Pennsylvania Public Utility Commission
Docket Number M-2025-30554271

Re: Data Center Surge and Impact on Pennsylvania's Power Grid: Testimony of Three Mile Island Alert

"Data Centers and Nuclear Power on the Susquehanna River: More Questions than Answers."

Revised: Overnight Mail: May 15, 2025.

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Pennsylvania Public Utility Commission
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Data centers – unlike residential and business customers — require a consistent and steady supply of electricity 24 hours a day, seven days a week. There are a number of issues that have not been addressed or fully flushed out; and, there are also several questions of paramount importance relating to AI and nuclear power.

• What is the priority: Computers or humans?

• Do the needs of Big Tech outweigh public benefit?

• Will the data center be co-located or in-front of the meter?

• How will the consumption of a large quantity of water for data centers and nuclear plants which operate 24/7 impact water supplies for farms, families, and small businesses?

• At what point — if any – does the public have an opportunity to be part of the process and establish priorities?

Nuclear Power on the Susquehanna River.

Pennsylvania has the second highest concentration of nuclear power plants in the nation. The flee consists four plants and 8 generating stations which generate 32% of Pennsylvnia's power or 40,966 MW during the summer peak period.

Nuclear plants are the most reliable form of baseload energy; but, do not operate at 100% all of the time. Power oscillates based on equipment changeout and technical challenges. Nuclear plants are shut down every two years from 30 to 45 days for refueling. This raises the questions of

where do Amazon and Microsoft get their energy when nuclear plants are down, how much will they be paying, and will the sudden consumption spike distort the market?

Pennsylvania is a deregulated state, and neither data centers nor nuclear plants are subject to the Public Utility Reality Tax ("PURTA"). The Susquehanna Steam Electric Station ("SSES") and Three Mile Island Unit-1 ("TMI-1") are operating as merchant generators with bilateral Power Purchase agreements with a single customer. These plants are subject to local taxation, and can
produce a windfall for local and state governments. The valuation of merchant generation property for tax purposes is based on cost, income, or comparable sales. The valuation using the income method could result in high assessed values for data centers and nuclear plants. Therefore, this protocol could replenish and exceed the loss of tax revenue under PURTA.

There are three nuclear power plants on the Susquehanna River. The Peach Bottom Atomic Power Station and the Susquehanna Steam Electric Station are boiling water reactors designed by General Electric. Both have license extensions of between 20 to 40 years and are fully uprated.

The Peach Bottom Atomic Power Station's initial construction cost of $2.943 billion (in 2007 dollars.) It is the only nuclear plant on the Susquehanna River not married to a data center. Peach Bottom is owned by Constellation Energy and Public Service Enterprise Group. Both entities own 50% of Peach Bottom and Constellation is the site operator.

Peach Bottom is a two-unit nuclear generating facility. (1) Peach Bottom 2 and 3 have a combined capacity of 2,600 megawatts, and both came on line in 1974. The Peach Bottom plant has a 76.90% lifetime operating capacity, although in 2023 the plant operated at a 95.7% capacity factor. (2)

The Susquehanna Steam Electric Station ("SSES") is located in Luzerne County; and, the total cost in 2007 dollars was $7.983 billion. The area includes the anthracite coal region. PPL operated the plant until June, 2015 when Talen Energy was spun off from PPL's competitive supply business. Talen entered bankruptcy in 2022, and emerged from it in 2024.

1 Peach Bottom-1 was a helium-cooled, graphite moderated 70 MW reactor that operated from 1967 -1974. The plant was part of the Atoms for Peace Program. Rate payers continue to or a clean-up that never happened. Constellation is asking for a decommissioning extension that would allow Peach Bottom-1 to be placed in SAFSTOR for 8o years.

2 Peach Bottom Unit 2 began the inspection period at rated thermal power (“RTP”). On March 14, 2025, the unit was down powered to 64 percent for a control rod sequence exchange and main turbine valve testing and returned to RTP on March 16, 2025. The unit remained at or near RTP for the remainder of the inspection period. Unit 3 began the inspection period at RTP. On March 22, 2025, the unit was down powered to 30 percent to repair the '3B' recirculation pump adjustable speed drive and performed a rod pattern adjustment and main turbine valve testing and returned to RTP the following day. The unit remained at or near RTP for the remainder of the inspection period. Nuclear Regulatory Commission, March 31, 2025.)

Talen Energy owns 90% of Susquehanna Electric Steam Station and is the site operator. Although construction began in 1973, the plants came on line in 1983 and 1985. The Allegheny Cooperative owns the remaining 10% of the nuclear station. The SSES has a capacity of 2,476 megawatts, and has a lifetime. (3)

capacity of 73.25%, but operated above the industry average at 96.5% in 2017.

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3 The Susquehanna Steam Electric Station Unit 1 began the inspection period at rated thermal power. On March 6, 2025, the unit down powered to 85 percent for scram time testing. On March 7, 2025, the unit down powered to 60mpercent for a rod sequence exchange and returned to rated thermal power on March 9, 2025. The unit remained at or near rated thermal power for the remainder of the inspection period. (Footnote continued on the next page.)

Unit 2 began the inspection period at rated thermal power. On January 9, 2025, the unit was down powered to 78 percent for a rod pattern adjustment and returned to rated thermal power on January 10, 2025. On January 16, 2025, the unit was down powered to 77 percent for a rod pattern adjustment and returned to rated
power on January 17, 2025. (Footnote continued on the next page.)

Talen Energy reported the refueling was extended at Susquehanna Unit 2 to perform incremental maintenance that is expected to improve capacity performance and efficiency. (Talen Energy, May 8, 2025.)

Three Mile Island Unit-1 (“TMI-1”) is an 835 MW pressurized water reactor designed by Babcock and Wilcox. The initial construction cost for TMI-1 was $400 million or $2.55 billion in 2018 dollars. The plant has experienced several ownership changes, was shut down from 1979 to 1985, operated from 1985 to 2019, and was shut down again in 2019 after failing to compete in the marketplace. TMI-1 has a lifetime capacity of 73.25%, but operated above the industry average at 96.5% in 2017.

Nuclear power plants on the Susquehanna River and across the country are operating beyond their design limits, but the capacity factors have continued to climb. The national capacity factor for nuclear power according was 90.96%. (Nuclear Energy Institute from 2022-2024.)

Nuclear plants will continue to be uprated and retired plants are cheaper to re-start. The same vexing challenges continue to inhibit nuclear development. “Nuclear power’s long-term role in the U.S. electricity generation mix depends on still-unresolved questions about plant economics, technology selection, federal policy and financial support, fuel availability, waste disposal and public attitudes, analysts for strategic consultancy ICF said.(”(Dino Vivanco is a Senior

Energy Markets Consultant at ICF International published in "Utility Drive," on March 27, 2025.)

Can nuclear power overcome its dependence on foreign fuel, and can nuclear power survive without substantial subsidies from the federal government? If nuclear power is "green," how long can we pretend that nuclear waste is not a problem?

Is Natural Gas the Answer?

The growth in power demand driven by the rise of artificial intelligence and cloud computing is currently being met by dispatchable fuel, i.e., coal, gas, and nuclear power. Pennsylvania is resource rich. Energy and water capacity exceed demand, but are also exported. Pennsylvania is expected to ramp up capacity to shoulder the energy and water needs of data centers.

The Marcllus Shale boom led people to believe gas was the answer. Pennsylvania produces a significant amount of natural gas, ranking second in the nation after Texas, and in 2023 Pennsylvania's natural production reached almost 7.6 trillion cubic feet. In 2024 Pennsylvania exported an estimated 87 million megawatt-hours of electricity; thus, this

makes the Commonwealth the largest net exporter of electricity in the nation.

The Pennsylvania-Jersey-Maryland interconnection ("PJM") base its capacity supply on assumptions about the reliability of certain types of resources. Prior to the most recent auction, PJM considered gas plants to be highly reliable. In the wake of winter storm Elliot (Christmas, 2022) when PJM experienced significant unplanned outages, it became clear that gas plants are not as reliable in extreme weather as previously assumed. PJM reported 63% outages during the storm were from gas plants.

A group of electric and gas utilities asked the Federal Energy Regulatory Commission to launch an inquiry to improve gas pipeline reliability. "Increased demand and extreme weather in the last decade have stressed the interstate gas transportation and storage system and reduced pipeline companies' operational flexibility," according to a filing at FERC by four National Grid utilities. ("Utility Drive," April 28, 2025.)

Marcellus Shale production peaked prior to the data center gold rush. Using data from the federal Energy Information Administration, the Ohio River Valley Institute concluded that the natural gas industry in the Marcellus and Utica shale region hit peak production in 2022, levels that

won't be equaled again for decades. If gas has peaked, and renewables contributed only 3%
of the energy needs of Pennsylvania, many believe coal and nuclear are on deck.

King Coal Is Dead. Long Live the King.

The Pennsylvania-Jersey-Maryland ("PJM") operates the electric transmission system or "grid" for all or part of 13 states and the District of Columbia. PJM is the independent system operator ("ISO") and regional transmission organization ("RTO"). PJM relies on diverse energy sources, and its members have pivoted to coal and nuclear energy to meet the anticipated increase in demand.

PJM has excess capacity; the grid's current reserve capacity is 18.6% up from 17.8%, and expected to increase by 2.2%. Gas peaked in 2022, but will reemerge. PJM has over 202 gigawatts of renewable energy resources waiting to come on-line. Fewer than 20% of the renewable projects will ever generate electricity; only 3% of electricity used in Pennsylvania come from renewables. Data center developers claim the pace of clean energy deployments is moving too slowly to keep up with data center demand.

The Mineral Basin Solar Project in Clearfield County, Pennsylvania will cover 2,000 acres, and becomes operational in 2026.This solar farm will reclaim a former coal site, and produce 4o2 megawatts at a cost $800 million.

More often former coal sites are converted to gas. For example, in Homer City, a former coal generator will be converted to gas, cover 3,200 acres, and generate 4.5 gigawatts (One gigawatt is one thousand megawatts). The cost is ten billion and the plant is scheduled to open in 2027. The energy will go to data centers and not feed the grid.

Microsoft reportedly entered into an agreement where they would buy all the electricity the 835-megawatt TMI Unit-1 would generate over 20 years. That energy is for one client with locations in the Midwest and Virginia. This plant will not create additional baseload.

Together these proposed projects represent 5,737 megawatts of power; but what's the back-up plan if Homer City, Mineral Basin, and Three Mile Island are delayed or don't come on-line?

More extensions for retiring coal plants, and expansions as well for operating mines are being planned. A 1,400-acre expansion to a 2,800-acre underground coal mine beneath the Pennsylvania Turnpike in Westmoreland County has been approved by the Department of Environmental Protection. LCT Energy LP operates the 2,800-acre Rustic Ridge #1 plant which produces 500,000 tons of coal a year used in steelmaking.

Three Mile Island's neighbor, Brunner Island, has three units with dual fuel switching capabilities allowing it to operate using coal or natural gas. The plant opened in 1961, and the combined capacity of the three units is 1,546 megawatts. Brunner Island is twice the size of TMI-1, and is set to cease burning coal by the end of 2028. The plant withdraws from the Susquehanna and later discharges up to 795 million gallons of once-through condenser cooling water each day. (Lower Susquehanna Riverkeeper.)

What if a data center and Brunner cut a deal? It is unlikely PJM would oppose a coal and gas-powered data center.

PJM is backing a $5.2 billion plan for new transmission lines across several states to bring power to Virginia. These lines would carry electricity produced at several coal-fired power plants in West Virginia that had been slated for closure: Fort Martin, Harrison, and Longview. West Virgina is the second largest producer of coal in the nation followed by Pennsylvania.

Maryland generates 55% of its electricity from coal. PJM has asked Talen Energy to keep Brandon Shores and Herbert A. Wagner - two other coal-fired facilities located near Baltimore - online at least through 2028. The plants had been scheduled to close by June, 2025.

Data centers are not incentivized to conserve energy or invest in energy efficiency programs. They cannot participate

in load shifting or rolling brown outs because they needed to be open 24/7. Taken together, coal and nuclear extensions may mark the demise of conservation and energy efficient programs like Act 129 in Pennsylvania.

Act 129 directs the Pennsylvania Public Commission to allow for cost recovery, and also implement conservation measures, default service procurement, real-time pricing, renewable energy sources, smart meter technology, time-of-use rates, plans, and cost recovery.

Legislation was recently introduced by Representative Kyle Donahue (HB 505) to amend "Pennsylvania's existing energy efficiency and conservation program to enhance electric utility requirements for reducing energy consumption and improving grid resilience." This program does not include data centers.

Water: Too Cheap to Meter?

Data centers married to nuclear plants are a water consumption juggernaut. The average data center uses one million to five million gallons of water per day, equivalent to the daily water use of a town with a population of 10,000 to 50,000 residents, according to a study by Frederick County, Maryland.

A prime example of the scale of water consumption is the Susquehanna Steam Electric Station ("SSES") located in

Luzerne County. When Susquehanna Steam Electric Station came on-line in 1983, its original application for water consumption was 40 million gallons per day ("mgd"). Since then, uprates and demand have impacted water use. Now the SSES is applying for renewal of surface water withdrawal of up to 76.000 mgd from the Susquehanna River, consumptive use of up to 53.000 mgd, and groundwater withdrawal of up to 0.125 (30-day average.

Amazon Data Services was granted a 1,600-acre re-zoning request on land adjacent to the SSES. Amazon officials said the company planned to construct 15 data center buildings over the course of the next decade. They applied for water at the SRBC. Consumptive use of 0.060 mgd (30-day average) was approved for these operations, but the amount didn't match the need. Amazon required additional water for the full build out, and PA Water – a regulated utility - agreed to build a 14-mile water line to the data center.

All of the data centers and nuclear plants along the Susquehanna River are required to apply for consumptive and surface water use permits from the Susquehanna River Basin Commission.

The Susquehanna River Basin Commission ("SRBC") manages the Susquehanna River Basin's water resources. The SRBC is headquartered in Harrisburg and its members are the

Commonwealth of Pennsylvania, the states of Maryland and New York, and the United States Army Corps.

TMI-1 when it was running used 50 million gallons of water a day, but does not possess a water permit for an operational plant. Constellation to need to file an application with the SRBC.

The SRBC issued a policy statement in the summer of 2024 in support of dry cooling. This strategy uses air rather than water to remove heat from a system. Dry cooling has the additional advantages of minimizing water consumption, and eliminates many of the adverse environmental problems associated with a conventional wet cooling system. Dry cooling has been adopted by numerous fracking facilities on the Susquehanna River.

The Nuclear Energy Institute opposed the adoption of the dry cooling proposal arguing it was less efficient and more expensive. TMI-Alert testified in support of dry cooling as an alternative to large consumptive and surface water use at nuclear plants. TMIA stated this was a more environmentally friendly option, and allowed for small businesses, farming and public health.

The Susquehanna River Basin Commission enacted this policy to help manage consumptive use. In order for the full force of this policy to have a maximum impact, there should be no exemptions for large consumptive use facilities,

including but not limited to data centers, fracking facilities, and nuclear generating stations.

> The Dry Cooling Resolution has been instrumental in reducing the water consumption of new power plants in the basin. The Commission recognizes that an increasing number of power generation facilities, most recently combined cycle natural gas powered plants, are utilizing dry cooling technology to reduce the environmental footprint in the basin, and are demonstrating overall efficiencies in operations that are equivalent to wet cooling processes. Dry cooling technology significantly reduces the water demand of such facilities and provides increased flexibility in siting facilities in proximity to fuel sources and electrical transmission lines. Use of dry cooling technology reduces impacts to aquatic ecosystems through the reduction of thermal impacts associated with large industrial volume discharges.

The first major test of this policy is the restart Three Mile Island Unit-1. The broader question is when will there be a public policy discussion on water allocation and water equity?

Nuclear plants on the Susquehanna River have been uprated, and these uprates require more water. TMI had a measurement uncertainty recapture uprate in 1988 for 1.3%

or 11 MW. Peach Bottom and Susquehanna have had stretch power uprates which are typically up to 7 percent, and are within the design capacity of the plants. These stations also had extended power uprates and were approved for increases of an additional 12 percent. Peach Bottom and Susquehanna have been uprated three times for a cumulative increase of 19 percent over the original plant design. This represents an increase of approximately 140 MW per unit. More uprates mean more power. More power means more radioactive waste. There are 8,140 tons of high-level radioactive waste in Pennsylvania: Is this a problem to be addressed by those who received a benefit and created the waste or a toxic riddle for future generations?

Data Centers and FERC.

Amazon Web Services ("AWS") acquired a data center campus from Talen Energy that is co-located with the Susquehanna nuclear power plant in Pennsylvania. The data center is situated on the same property as the power plant, and is designed to be directly powered by the nuclear plant's output. However, the co-location arrangement has faced some challenges and is currently in dispute with PJM Interconnection, a regional grid operator.

Exelon and American Electric Power successfully opposed a proposal that would result in the co-location of an Amazon Web Services data center at Susquehanna. The plan would have allowed for up to 960 MW to be purchased in 120 MW

increments. This proposal would remove one nuclear unit from the grid.

Exelon and AEP argued that the Interconnection Service Agreement could result in the data center avoiding transmission costs of up to $140 million per year, shifting these costs to PJM customers. “Participants involved in co-location arrangements should pay the costs of any grid services they consume and the arrangements must be reliable and operationally manageable,” PJM told FERC. (“Utility Drive,” published April 1, 2025.)

Members of the Federal Energy Regulatory Commission have voiced concern about how the Amazon data center, which diverts electricity from the broader grid, might affect power reliability and costs for the general public. Regardless, Amazon has a one-time option to cap its commitment at 480 MW. A deal for 360 MW has been consummated.

Conclusion.

The growth rate for electricity demand is likely to increase, and largely driven by data centers. However, access to water resources will impact siting, and the hyper scale

centers – like Amazon - are going to require more land than earlier data centers.

Pennsylvania has approximately 77 data centers operated by 43 operators across 12 markets. The largest data center is Amazon at the Susquehanna Steam Electric Station which uses 48 MW. (Source: Baxtel, "Pennsylvania Data Centers.") There are waves of data centers on the horizon, and they will need a lot of power and water. What if data centers don't expand at the rate predicted? What if retirements are delayed, and don't outpace the construction of new resources?

The role of dispatchable fuel sources, (coal, gas, and nuclear) especially natural gas, will play a critical role. Natural gas currently accounts for 26 percent of the electricity consumed by data centers, with nuclear energy holding a 15 percent share.

Distribution and resiliency for the generation of AI will require more resilient transmission capacity. Data centers connect at much higher transmission voltages, and they require heavier duty wires than typical electric users. This may create distribution rate shock, and spikes in Distribution System Improvement Charges ("DISC"). (4)

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4 The DSIC is designed to provide for "the timely recovery of the reasonable and prudent costs incurred to repair, improve or replace eligible property in order to ensure and maintain

adequate, efficient, safe, reliable and reasonable services." 66 Pa.C.S. § 1353 (a).

Electric generation is deregulated in Pennsylvania, but distribution and transmission are not. The traditional metric to allow utilities to recover costs is known as “used” and “useful.” This mechanism allowed for utilities to recover investments from their customers.

Does the principal of “used” and “useful” apply to maintenance, upgrades, and weather damage to transmission lines? Who is going to pay for the upgrades? Are intra- and inter-class subsidization.
being exploited by data centers?

Data centers and nuclear plants are not isolated from macro- economics. Dispatchable energy and renewable energy schedules will have to compete and contend with commodity prices, tariffs, and supply chain delays.

What about the consumer? What are the opportunity costs?
Should exclusive contracts between data centers and nuclear power plants be prioritized over public service?

Nuclear power has the highest capacity factor and is among the most reliable sources of energy, but is the most expensive form of electricity and uses more water per

megawatt than gas. How will nuclear plants operate during droughts and peak demand conditions?

Nuclear power construction is always behind schedule and overbudget. The NRC is looking for new methods to indemnify new nuclear plants through “derisking” or cost overrun insurance. The costs on the ground are hard to overcome. Construction costs for nuclear power in 2024 ranged from $6,417/kW to $12,681/kW compared with $1,290/kW for new gas-fired power plant. (Deloitte, “Nuclear Energy’s Role in Power Data Center Growth,” April 9, 2025).

Billions of dollars and increased rates hit Georgia and South Carolina electric customers. Westinghouse went bankrupt due to cost over runs at Summer. However, a year after bringing the second AP 1000 on-line at Vogtle, Westinghouse rebranded itself as an option for small modular reactors.

Many policy planners believe nuclear power is on the verge of a dramatic comeback. Dr. Carly Simon summed up the optimism in an Opinion piece for “Power Magazine” on May 1, 2025. She also argued that the next five years are pivotal.

> The surge in electricity demand for new data centers has already led to plans to expand nuclear power generation in the U.S. Restarts of two recently retired nuclear power

plants are planned—Holtec's Palisades Nuclear Plant in Michigan, and Three Mile Island Unit 1 in Pennsylvania by Constellation and Microsoft. Restarting these existing plants is much less expensive than building new ones, and is the fastest path to adding nuclear energy to the U.S. grid.

Dino Vivanco, Senior Energy Markets Consultant, noted the multitude of challenges for nuclear expansion. "As the nuclear industry stands at this critical juncture, the interplay of economic viability, lead time, technological uncertainty, scalability, federal incentives, fuel availability, and public acceptance will ultimately determine whether nuclear energy can rise to the challenge of meeting America's growing electricity demand and contribute to a reliable energy future." (ICF International published in "Utility Drive," on March 27, 2025.)

There is resistance from an unlikely quarter: Texas. The Lone Star state is the largest producer of gas, oil, and renewable energy. Texas is home to two nuclear plants and four reactors.

What's the problem? Texas is still reeling from the grid power failure in February, 2021. Texas is proposing legislation that could delay data center construction. The effects of the proposed bill could result in a maximum 24-month approval

process along with a requirement to pay additional fees to the Texas grid operator in order to install backup generators.

New projects and new rules will alter the balance of power. Nothing runs 24/7/365. A diverse range of energy and fuel sources will be necessary to meet demand. There is no cure all. The old way of doing business has to be supplanted by better coordination and oversight, clear and consistent standards and regulations, and equal opportunities to access the grid for all energy sources.

The marriage of data centers to nuclear power is an expensive proposition. Nothing is cheap, and nothing is certain. Nothing runs all the time, but nuclear plants are being relicensed for an additional 20 to 40 years. The partnership between data centers and nuclear power plants has the potential to meet the needs of data centers, but does nothing to address the energy needs of businesses, consumers, and farmers.

When it comes to data centers and nuclear power plants hooking-up: The glass is neither half-full or half-empty. It's expensive and opaque.

Respectfully submitted,

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