proposes Repeal of Biden-Harris EPA Regulations for Power Plants, Which, If Finalized, Would Save Americans More than a Billion Dollars a Year

Breaking down barriers to affordable, dependable energy for American families

June 11, 2025

EPA Will Revise Wastewater Rules to Support Electric Energy Reliability and Unleash American Energy

June 30, 2025

RMR and 202(c) Orders

- RMR (Reliability Must Run) agreements with PJM
 - ► Brandon Shores Units 1 & 2 1,370 MW coal plant in Maryland (PJM)
 - ► H.A. Wagner Units 3 & 4 360 MW (coal) + 415 MW (oil) in Maryland (PJM)
 - ► Indian River Unit 4 411 MW coal plant in Delaware (PJM)
- ▶ 202(c) orders from DOE
 - Ordered to maintain operations beyond planned retirement date:
 - ► Eddystone 760 MW oil & gas peaker in Pennsylvania (PJM)
 - ▶ J.H. Campbell 1,560 MW coal plant in Michigan (MISO)
 - Ordered to run beyond its environmentally restricted operating limits:
 - ► H.A. Wagner Unit 4 400 MW oil unit in Maryland (PJM)

Can we build generation faster?

Ohio and other states support a market-based approach

But...



Can we build generation faster?

- Ohio and other states support a market-based approach, but...
- The PJM market spooks investors
- Something has got to give
- Large loads are willing to build their own, but details matter





Data Centers and New Generation

- Data centers expanding beyond solar and wind because they need baseload
- Data centers are also investing in new nuclear, including SMRs
- AEP agreement with Bloom Energy fuel cells
- Data centers in Central Ohio planning to island without a grid connection (at least for now)



HOME > NEWS > THE CRITICAL POWER CHANNEL

Ohio regulators approve construction of 200MW gas power plant to serve Meta's New Albany data center

Slated for completion by Q3 2026

June 10, 2025 By: Zachary Skidmore D Have your say



Co-Located Load with Generation

- Siting new generation with large loads can be a good solution, but details matter...
- Co-location advocates argue load should pay a lower rate for transmission
 - Only true if "fully isolated" from grid
- Removes existing generation resources from the grid that may have impact on everyone else
 - Concern in Ohio where generation is not regulated
- FERC and state legislatures considering these issues carefully

Ways to Address Transmission Cost Shifting

- Retail Level: AEP Ohio Approach
- Longer contract terms, minimum demand of 85%, and credit support
- Does NOT address cost shifting at the wholesale level
- AEP has taken a similar approach in Indiana and West Virginia
- Wholesale Level: Dayton Power & Light (AES Ohio) Approach
- Single contract, rather than generally applicable tariff, filed at FERC
- Minimum term and minimum demand ratchet that would cover or exceed the transmission investment costs
- AES Ohio intends to apply any costs recovered to offset the costs of other wholesale transmission customers
- Wholesale Level: Demand Allocation and Direct Assignment
- Dominion (TO in Virginia) changed from 1 CP to 12 CP
- Direct Assignment of Transmission Costs

Distribution/Retail Service Impacts

- Large Data Center loads are typically connected at transmission level with limited investment in distribution facilities
 - Difficult to allocate fixed distribution costs to data center loads, although AEP Ohio is trying
- Data Centers are still retail loads and subject to retail service charges
- Can apply for special deals and reasonable arrangements in Ohio
 - Pending reasonable arrangement request for Amazon at PUCO
- Data center loads can be a significant risk to small utilities like cooperatives
 - Large data center load can be the same size or larger than the rest of the cooperative's aggregate load
 - Average cooperative load size in Ohio is ~75 MW
 - Trailing costs, stranded investments in transmission and distribution and generation, unpaid receivables for just a few weeks, can put cooperative at financial risk

Federal Response

- Federal Energy Regulatory Commission focusing on co-located load with generation
 - FERC held a technical conference to consider impacts of co-located load with generation
 - FERC opened a case to investigate how co-location arrangements with load should be set-up to allow for appropriate cost-allocation and avoid reliability concerns
 - ▶ PJM has proposed 8 options for interconnection, with preference for "front of the meter" arrangements
- FERC held technical conference to address resource adequacy issues
- Trump Administration taking action to eliminate barriers to AI development
- Trump Administration taking action to keep fossil-fuel based generation online
 - EPA reversing course on some rules that would lead to premature closure of fossil-fuel based generation
 - ▶ DOE 202(c) Orders to keep coal plants on-line
- Some view AI as central to national security



State Responses

- Ohio legislature has not taken any steps to investigate co-located load arrangements or impacts of large loads on electric grid
 - Maryland, Virginia, and other states have directed investigations on these issues
- Ohio is deregulated for generation, reliant on PJM market to ensure sufficient generation resources are built
- HB 15 signed into law and effective in August
 - Provides larger role for behind-the-meter generation
 - No limitation on co-location with generation arrangements
 - Aimed to spur new generation
 - Strict limitations on IOU ownership of generation
- Still reliant on PJM market to ensure generation is built

Questions?