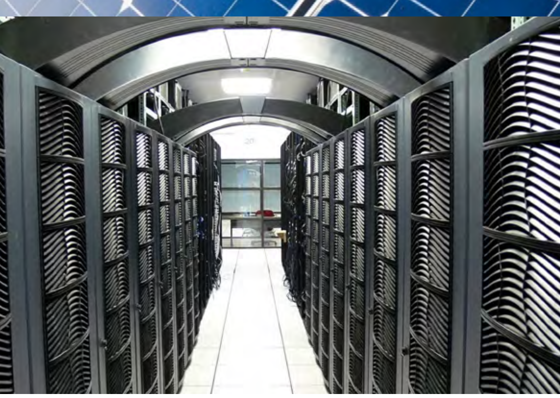
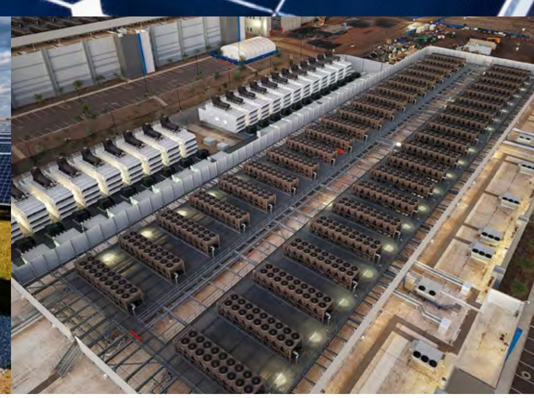
Bring Your Own New Clean Energy:

AN ASSESSMENT OF GENERATION STRATEGIES IN THE PJM FOOTPRINT





1 INTRODUCTION

Data center growth is outpacing PJM Interconnection's ability to bring new generation online, and the strain is showing up in consumers' bills, in the reliability of the grid, and in the air Pennsylvanians breathe. As policymakers and grid operators search for solutions, one response has gained traction—requiring or encouraging large new loads to bring their own generation (BYOG) as a condition of connecting to the grid. But BYOG is not a simple "one size fits all" policy—it can encompass different possibilities, which do not all serve the public interest equally.

This paper evaluates potential strategies for large loads against three key questions: 1. Does the strategy lower or raise costs for other ratepayers? 2. Does the strategy strengthen genuine grid reliability, or does it instead shift risk onto other customers? 3. Does the strategy reduce pollution, or does it lock in additional polluting fossil infrastructure and the local harms that come with it?

Consideration of these questions shows that BYOG alone is not enough to serve the public interest and environment. Instead, PennFuture advocates for Bring Your Own New Clean Energy (BYONCE). Under BYONCE, large new loads are expected to demonstrate that they add meaningful low-cost clean supply to the grid, that policies align financial burdens with cost causation, and we avoid locking in new polluting fossil generation.

Key Messages

- Any successful program to address data center growth will require additionality—simply redirecting existing generation to new loads isn't a solution.
- To lower consumer costs, increasing the supply of energy isn't enough—we need to increase the supply of the lowest-marginal-cost generation like wind and solar.
- New natural gas-powered generation, particularly new combustion turbines, is not likely to lower consumer prices.
- Where possible, data centers should look to energy storage systems rather than diesel generators to provide emergency backup.
- To the extent diesel generators are installed, they should be certified as cleaner Tier-4 engines rather than Tier-2.

2 BACKGROUND

2.1 The Scale of Data Center Load Growth and the rise of BYOG

Data center electricity demand represents one of the most significant new load classes to confront our grid operator, PJM Interconnection (PJM), in its history. The International Energy Agency (IEA) projected that global data center electricity demand could double between 2022 and 2026, driven overwhelmingly by artificial intelligence (AI) work-loads.[1] Within PJM—the grid operator covering all or parts of 13 states and the District of Columbia, serving approximately 67 million customers—the aggregate effect is severe.

PJM's own 2026 Long-Term Load Forecast trimmed near-term projections by 2.6% (4.4 GW) for 2028, driven by stricter vetting of interconnection requests and updated economic modeling.[2] Despite this correction, the directional trajectory remains steep: a 2.6% trim is not enough to keep the graph from going very sharply up and to the right. (See Figure 1.)

While the true magnitude of future demand is difficult to accurately determine, investment signals suggest that it will be significant. Amazon alone announced more than $20 billion in AI infrastructure investment in Pennsylvania—the largest capital investment in the Commonwealth's history.[4]

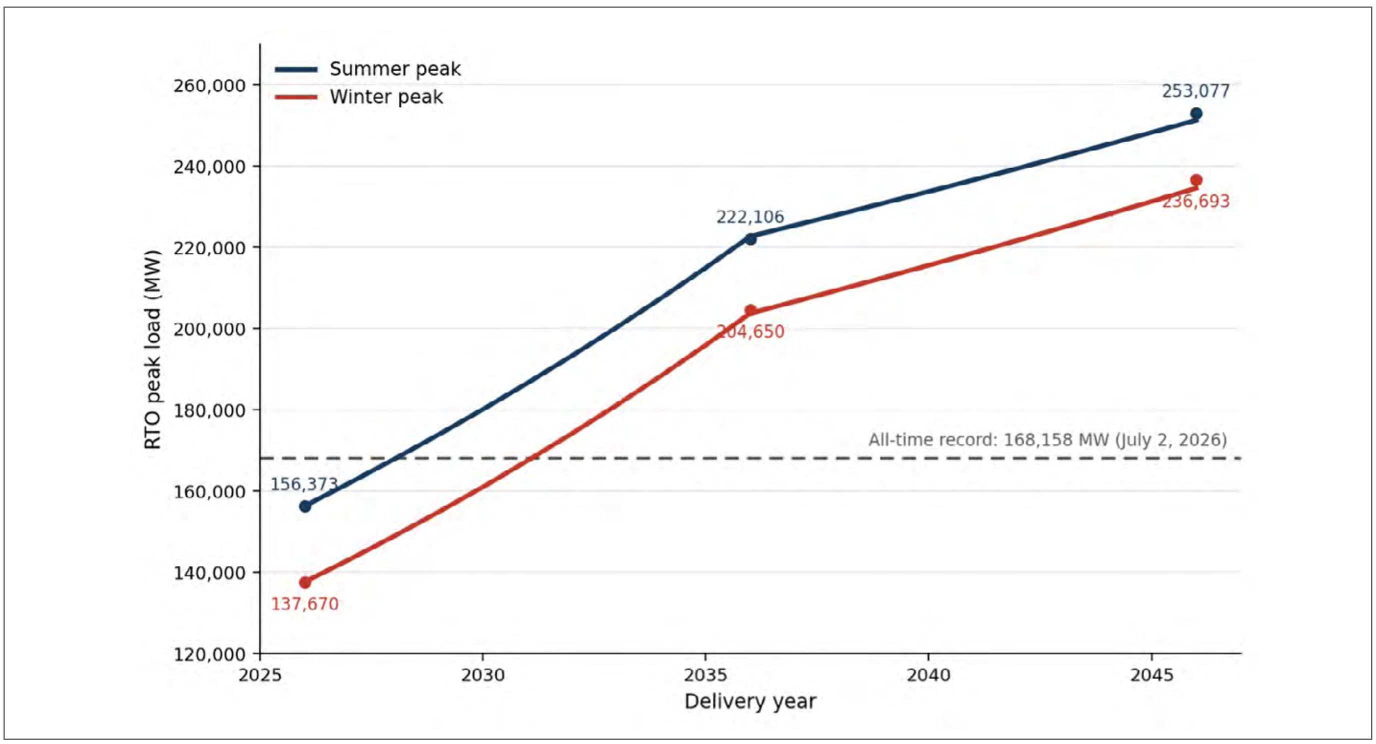


Figure 1. PJM Load Forecast [3]

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[1] International Energy Agency, *Electricity 2024: Analysis and Forecast to 2026* (2024), https://www.iea.org/reports/electricity-2024.

[2] Ethan Howland, *PJM Trims Near-Term Load Forecast on Stricter Data Center Vetting*, Economic Outlook, Utility Dive (Jan. 15, 2026), https://www.utilitydive.com/news/pjm-interconnection-load-forecast-data-centers/809717/.

[3] PJM Interconnection, L.L.C., 2026 PJM Load Forecast Report 6 (Jan. 14, 2026), https://www.pjm.com/-/media/DotCom/library/reports-notices/load-forecast/2026-load-report.pdf.

Emails obtained via Pennsylvania's Right-to-Know law revealed that Governor Shapiro's office offered Amazon exclusive early access to a permitting fast-track program before it was available to the public and coordinated closely with the company on project siting.

On May 6, 2026, PJM Chief Operating Officer Stu Bresler told Reuters that the system is experiencing a demand ramp-up "we haven't experienced since, probably, the Industrial Revolution," and warned of an electricity shortfall as early as 2027.[5] That same day, PJM published a sweeping white paper on market reform describing what it calls a "credibility trap": scarcity prices spike high enough to signal the need for new investment, but considerable difficulties bringing significant new generation online mean the shortage persists and costs keep soaring.[6]

With the lack of sufficient capacity on our power grid becoming an increasing challenge to data center developers, one often suggested solution is for such projects to deploy their own generation.

2.2 The Growing Demand for BYOG

Bring Your Own Generation (BYOG) strategies in the PJM footprint are increasingly shaping both grid reliability planning and consumer cost exposure. But the dominant forms of BYOG now under development—large gas-fired generation and extensive diesel backup systems—are unlikely to solve the underlying affordability problem on their own. Instead, they risk locking in additional fossil infrastructure, shifting system costs onto other customers, and blurring the distinction between private power arrangements and resources that genuinely add clean supply to the grid.

BYOG can take several forms. Front-of-the-meter (FTM) generation interconnects directly with the PJM grid and participates in wholesale markets, often paired with a power purchase agreement (PPA) from a large load. Behind-the-meter (BTM) generation instead sits on the customer's side of the interconnection, providing emergency backup power or offsetting demand that would otherwise be drawn from the grid. This paper will examine each of these forms in turn.

Across all these forms, three distinctions determine whether the new arrangement is in the public interest.

The first is additionality. Generation that adds new supply to the grid relative to demand can, under the right conditions, put downward pressure on prices as it improves reliability.

Generation that is simply redirected from existing resources to serve new load does neither. Any credible BYOG or BYONCE standard must start with additionality.

The second key element is cost. Because generation is called to run in merit order based on marginal prices, new generation only lowers wholesale prices if it results in lower average prices than the grid's current average. Adding new supply priced above the grid's current average may allow for data center expansion and help address some reliability concerns, but it results in higher costs that are transferred to the public.

This has an important implication for how BYOG and BYONCE standards should be designed: lowering consumer costs does not necessarily require that a data center's own load be matched, hour-by-hour, to its own dedicated wind or solar generation. Because PJM dispatches the lowest-cost available resources first regardless of who procured them, any new low-marginal-cost supply added anywhere on the system puts downward pressure on the price everyone pays. The goal should be to maximize new low-cost generation on the grid rather than engineering a self-contained private supply chain for every new load.

The final element is the environmental and societal cost. Fossil fuel generation emits particulate matter, ozone precursors, and greenhouse gases that impose real costs on public health and the climate, and those costs are paid for by the people and, particularly, by the communities that already carry a disproportionate share of Pennsylvania's industrial pollution burden. None of this shows up on a data center's power bill, but it shows up in asthma rates, emergency room visits, extreme weather, rising insurance premiums, and infrastructure costs that ultimately touch every ratepayer. A credible BYOG standard must weigh these costs alongside additionality and price, not treat them as a footnote to the economics.

4 Jael Holzman, *Inside Josh Shapiro's Attempt to Navigate the Data Center Backlash*, Heatmap News (April 29, 2026), https://heatmap.news/politics/shapiro-amazon-emails.

5 Laila Kearny, *U.S. Power Grid Operator PJM Is Considering Market Overhaul*, Reuters (May 6, 2026), https://www.reuters.com/business/energy/us-power-grid-operator-pjm-is-considering-market-overhaul-2026-05-06/.

6 PJM Interconnection, *Powering Reliability Through Market Design*, Special Report (May 6, 2026), https://www.pjm.com/-/media/DotCom/library/reports-notices/special-reports/2026/20260506-powering-reliability-through-market-design.pdf.

3 PJM MARKETS AND ISSUES

3.1 Energy Markets

Understanding the regional energy market is critical to understanding why a BYONCE standard better serves the public interest. Whether a given load addition raises consumer energy prices is not just a question of whether new generation is built alongside it.

PJM Interconnection (PJM) is a private company that acts as grid operator across all or part of 13 mid-Atlantic and Midwestern states and the District of Columbia, managing the high-voltage transmission system and serving approximately 67 million people. As a federally regulated Regional Transmission Organization (RTO), PJM runs the wholesale electricity markets that determine how power is priced and dispatched across its territory.

The energy market consists of a day-ahead auction in which generators submit offers reflecting their cost of producing energy at various output levels. PJM forecasts the next day's demand and clears the market the evening before through a security-constrained economic dispatch—meaning it selects the lowest-cost combination of generators that can meet demand reliably, given the physical limits of the transmission system. Prices are set locationally, resulting in each generator being paid a locational marginal price (LMP) reflecting the cost of delivering the next megawatt to its specific location on the grid, accounting for both the energy itself and any transmission bottlenecks required to move power there. In other words, the highest price generation called upon to run sets the price that all the generators in that area receive. When load growth in a constrained area is not matched by new generation, the dispatch in that region moves along the dispatch curve (see Figure 2) up and to the right resulting in higher-cost units being dispatched with prices rising accordingly.

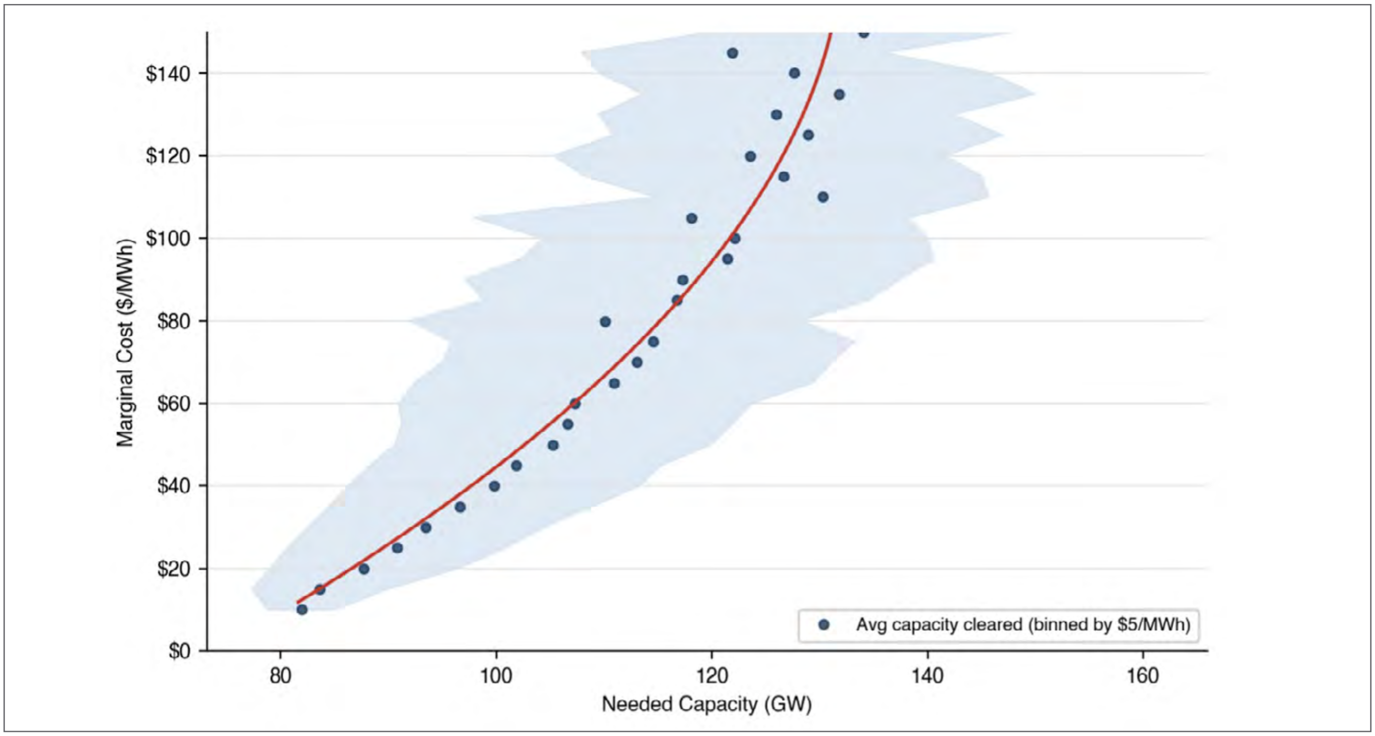

Figure 2. PJM Dispatch Curve (2025[7])

[7] PJM Interconnection, LLC, *Data Miner 2: Generation by Fuel Type (Hourly)*, https://dataminer2.pjm.com (last visited June 23, 2026).

Note that Figure 2 is based on day-ahead prices and does not include real-time variability throughout the day or operating reserve (uplift) charges that happen when units must be called up outside of merit order to maintain reliability. As a result, this chart represents a conservative estimate of actual costs.

Because the market chooses the available resources with the lowest marginal cost, the cost of generation influences how much any available resource will run. Because clean renewable generation like wind, solar, and hydroelectric as well as nuclear resources have very low marginal costs driven by operation and maintenance (O&M) expenses rather than fuel, such generation will likely clear the market and be called to run whenever they are available. The price-duration chart in Figure 3 depicts this relationship—the higher the marginal cost of generation, the less it tends to run.

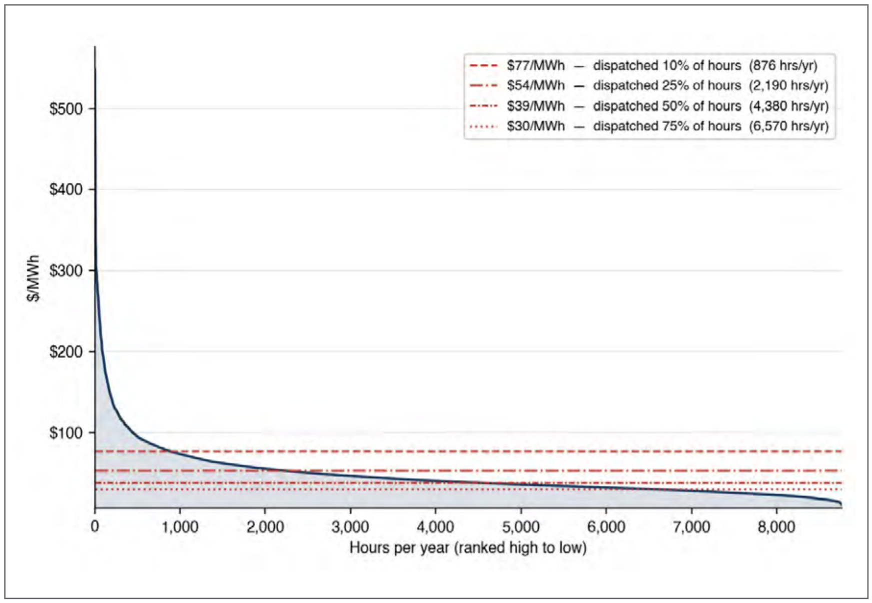

Figure 3. Price-Duration chart for PJM (2025)[8]

Industry and regulators often group nuclear, coal, and combined-cycle gas (NGCC) together as what they call 'baseload' generation, traditionally defined as being generation that runs nearly constantly, rather than being variable like solar and wind. In PJM's current market, this terminology increasingly fails to reflect how these plants operate. As shown in Figure 4, nuclear is the only resource still running nearly continuously—also described as having "high capacity factors." NGCC units are technically capable of high capacity factors, but in practice they are operated as load-following resources and typically run 50 – 70% of the hours in a given year, with the exact figure driven by gas prices and the availability of cheaper marginal supply.[9] Coal generation in PJM, meanwhile, has fallen sharply and plants tend to operate roughly 30 – 40% of the time,[10] with

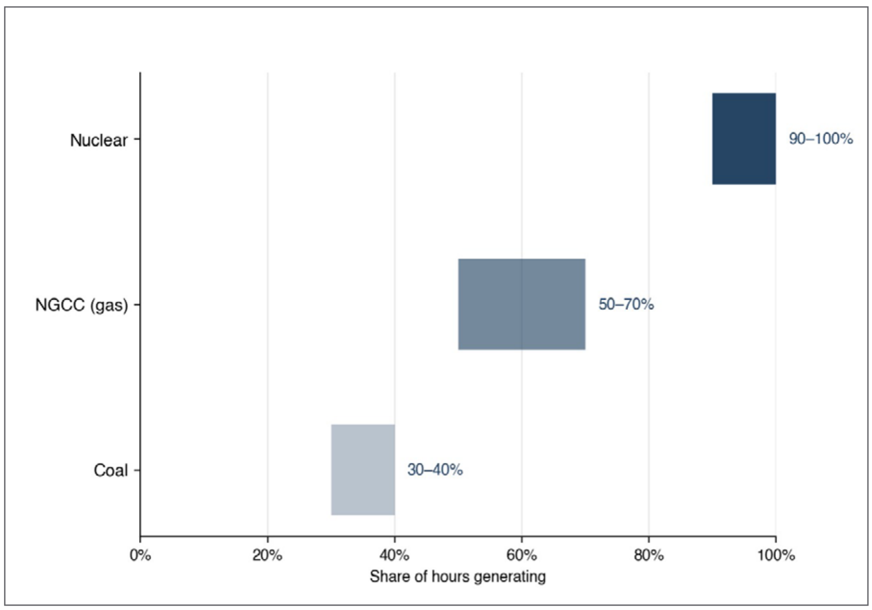

Figure 4. Capacity Factor Ranges for "Baseload" Plants

[8] PJM Interconnection, LLC, *Data Miner 2: Day-Ahead Hourly LMPs*, https://dataminer2.pjm.com (last visited June 22, 2026).

[9] U.S. Energy Information Administration, *Natural Gas Combined-Cycle Power Plants Increased Utilization with Improved Technology*, Today in Energy (Nov. 20, 2023), https://www.eia.gov/todayinenergy/detail.php?id=60984.

[10] U.S. Energy Information Administration, *PJM Has Been Dispatching Coal-Fired Generators Less than Other Generators*, Today in Energy (June 17, 2024), https://www.eia.gov/todayinenergy/detail.php?id=62343.

units increasingly behaving as "mid-merit" resources rather than always-on generation. In other words, the distinction between "baseload" and "variable" power is much less meaningful than it once was.

The remaining resources are the "peakers" that are intended to ensure reliability by responding to fluctuating peak demand (see Figure 5). This includes natural gas combustion turbine (CT) plants that, while cheaper to build, are significantly more expensive and less efficient than NGCC plants and vary widely in how often they run—many of these plants may remain idle all but a few days per year while some run much more often.[11] PJM also procures demand response resources, where it pays large industrial and commercial consumers to reduce consumption during peak periods. This effectively competes with CTs and similarly tends to be limited to the highest-price hours. Beyond that, we have the most expensive plants to operate such as diesels and internal combustion engines that often run less than 5% of the time, and sometimes as low as 1%.[12]

PJM's day-ahead energy prices have been volatile with prices averaging $21.40/MWh in 2020, spiking to $75.44/MWh in 2022, and then settling into a range above pre-pandemic levels—$31.93/MWh in 2023, $33.79/MWh in 2024, and roughly $48/MWh in 2025.[14] This volatility, as expected, correlates with natural gas prices since gas plants set the marginal price in most PJM hours. The 2022 price spike, for example, coincided with Henry Hub prices nearly doubling as Russia's invasion of Ukraine disrupted European gas supplies and record volumes of U.S. LNG were exported to replace them.[15] Energy prices have moderated since that peak but have not returned to pre-2021 levels, leaving consumers exposed to a wholesale market that is structurally tied to gas price swings and, more recently, under additional upward pressure from the load growth described above.

Thus, whether a given load addition raises consumer energy prices is not just a question of whether new generation is built alongside it. Looking again at Figure 2, new demand pushes the marginal price up the existing curve; new supply

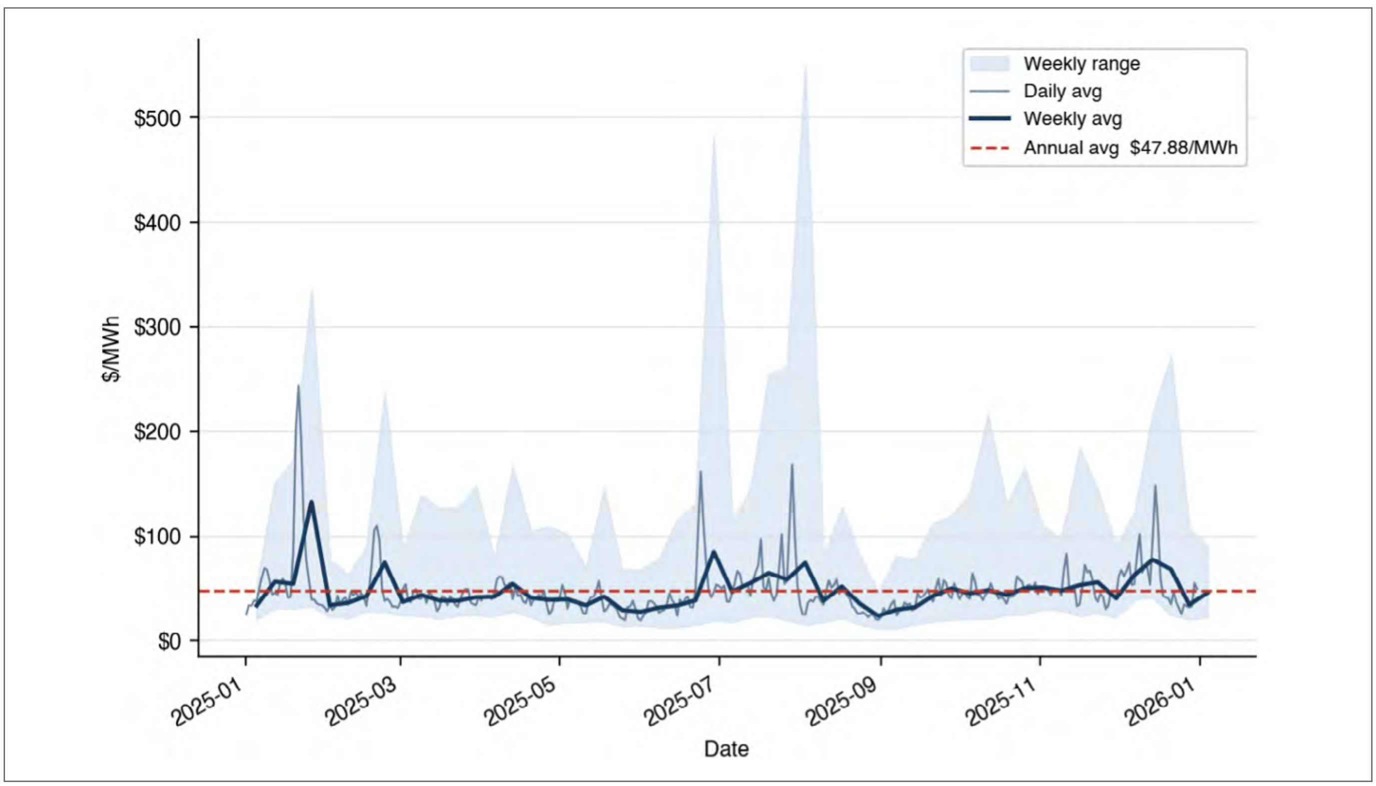

Figure 5. PJM Energy Price Variation (2025)[13]

[11] Catalyst Cooperative, *Nightly SQLite Build*, Public Utility Data Liberation (PUDL), https://catalyst.coop/pudl/ (last visited July 2, 2026).

[12] U.S. Gov't Accountability Office, GAO- 24-106145, Electricity: Information on Peak Demand Power Plants (2024), https://www.gao.gov/products/gao-24-106145.

[13] *Supra 10*.

[14] Monitoring Analytics, LLC, *2024 Annual State of the Market Report for PJM14* (Mar. 13, 2025), https://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2024/2024-som-pjm-press-briefing.pdf.

[15] U.S. Energy Information Administration, *Energy Commodity Prices in 2022 Showed Effects of Russia's Full-Scale Invasion of Ukraine*, Today in Energy (Jan. 3, 2023), https://www.eia.gov/todayinenergy/detail.php?id=55059.

only lowers wholesale prices if it is both genuinely additional and is cheaper than existing marginal prices. New, more expensive generation either doesn't get called upon to run or, when needed for reliability purposes, must be paid "uplift" prices above the market rates and raising consumer costs.

3.2 Price Escalation in the PJM Capacity Market

In addition to the day-ahead market and a real-time spot market where generators bid to supply electricity, PJM operates a forward capacity market called the Reliability Pricing Model (RPM). In this auction, generators and other qualified resources—including demand response providers, storage, and, increasingly, aggregated distributed energy—commit to making capacity available in a future delivery year. Rather than providing energy, the chief concern in this market is ensuring future reliability: that PJM will have enough resources online to meet forecast peak demand plus a planning reserve margin three years out.

Resources that clear the annual Base Residual Auction (BRA) in this market receive a contracted capacity payment in exchange for their availability commitment, with penalties for non-performance. The primary purpose of the RPM is to ensure PJM has sufficient generation, demand response, and storage to meet forecast peak demand plus a reserve margin.

The market is designed to send price signals that attract new entry and to provide the 'missing money' that allows mid-merit and peaking capacity to remain available even when energy revenue alone is inadequate to support that decision.

By design, these capacity auctions should take place three years in advance. This advance time allows the signal to be turned into reality, because electricity generation cannot spring up overnight. However, for a variety of reasons,[16] PJM has not held the auctions a full three years in advance since May of 2018. For example, the results of the auction for the delivery year beginning June 1 of 2026 were posted in July of 2025.[17]

Prices have increased dramatically in recent auctions. While prices for the 2024/2025 capacity auction were lower than average at $28.92 per megawatt-day, the 2025/2026 and 2026/2027 capacity auctions produced dramatic price spikes, with the 2025/2026 RTO clearing price rising to $269.92 per megawatt-day reaching $329.17 for 2026/2027, $333.44 by 2027/2028, and $325 in 2028/2029. (See Figure 6).

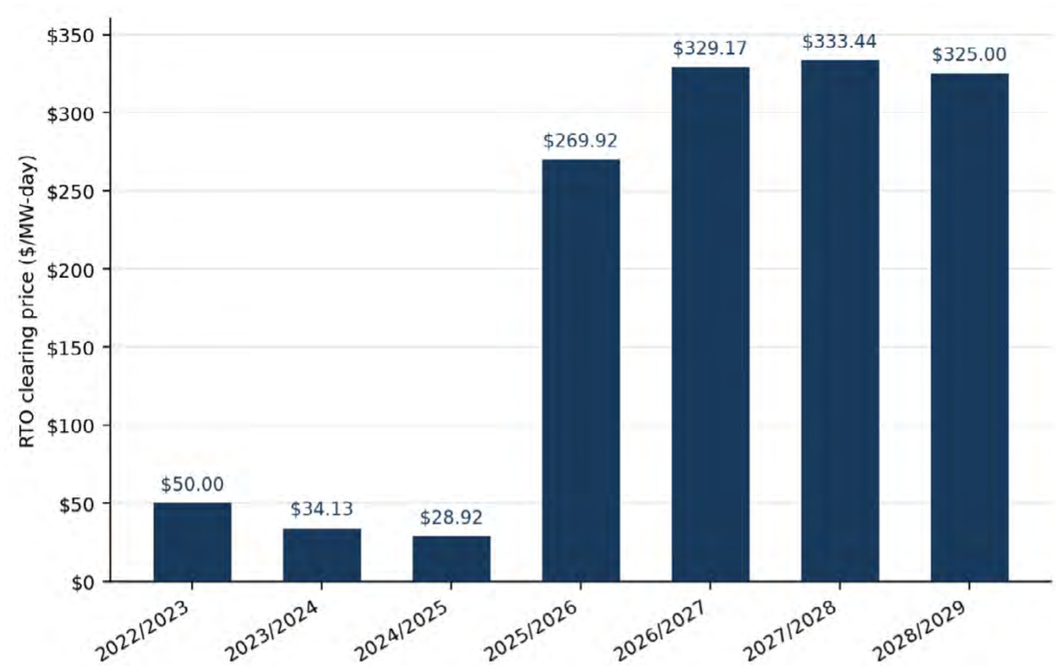

Figure 6. PJM Capacity Clearing Prices

[16] See generally PJM Interconnection, L.L.C., 189 FERC ¶ 61,105 (2024) (granting waiver to delay the 2026/2027 Base Residual Auction and noting that PJM's tariff "reflects delays along with compressed schedules for some capacity auctions.")

[17] PJM Interconnection, LLC, *2027/2028 RPM Base Residual Auction Report* (Dec. 15, 2025), https://www.pjm.com/-/media/DotCom/markets-ops/rpm/rpm-auction-info/2027-2028/2027-2028-bra-report.pdf.

This escalation reflects a combination of factors. On the demand side, data center growth has most recently been identified as being responsible for $6.3 billion in charges or 38% of the 2028/2029 total.[18] On the supply side there have been several factors, described below, including delays associated with PJM's interconnection queue process and changes to their accreditation framework that determines the value of different resources to reliability during stress events.

3.2.1 The Interconnection Queue Problem

PJM's generator interconnection queue had been a significant bottleneck leading up to February of 2022, when PJM stopped accepting applications for new projects and began a queue reform process to clear the enormous backlog. At its peak, this included over 287 GW of potential capacity effectively stuck in limbo across thousands of projects.[19] These delays have stalled new generation which drove up prices, as will be discussed.

By July 2023, PJM began the transition from a first-come, first-served model to a cluster-based first-ready, first-served process. This resulted in the creation of Transition Cycle 1 (TC1) for applications received between April 2018 and October 2020 and Transition Cycle 2 (TC2) for applications received between October 2020 and 2022.

After considerable delays, PJM is showing progress clearing the backlog, but clearing the queue entirely will still take years and the delays have taken a toll. Of 315 new service interconnection projects that entered TC1 representing more than 64 GW of generation—more than 80% of which were solar and wind projects—only 83 projects completed the required study phases including 14.1 GW of generation and 6.8 GW of storage.[20] While 7 GW of the projects are expected to come online in 2026, the rest could take another 1 to 2 years.

For TC2, out of an original 648 projects there are 278 remaining projects representing 29.8 GW of generation and 23 GW of storage. Of these, gas projects lead with 22.2 GW of capacity, but solar and storage projects represent the greatest number of projects.[21]

Also, as of May 2026, PJM reopened the queue to new applications and Cycle 01—the first full cluster under the reformed process—drew 811 new projects capable of generating 220 gigawatts of energy. While storage projects represented the greatest number of applications (349), gas generation represented the most gigawatts (105.8).[22]

While processing times for generation interconnection agreements are now expected to take 1 – 2 years, many projects that have completed TC1 will have seen much longer delays. Thirty-six of these projects have more than a ten-year gap between the initial submission of their application and their in-service date and they must still navigate construction, engineering, and network upgrades before supplying power.

The stalled new generation has increased prices. PJM has framed skyrocketing prices as part of a "credibility trap" where, they argue, the high prices are an economically necessary market signal to potential new generation but that intervention of policy makers in reaction to the high prices, is what resulted in price caps which, they conclude, "undermines the credibility of those same prices" and results in investment capital "stay[ing] on the sidelines."[23]

Some policymakers including Governor Josh Shapiro have framed this issue as a market failure where the public has been forced to pay runaway prices to signal the need for capacity. Meanwhile the persistent issues with the queue—including the multi-year backlog processing applications and the compressed auction timelines leaving potential generation insufficient time to respond to the price signals—leave no pathway to get the new capacity we are paying to "signal".[24]

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[18] Ethan Howland, Data Centers Drove $6.3B in PJM Capacity Auction Costs: Market Monitor, Utility Dive (July 20, 2026), https://www.utilitydive.com/news/pjm-data-centers-capacity-auction-imm-bowring/825626/.

[19] Monitoring Analytics, LLC, 2023 State of the Market Report for PJM § 12, 661, 684 (2024), https://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2023/2023-som- pjm-sec12.pdf.

[20] PJM Interconnection, LLC, *Cycle Service Request Status*, https://www.pjm.com/planning/m/cycle-service-request-status (last visited June 10, 2026).

[21] *Id.*

[22] PJM Inside Lines: "Over 800 New Generation Projects Seek to Connect Under PJM's Reformed Process" (April 29, 2026).

[23] PJM Interconnection, LLC, *supra* note 5, at 6.

[24] *Complaint of Shapiro v. PJM Interconnection, LLC*, Docket No. EL25-46-000 (FERC filed Dec. 30, 2024).

3.2.2 Accreditation Reform

During Winter Storm Elliott, in December of 2022, when extreme cold hit the mid-Atlantic region, 24% of the generation on the PJM grid failed. Gas plants accounted for over 70% of the failures despite representing only 46% of installed capacity in the storm-impacted area. That's not a minor shortfall; gas plants failed at a rate more than 52% higher than their share of the fleet. Frozen equipment, mechanical failures, and fuel supply disruptions knocked gas offline by the gigawatt. Gas production in Pennsylvania's own Marcellus Shale dropped 23%.[25]

Several factors contributed to the failure of natural gas-fired generation during the storm. Broadly these included fuel shortage issues resulting from lack of contracted supply and lack of available pipeline capacity along with a mismatch between gas and electric market cycles leaving many gas generators without the ability to buy fuel.

Compounding the fuel-supply issue, and despite the storm's forecast well in advance, insufficient winterization resulted in additional mechanical failures independent of fuel supply.[26]

While PJM has taken several steps to improve reliability, one key measure has been capacity accreditation reform. While PJM used to assume that nearly all the generation capacity of a gas plant would be available if needed, the current system lowers the Effective Load Carrying Capability (ELCC) of these plants. Under the new methodology adopted for the 2025/26 Base Residual Auction, gas combined-cycle accreditation fell from approximately 95% to 79%, and gas combustion turbines from approximately 89% to 62%. Gas-class accreditation reform alone reduced accredited gas-fired capacity in the 2025/2026 Base Residual Auction by approximately 16,300 MW relative to what the prior methodology would have counted.[27]

[25] PJM Interconnection, LLC, *2023 Winter Storm Elliott Event Analysis and Recommendation Report* (July 17, 2023), https://www.pjm.com/-/media/DotCom/library/reports-notices/special-reports/2023/20230717-winter-storm-elliott-event-analysis-and-recommendation-report.pdf.

[26] *Id.*

[27] Energy Ventures Analysis, *Results and Likely Impacts of PJM's 2025/26 Base Residual Auction* 10 (Aug. 2024), https://americaspower.org/wp-content/uploads/2024/08/EVA-Report-on-PJM-2025-26-BRA-Results-Final.pdf.

4 FROM BRING YOUR OWN GENERATION TO BRING YOUR OWN NEW CLEAN ENERGY

The rapid growth of large loads, particularly data centers, is straining PJM's ability to maintain grid reliability. Interconnection queues, transmission capacity constraints, and generation supply chain bottlenecks have created a widening gap between new load coming online and the generation needed to serve it. One emerging policy response is "bring your own generation" (BYOG), a framework under which large new loads will be encouraged, or possibly required, to secure dedicated generation capacity as a precondition to grid interconnection. PJM's Independent Market Monitor has advocated for making such a capacity commitment an express precondition for large load interconnection,[28] and Pennsylvania Governor Shapiro's GRID energy plan similarly conditions tax credits and fast track permits for large load development on demonstrated generation adequacy.[29] However, BYOG is not a single policy but a family of approaches with varying objectives. In practice BYOG may be implemented to benefit data centers without reducing, or even avoiding, an increase in consumer electricity costs. Conflating these different goals has led to a muddled policy discussion, and a significant amount of confusion. Each of these will be discussed individually below.

4.1 Emergency Backup Generation

Across all data centers, one in five report that their most recent outage cost more than $1 million, but with hyperscale data centers those costs could easily climb far higher.[30] Being available even 99 percent of the time is insufficient—such a data center would still be likely to experience 3.65 days of downtime per year, costing potentially hundreds of millions of dollars if not billions in lost revenue, contractual penalties, and reputational damage for the owners. Not surprisingly, data centers prioritize fault tolerance and redundancy targeting uptimes at the "five nines" (99.999%) level or better to reduce average downtime to minutes or seconds per year. With power failures being the leading cause of downtime, backup generation is essential and, of the various options available, diesel engines have historically been the dominant choice—their deployment has nearly tripled between 2018 and 2024.[31]

While relatively expensive to run compared to other generating technologies, diesel generators are designed to start rapidly (10 – 15 seconds from cold start to full load), they are easily obtained, very reliable if properly maintained, and can have multiple days' worth of fuel stored on site insulating the data center from logistical issues.

Of the diesel engines available, data centers often have a choice between those certified as Tier 2 or Tier 4 engines. Tier 2 engines are significantly cheaper with 30 to 50 percent lower capital costs, as well as significantly lower operation and maintenance costs. While less expensive, they are restricted in how they are used. Such engines are generally limited to 100 hours per year for maintenance and testing. Other non-emergency operation such as demand response is limited to 50 hours per year, which count towards the 100-hour limit. Critically, these generators "cannot be used for peak shaving or non-emergency demand response, or to generate income for a facility"[32] so they cannot be dispatched to run whenever grid prices make it economical to do so.[33]

[28] *Independent Market Monitor for PJM*, Monitoring Analytics, LLC, https://www.monitoringanalytics.com/home/index.shtml (last visited July 13, 2026); see also Monitoring Analytics, LLC supra note 13.

[29] H.B. 2650, 210th Gen. Assemb., Reg. Sess. (Pa. 2026).

[30] Uptime Inst., *Annual Outage Analysis 2025* (May 2025), https://uptimeinstitute.com/resources/research-and-reports/annual-outage-analysis-2025.

[31] Catherine Casomar & John Bangsund, Diesel Generators at Data Centers: Status, Impacts, and Protective Practices, Better Data Center Project, at 3 (v.1, Mar. 2026).

[32] 40 CF.R. § 60.4122(f)(3).

[33] 40 C.F.R. § 63.6640(f).

Tier 4 generators emit significantly less pollution than Tier 2 and, while they can be used for emergency backup generation, they are not restricted to emergency use. If a data center seeks to permit its engines for non-emergency operation, they may be eligible for other revenue streams including energy sales and other grid services that, over the operating life of the engine, may offset all or part of the added cost.

From the perspective of consumer electric rates, actual emergency backup generation (regardless of Tier) has no material effect on prices. These engines are not registered as resources in the PJM capacity market, so they don't impact the supply of accredited capacity. Their effect on wholesale energy prices is similarly limited as they are subject to a 100-hour annual cap on non-emergency operation.

However, diesel combustion produces the highest CO_2 per kilowatt-hour of any commonly deployed generation technology, as much as twice the CO2 as the U.S. grid on average,[34] as well as emitting particulate matter, ozone precursors, and other pollutants, all of which impose local air quality costs on surrounding communities. With dozens, if not hundreds, of diesel generators potentially being installed, even short events can result in significant pollution.

While it is possible for facilities to accept additional permit limitations on diesel generators to avoid being classified as major sources under the Clean Air Act,[35] those limits are not always enforceable. There has been an increased use of Federal Power Act §202(c) orders that allow generating sources to exceed permit limitations whenever the Department of Energy determines that an emergency exists. This power has, historically, been rarely used with only 16 events—mostly weather related—between 2000 and May 2025.[36] Following an Executive Order 14262 on April 8, 2025, there has been a significant increase with 45 such orders having been issued so far in 2026.[37]

From an environmental perspective, requiring any diesel generation at data centers to meet Tier 4 standards is a reasonable minimum standard. This creates a concern that such generation could be permitted to operate more than 100 hours per year and result in a net increase in air pollution. How often that would happen in practice depends on the specific situation and the permit conditions adopted, but because the marginal cost of running large diesel engines is in the range of $240/MWh[38] and, based on PJM's 2025 data, that is unlikely to be less expensive than purchasing power from the grid more than 100 hours per year,[39] it seems unlikely we would see such excess generation for purely economic reasons.

Ideally, the better choice is to replace the diesel generation with battery energy storage systems (BESS). That would provide faster and more reliable backup power with no local emissions and, particularly when paired with clean energy sources, a net reduction in total emissions.

While capital costs with battery storage are generally higher than diesel, such systems are becoming more affordable and offer some key economic advantages. Where diesel generation may end up an expensive insurance policy on company balance sheets that sits nearly idle all year, BESS has the ability to create additional revenue streams by participating in wholesale market arbitrage, frequency regulation, and other markets.[40] The key design factor with battery storage is to ensure its operational duration is sufficient to cover most reliability events.

The primary challenge with BESS over diesel generation is the limited duration a system is available. While diesel installations may store several days' worth of fuel on site and run indefinitely if fuel can be delivered, most commercially available BESS systems are sized for two to eight hours of discharge. That mismatch matters less than it first appears, however, because most grid outages are resolved within hours, not days; multi-day events are a long-tail risk, not a typical case. A storage-first approach that sizes BESS to cover most short-duration events provides the added reliability, revenue, and emissions benefits. Data centers can then decide if the added redundancy of largely idle Tier 4 generation is worth the cost.

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34 *Supra 28.*

35 *See* e.g., Pennsylvania Department of Environmental Protection, Notice of Receipt of Plan Approval Application, Amazon Data Services, Inc. (PNE 100), Permit No. 09-0261A, 56 Pa. Bull. 2290 (Apr. 25, 2026), https://www.pacodeandbulletin.gov/secure/pabulletin/data/vol56/56-17/56-17.pdf.

36 Cong. Rsch. Serv., IF12991, *Federal Power Act: The Department of Energy's Emergency Authority* (May 8, 2025), https://www.congress.gov/crs_external_products/IF/PDF/IF12991/IF12991.1.pdf.

37 U.S. Dep't of Energy, *2026 DOE 202(c) Orders*, Energy.gov, https://www.energy.gov/ceser/2026-doe-202c-orders (last updated July 15, 2026).

38 U.S. Energy Info. Admin., *Annual Energy Outlook 2022, Cost and Performance Characteristics of New Generating Technologies* 2 tbl.1, https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf.

39 *Supra* note 7.

40 Lazard, *Levelized Cost of Energy+ (2026)*, https://www.lazard.com/research-insights/levelized-cost-of-energyplus-lcoeplus/.

4.2 Front of the Meter Generation

The primary power source for most new data centers is likely to be the traditional utility-scale resources that participate in PJM's wholesale electricity markets as independent market participants.[41] These front of the meter (FTM) generators supply electricity into the broader grid and are dispatched according to market conditions, system needs, and operational constraints established under PJM's Open Access Transmission Tariff (OATT).[42]

FTM generation participates fully in PJM's market structures and potentially receives compensation through multiple revenue streams, including energy sales, capacity payments under the Reliability Pricing Model (RPM), and ancillary service markets[43] reflecting its contribution to reliability and resource adequacy.

For a data center project to "bring" this generation, the most common model is through a power purchase agreement (PPA). These are contractual arrangements between a generator and an off taker like a large data center. The most notable recent example is Microsoft signing an agreement with Constellation Energy to purchase energy from the planned restart of the Three Mile Island Unit 1 nuclear reactor (renamed as the Crane Clean Energy Center).[44]

Typically, PPAs are a financial arrangement running in parallel with PJM's markets, structured as a contract-for-differences. The generator still participates in PJM's energy markets and is dispatched according to the same rules as any other resource, earning the market price for its output. Separately, the generator and the buyer settle the difference between that market price and an agreed upon PPA price: if the market price is below the contracted price, the buyer pays the generator the shortfall; if the market price is above the contracted price, the generator pays the buyer the excess. The result is that the buyer's price for energy and the generator's revenue is effectively decoupled from market volatility.

How PPAs impact other consumers depends on several factors. Most importantly is whether they result in new additional generation on the grid that was not in use prior to the PPA or if they are effectively diverting energy from existing resources to a new load. This requirement for a net increase in generation, known as "additionality," is key.

Assuming, as in the case of the Crane Clean Energy Center, that this is new generation,[45] the next question is where it clears in PJM's dispatch order. New generation creates downward pressure on wholesale prices to the extent that it displaces more expensive generation at the margin. Because nuclear, like solar and wind generation, has near-zero marginal cost, it has the potential to displace higher priced (mostly gas) generation. Whether that displacement occurs, however, will also depend on the extent to which the new generation is offset by new demand. If demand grows faster than the new generation, wholesale prices are still likely to rise.

Similarly to the energy market, the impact of PPAs on the capacity market depends on whether the underlying generation is bid into PJM's competitive capacity auction or used to self-supply the buyer's own capacity obligation. If the generation is bid into the market and clears, it adds to the pool of resources available and will exert a downward pressure on capacity prices in general. But many large PPAs, including the Crane Clean Energy Center deal, convey capacity along with energy directly to the buyer, allowing that buyer to self-supply its own capacity obligation rather than procure it through the auction. In that case, the capacity never enters the competitive pool, and other consumers see none of the clearing-price benefit. This insulates the buyer from capacity market prices without relieving the pressure on anyone else. With PJM's sharply rising capacity prices this may determine whether a given PPA helps or is neutral to other ratepayers. PJM and FERC could close this gap by requiring that capacity conveyed under a large-load PPA clear the competitive capacity auction rather than being self-supplied.

Beyond energy and capacity revenues, PPA generation also creates cost-shifting risks associated with the use of transmission facilities. Transmission network upgrade costs

[41] PJM Interconnection, LLC, Open Access Transmission Tariff (OATT), (defining generator interconnection and market participation requirements); see also PJM Interconnection, LLC, *Manual 14D: Generator Operational Requirements*.

[42] *Id.*; 18 C.F.R. § 35.28 (pro forma OATT requirements for non-discriminatory open access).

[43] PJM Interconnection, LLC., OATT atach.DD (Reliability Pricing Model); PJM Interconnection, LLC, *Manual 18: PJM Capacity Market*. Capacity resources interconnected as front-of-the-meter (FTM) generation must satisfy applicable Capacity Performance obligations. See Settlement Intervals and Shortage Pricing in Markets Operated by Regional Transmission Organizations and Independent System Operators, Order No. 825, 155 FERC ¶ 61,029 (2016) (establishing Capacity Performance).

[44] Brian Martucci, *Constellation Plans 2028 Restart of Three Mile Island Unit 1*, Spurred by Microsoft PPA, Utility Dive (Sept. 20, 2024), https://www.utilitydive.com/news/constellation-three-mile-island-nuclear-power-plant-microsoft-data-center-ppa/727652/.

[45] While Three Mile Island was an existing plant, it ceased operation in September of 2019 and has not been counted on to provide any capacity.

triggered by generator interconnection are initially assigned to the interconnecting generator (the generator pays), while upgrade costs triggered by new load interconnection are assigned to the load (the new load pays). Upgrades needed for the reliability of the broader system, rather than any single interconnection, are treated as system-caused and socialized across the transmission zone or RTO (the ratepayers pay). The degree to which costs stay with the data center, however, depends critically on how PJM classifies a given upgrade among these three categories, a classification FERC is actively revisiting for large-load interconnections.[46]

Even if costs are initially assigned to the generator, there is a potential for cost shifting if that generator withdraws from the queue before the upgrade is paid for. When that happens, the cost is reallocated to remaining projects, which may cause those projects to withdraw or, where no remaining project can absorb a sunk cost, may ultimately be paid by ratepayers.[47]

Taken together, these dynamics suggest that PPAs are not inherently good or bad for other ratepayers. Rather, the outcome hinges on a small number of structural choices that policymakers can directly influence:

First, regulators should distinguish between PPAs backed by genuinely new generation and those that simply reassign existing generation to a new load, since only the former has the potential to offset the price pressure that new data center demand itself creates.

Second, and most consequentially given today's tight reserve margins, PJM should scrutinize the practice of conveying capacity directly to a PPA buyer for self-supply rather than requiring it to clear the competitive auction.

Third, cost-causation rules for transmission upgrades need to keep pace with the scale and pace of PPA-backed generation, so that interconnection costs are borne by the parties that trigger them rather than socialized onto other queue participants.

Finally, regulators should actively encourage not just new generation but new clean and zero-carbon generation. While restarting the Three Mile Island reactor is an isolated case, Pennsylvania has a significant capacity to expand solar and wind generation which, without the need for fuel, operates at near zero marginal cost.

Absent attention to these levers, PPA-backed generation risks becoming a mechanism by which large buyers secure price and reliability certainty for themselves while leaving the underlying market tighter, and more expensive, and more polluting for everyone else.

4.3 Behind the Meter and Hybrid Generation

An alternative to bringing generation onto PJM's grid is to avoid the grid almost entirely by siting a generator immediately adjacent to a data center and connecting the two directly, so that the load draws power without ever crossing PJM's transmission system. In these "behind the meter" (BTM) or "co-located" arrangements, the point of interconnection with PJM's grid sits upstream of both the generator and the load, rather than the generator injecting into, and the load separately withdrawing from, the broader wholesale system.

As with PPAs, the impact of a co-located arrangement on other consumers depends critically on whether the co-located generator is existing capacity redirected to serve a new load, or new additional capacity. Again, additionality is key.

4.3.1 Diverting Existing Generation to New Co-located Loads

An existing generator may retain its interconnection to the PJM grid as a new direct connection is built to serve the co-located load out of the plant's existing output. In such a case, the generator may continue to participate in PJM's markets with whatever output isn't consumed on site. This arrangement subtracts from the energy and capacity available to the rest of the system while adding a large new load. Because it fails to provide additionality to offset the load, this should not be considered "bring your own generation" of any sort.

The most notable recent case where this was attempted was Talen Energy's plan to supply power directly to an Amazon Web Services (AWS) data center campus co-located at

[46] Fed. Energy Reg. Comm'n, *FERC to Act on Large Load Interconnection Docket by June 2026*, (Apr. 16, 2026) (Docket No. RM26-4-000) (announcing the Commission will act in this docket by the end of June 2026), https://www.ferc.gov/news-events/news/ferc-act-large-load-interconnection-docket-june-2026.

[47] Lawrence Berkeley Nat'l Lab., *Interconnection Cost Analysis in the PJM Territory* (2023), https://eta-publications.lbl.gov/sites/default/files/berkeley_lab_2023.1.12-_pjm_interconnection_costs.pdf.

Talen's existing Susquehanna nuclear plant in Pennsylvania. In 2024, PJM's attempt to amend Talen's interconnection service agreement (ISA) to accommodate the arrangement drew protests from transmission owners and other generators and became the subject of a contested FERC proceeding and was eventually rejected by FERC.[48] Among the concerns FERC noted were claims that this arrangement would shift transmission-related costs to other ratepayers.[49]

FERC's cost-shifting issues were avoided in this case by restructuring the arrangement as a PPA where power from the generator flows to the PJM grid and the data center campus is treated like any other grid-connected load. In addition, FERC ordered PJM to develop new rules for co-located loads, compliance with which by PJM is ongoing. Even though FERC's concerns were addressed, the lack of additionality will continue to create upward pressure on wholesale prices.

From an environmental perspective there are two additional concerns with this sort of co-location. First, if polluting generation is used and the new load causes it to operate at higher capacity factors, there may be an increase in local emissions over and above what existed before. Second, even in the Talen/AWS case where the nuclear generation doesn't directly emit air pollution, there will likely be a net increase in pollution across the region as dirtier resources are called upon to backfill the generation that formerly was used by the grid.

The key point here is that a review of cost allocation alone, even if it is purported to be fair, may not address the broader cost and environmental impacts.

4.3.2 Building New Generation for New Co-located Loads

Building new generation on site to serve the new load and avoiding diverting capacity from the grid provides additionality. That is a necessary element for any reasonable BYOG policy, but it alone is not sufficient.

If the project has no interconnection to PJM's grid at all, it has no effect on other ratepayers' supply-demand balance one way or the other—it neither adds supply nor adds load from the system's perspective. But that also means it provides none of the reliability benefit that the same plant would have provided had it interconnected, and if it relies on polluting generation, it still carries the emissions and local siting consequences.

While true "islanding" such as this exists, projects tend to be very rare and are driven by external factors rather than the preference of the project owners. Even then, such arrangements may be temporary until interconnection issues can be resolved.

The much more common scenario uses hybrid systems that are fully interconnected to the grid but have the capability to self-supply.

Most of the new generation being proposed for this purpose are natural gas combustion turbines (CTs). This is often the technology of choice for these arrangements because they can be manufactured and installed faster than natural gas combined cycle (NGCC) plants, start and ramp quickly enough to be dispatched opportunistically, can be added in modular increments as load grows, have much lower fuel costs than diesel engines, are not limited to use as backup generation and, perhaps most importantly for data centers, can operate reliably for long periods of time.

Still, because they have materially higher marginal costs than PJM's average price in most hours, a grid-connected CT will only be economic when the wholesale price exceeds its own marginal cost. In practice, that varies widely from plants that run a few days per year to plants that may run more than 30% of the available hours.[50] When grid prices are lower, it makes sense for the on-site CT to sit idle and have the data center buy power from the grid like any other large customer.

The practical effect is that the hybrid arrangement behaves less like a new generating resource and more like a price-triggered switch. It genuinely peak-shaves the load's draw during the highest-priced hours, which can meaningfully reduce this load's contribution to system peak and lower costs. But for the hours when running the CT isn't cost-effective, the arrangement is indistinguishable from ordinary new load growth. It draws on the grid and adds to

[48] *PJM Interconnection, L.L.C. and Susquehanna Nuclear, LLC*, FERC Docket No. ER24-2172 (amended Interconnection Service Agreement for co-located load at the Susquehanna Steam Electric Station),

[49] Sona Patel, *FERC Blocks PJM Proposal to Expand Amazon Data Center Load at Susquehanna Nuclear Plant*, POWER Mag. (Nov. 2, 2024), https://www.powermag.com/ferc-blocks-pjm-proposal-to-expand-amazon-data-center-load-at-susquehanna-nuclear-plant/.

[50] *Supra* note 10.

demand, putting the same general upward pressure on wholesale prices that any large new grid-connected load does. Because this balance depends on project-specific conditions and the state of the market, a data center installing its own CT generation may not create any downward pressure on consumer energy prices.

From the perspective of the data center owner, other concerns may take priority over minimizing marginal costs. In addition to potentially enabling faster interconnection and operation, installing CT generation provides a hedge against price spikes, cost savings from reducing peak demand, some degree of redundancy, and the potential for additional revenue by providing ancillary services to the grid.

As in the energy market, it's unclear whether other consumers will see any savings from such co-located generation in the capacity market. PJM's current rules let large co-located loads offset most of their demand for billing purposes using on-site generation, even while still relying on the grid for backup power. FERC ruled in December 2025 that this creates a hidden reliability risk borne by other customers and ordered PJM to set a new limit on how much load can be offset this way. That limit, which will determine whether other ratepayers see any benefit from a data center's peak-shaving or whether it stays entirely private to the data center, has not yet been settled.[51]

[51] Ethan Howland, *FERC Orders PJM to Craft Large Load Colocation Rules*, Utility Dive (Dec. 19, 2025), https://www.utilitydive.com/news/ferc-pjm-colocation-data-center/808368/.

5 CONCLUSION

Absent passage of a moratorium bill or some related policy, it is unlikely that data center growth in Pennsylvania is going to wait for generation available to PJM to catch up, and "bring your own generation" has emerged as the default policy response to that mismatch.

As has been discussed, BYOG is not a single policy, but a label applied to arrangements that range from genuinely additive new clean generation to diesel backup that never touches the grid to gas peakers that function, in practice, as an ordinary new load with a price-triggered switch attached. Evaluated against the three questions set out at the start—does it lower or raise costs for other ratepayers, does it strengthen genuine reliability or shift risk elsewhere, and does it reduce pollution or lock in new fossil infrastructure—these pathways do not perform equally.

Emergency backup diesel has little effect on wholesale prices or capacity markets, but its local air quality impact is real and largely avoidable. Insisting on Tier 4 standards at a minimum or, better still, battery storage systems should be the norm rather than the exception. Front-of-the-meter PPAs can put real downward pressure on energy prices when they are backed by genuinely new, low-marginal-cost generation like solar or wind or nuclear. Such new generation can also lower capacity prices, but only if the new capacity clears PJM's auction rather than being conveyed directly to the buyer for self-supply. Behind-the-meter and hybrid arrangements are the most ambiguous: diverting an existing plant's output to a co-located load provides no additionality at all, and even genuinely new on-site gas capacity behaves like ordinary load growth in every hour it isn't economic to run. In none of these cases can we simply assume that a data center bringing its own generation results in lower costs, stronger reliability, or less pollution for everyone else. Each depends on structural choices that policymakers can influence.

That is why PennFuture recommends policymakers move past BYOG as currently framed and adopt Bring Your Own New Clean Energy (BYONCE) as the standard: large new loads should be expected to demonstrate that they add meaningful, low-cost clean supply to the grid, that the financial burden of their connection aligns with what actually caused the cost, and that their arrangements do not lock in new polluting fossil infrastructure. Specifically:

- To lower consumer prices, policy must focus on lowering the underlying cost of energy—not simply on getting more generation built at any price.
- Regulators should advance plans to use battery storage to replace diesel backup generation, both for its reliability and its emissions profile.
- Where data centers do rely on diesel backup, that generation should be required to meet Tier 4 standards.
- Any form of BYOG must be held to a genuine additionality standard before it counts toward a load's generation obligation.
- Policymakers and PJM should not assume that adding gas combustion turbines lowers costs for other ratepayers; the evidence suggests the opposite is just as likely.

Absent this kind of scrutiny, "bring your own generation" risks becoming a policy that sounds like it solves the affordability and reliability crisis while letting the largest new loads on the system buy their way out of it leaving the underlying market tighter, more expensive, and more polluting for everyone else.