



THREE MILE ISLAND ALERT

AI and Nuclear Power on the Susquehanna River: More Questions than Answers.

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There are several questions of paramount importance relating to AI and nuclear power: Will the data center be co-located or a direct connection? Who is going to benefit, and will the contract serve one exclusive entity? Do the needs of Big Tech outweigh public benefit? Is the use of millions of gallons of water to cool data centers a water priority for Pennsylvania? At what point — if any — does the public have an opportunity to be part of the process?

Big Tech has embraced nuclear power as a “clean” and dependable energy source. Data centers – unlike residential and business customers — require a consistent and steady supply of electricity 24 hours a day, seven days a week. How can this be maintained without load shifting or rolling brownouts? What happens when the nuclear plants are off-line or closed for refueling outages?

Nuclear energy has been reclassified as “green” to accommodate Big Tech’s clean energy portfolios as they claim the pace of clean energy deployments is moving too slowly to keep up with data center demand. However, the Pennsylvania-Jersey-Maryland (“PJM”) grid currently has over 202 gigawatts (“GW”) of renewable energy resources waiting in the queue.

The growth in power demand driven by the rise of artificial intelligence and cloud computing is currently being met by fossil fuels like coal and natural gas. Is coal making a comeback? What is the impact on conservation, energy efficiency, and renewables?

The resurrection of shuttered nuclear plants will cost about \$2 billion per reactor. Data centers require large amounts of energy, but there only so many eligible nuclear plants to restart, i.e. Duane Arnold, Palisades, and Three Mile Island (“TMI”). These are all small reactors – between 615 to 835 MW — that came on-line in 1974. What does the supply chain look like for 50 year-old parts? Should exclusive contracts be prioritized over public service?

One large nuclear plant may be in play. Public Service Enterprise Group (“PSEG”) is in talks to develop data centers alongside its nuclear plants. The company is in discussions about potential direct power sales to data centers from one of its units.

PSEG Nuclear operates the Salem and Hope Creek Nuclear Generating Stations, New Jersey, and is a part owner of the Peach Bottom nuclear generation station in Delta, Pennsylvania. The stations have a total generating capacity of 3,572 MW.

“We have had discussions related to both sides of the meter in recent months ... for mid-sized data center construction of approximately 50 MW [megawatts] to 100 MW, and behind-the-meter inquiries for co-located facilities that prioritize highly reliable carbon-free baseload power from existing facilities,” said CEO Ralph LaRossa. (“Utility Drive,” May 1, 2024).

Can a co-located and a direct connection co-exist on the same site?

Water: Too Cheap to Meter?

Data center water consumption varies based on factors such as cooling system type, external temperature and humidity, facility size, and transmission capability. Typically, these facilities consume less water in the winter and more in the summer. Higher outdoor temperatures increase the energy needed for cooling systems, which in turn requires more

water to reduce the data center's internal air temperature to optimal levels. How will data centers and nuclear plants operate during drought conditions?

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. All of the data centers and nuclear plants on the Susquehanna River are required to apply for consumptive and surface water use 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 membership includes the Commonwealth of Pennsylvania, the states of Maryland and New York, and the United States Army Corps.

When will there be a public policy discussion on water allocation? Why has there been no discussion about aquatic ecosystem damage, fish kills, and thermal inversion? Does feeding AI take precedence over supplying water to businesses, farms, and homes?

The SRBC adopted a new policy this summer that may impact data centers and calls for a dry cooling option for all new applications.

(d) Project sponsors proposing new or significantly modified power generation plants in the basin shall consider the use of dry cooling technologies and submit to the Commission a rigorous alternatives analysis. This analysis shall include evaluation of the costs, benefits, trade-offs and drawbacks of various cooling and water conservation techniques, and a full evaluation of options for providing effective consumptive use mitigation.

This policy may impact the restart of Three Mile Island. If the Nuclear Regulatory Commission (“NRC”) rules that restarting the plant is analogous to licensing, then Constellation will have to consider dry cooling. Dry cooling has been adopted by the fracking industry.

Alphabet Soup

There are several state and federal agencies that play a critical role in electric generation and distribution, water usage, and consumptive use mitigation.

The Pennsylvania-New Jersey-Maryland Interconnection is the regional transmission organization (“RTO”) that manages the flow of electricity in a 13-state region including the data centers at the Susquehanna and Three Mile Island nuclear stations. PJM is headquartered in Valley Forge, approximately 89 miles east of Harrisburg. PJM coordinates the flow of electricity across the high-voltage, long-distance electric lines in the region.

PJM also develops market and reliability rules so that the wholesale electricity transmission system operates reliably and safely. This is a critical point since the new 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.

The Federal Energy Regulatory Commission (“FERC”) is the agency that regulates the transmission and sale of electricity, natural gas, and oil across state lines. FERC has jurisdiction

over the wholesale sale of electricity between power suppliers and generators.

The Nuclear Regulatory Commission promotes (“NRC”) promotes and regulates nuclear energy. The mission of the NRC has been transformed after the passage of the Advance Act in July, 2024. The NRC’s new mission statement will focus on the safe and secure use of nuclear energy and radioactive materials. The NRC's mission will also include protecting public health and safety, promoting common defense and security, and protecting the environment.

Which begs the question, what were they doing prior to the Advance Act?

The NRC adopted a *laissez-faire*, industry friendly protocol in 1998-1999. The Systematic Assessment of Licensee Performance was replaced by the Reactor Oversight Process. The Commission relies on licensee self-identification to collect data and identify problems. The NRC is a captured agency and a partner and regulator of nuclear energy.

How can an agency promote and regulate nuclear power at the same time?

The alphabet soup of oversight agencies rarely coordinates or executes Memorandums of Understanding. I have litigated in all of the above venues and attempted to navigate the regulatory moats that federal and state agencies erect. The unintended consequences are behaviors to protect exclusive zones of interest. This type of regulatory behavior gives rise to undesired corporate behaviors such as “backfits,” delays in replacing parts, “grandfathering,” postponing maintenance, and remote site inspections.

Nuclear Power on the Susquehanna River.

There are three nuclear power plants on the Susquehanna River. The Peach Bottom Atomic Power Station (“Peach Bottom”) and the Susquehanna Steam Electric Station (“SSES”) are boiling water reactors designed by General Electric. Both have license extensions of between 20 to 40 years and are fully uprated. Three Mile Island Unit 1 (“TMI-1”) is a pressurized water reactor. Peach Bottom and Susquehanna are owned by partnerships.

Talen Energy owns 90% of Susquehanna and is the site operator. The Allegheny Cooperative owns the remaining 10%. Peach Bottom is owned by Constellation Energy and Public

Service Enterprise Group. Both entities own 50% of Peach Bottom. Constellation is the site operator.

Three Mile Unit-1 is owned by Constellation. Three Mile Island Unit-2 was the site of March, 1979 core melt accident. It is owned by TMI-2 Solutions, and has not been decommissioned.

Peach Bottom is the only one of plants that has not partnered with Big Tech. It is located on the west bank of the Conowingo Pond in York County, Pennsylvania, and 36 miles from downtown Baltimore.

Peach Bottom is a two-unit nuclear generating facility that uses water from the Conowingo Pond for cooling purposes. Peach Bottom 2 and 3 have a combined capacity of 2,2770 megawatts, and came on line in 1974. The plant is owned by Constellation and PSEG.

Peach Bottom, Unit 1, was a 70 MW, high temperature, gas cooled reactor that was operated from June of 1967 to its final shutdown on October 31, 1974. The plant is a relic from the Atoms for Peace Program (1953) and it remains in the rate base. The spent fuel was shipped to a Department of Energy facility in Idaho. The reactor vessel, primary system piping, and steam generators remain in place. The technology to

decommission the plant does not exist, and it is the first reactor to ask for an extension for decommissioning.

The nuclear plants on the Susquehanna River have been uprated. TMI had a measurement uncertainty recapture uprate which is less than 2 percent. Peach Bottom and Susquehanna have had stretch power uprates which are typically up to 7 percent, and are within the design capacity of the plant. These stations also had extended power uprates, and were approved for increases of an additional 12 percent. Peach Bottom and Susquehanna has been uprated three times for a cumulative increase of 19 percent over the original plant design.

These uprates require more water. PECO and PPL were fined by the SRBC for illegal water withdrawals. Both plants increased consumption without permission after completing power uprates. In December, 2006, Exelon paid a \$640,000 fine at Peach Bottom, and PPL paid a \$500,000 fine at Susquehanna in September, 2007. PECO is now rebranded as Constellation. PPL was later sold to Talen Energy.

The Dance: Amazon and Talen Energy.

The Susquehanna Steam Electric Station (“SSES”) is located in Luzerne County, 150 miles northwest of Hope Creek and Salem, and 100 miles northeast of TMI. PPL operated the plant until June 2015 when Talen Energy was formed from PPL's competitive supply business. Talen entered bankruptcy in 2022, and emerged from bankruptcy in 2024.

Talen owns 90 percent of the SSES, and the Allegheny Cooperative owns the other 10 percent. The plant has two General Electric boiling water reactors within a Mark II containment building. Each unit has a capacity of 1,300 MW.

Talen Energy’s consumptive use is immense. The SSES takes an average of 29.86 million gallons of water per day from the Susquehanna River that is not returned. The Extended Power Uprate doubled the amount of water that was needed with an upper limit of 65.4 million gallons per day, totaling almost 24 billion gallons of Susquehanna River Water per year.

In 2007 PPL applied for surface water withdrawal of up to 66,000 million gallons per day (“mgd”) from the Susquehanna River, and groundwater and consumptive Water Use of up to 48.000 mgd for power plant operation.

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) from Well TW-2 (Docket No. 19950301).

Amazon Data Services (“ADS” and “Amazon”) was granted a 1,600-acre re-zoning request on May 30, 2024 on land adjacent to the SSES. Amazon officials said the company hopes to construct 15 data center buildings over the course of the next decade.

Cumulus Data Center campus owner and nuclear power plant owner Talen Energy agreed to sell the facility to Amazon Data Services for approximately \$650 million. It is directly connected to the SSES. Cloud data service provider AWS will install its hyperscale data center at the site. Talen’s Nautilus crypto data center was not part of the deal with Amazon.

This site contains bitcoin mining: a partnership of Talen-owned Cumulus with Terawulf, with one substation delivering to the existing on-site facility. The bitcoin mine was not part of the deal, and is reported at 150 MW with a potential for 200 MW. The mine places additional demand on water use.

The Amazon facility will involve consumptive use of water for evaporative cooling units for Building, #2 and Building, #3. No consumptive use is anticipated for Building #1. Consumptive use of 0.060 mgd (30-day average) was approved

for these operations. Operations for Building #2, which will trigger consumptive use of water, are anticipated to begin in July 2025. Where is water going to come from for the additional twelve buildings planned for this site?

Exelon and American Electric Power (“AEP”) 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.

However, Exelon and AEP argued that the Interconnection Service Agreement (“ISA”) could result in the data center avoiding transmission costs of up to \$140 million per year, shifting these costs to PJM customers. They claimed if this co-located load was permitted to avoid significant costs, other generators and large consumers might pursue similar arrangements.

Should large quantities of load rush to co-locate with generation on terms that bear even a resemblance to the ISA at issue here, PJM capacity markets will have steadily decreasing volume as the capacity resources flee to serve load that uses and benefits from—but does not pay for—the transmission system and the ancillary services that keep the system running. This will harm existing customers.

The Amended Susquehanna ISA creates an arrangement where a large data center will be, as a matter of contract, provided with energy from a unit at the Susquehanna nuclear facility, purportedly without any use of the transmission grid because the physical interconnection is to facilities “behind” the point of generator interconnection. The application refers to the data center as “Co-Located Load”, meaning that it is located proximate to the two Susquehanna nuclear units and that its interconnection with the grid occurs through facilities owned

by Talen that are also used to interconnect Susquehanna rather than being separately interconnected to the grid through a different substation or even to facilities at Susquehanna that are owned by PPL [Talen Energy]. This arrangement nonetheless relies on the transmission grid in numerous ways, and its purported independence from the grid is a fiction. (AEP & Exelon Brief.)

This case is being appealed by Talen Energy at the Federal Energy Regulatory Commission. Regardless, ADS also has a one-time option to cap its commitment at 480 MW. A deal for 360 MW has been consummated.

On-site delivery makes it possible to sell at a lower price and still be profitable: There are no transmission congestion costs added to the delivered power price. There are no line

losses that must be factored into the total delivered MW. There is no energy market price risk.

On-site physical developments.

1. Two substations added to supply directly to on-site customers. Reported current on-site delivery capability 950 MW.
2. Bitcoin mining: A partnership of Talen-owned Cumulus with Terawulf — with one substation delivering to the existing on-site facility is reported at 150 MW with a potential for 200 MW.
3. Data center development: Initial demand listed as up to 65+ MW, but elsewhere reported by Talen at an initial 48 MW.

Why would Talen want to take resources out of the market?

1. PJM's market rules confusion over several years made the capacity market a less reliable predictor of future revenues.
2. Capacity prices have fallen over several years making the revenue potential less robust for Talen's PJM assets.
3. Energy prices were off in 2023 with unusually mild peak temperatures.
4. Finances: Talen entered bankruptcy in 2022 and emerged in May, 2023. Protecting revenues is a bigger deal than before.

Data centers are not Talen's core business. Fitting out data centers is a substantial cost. Selling capacity takes the company into a highly competitive business. Operating data centers require specific and expensive skills. Technology changes complicate and add costs for each area of running this business. All this appears to make the Amazon sale a reasonable vehicle for extracting money to support the corporation.

What happens when both SSES units drop in power? There are still substations connecting both the bitcoin mining and data centers, and power can flow in both directions. Do

we know how the contracted price changes when power flows from the grid rather than from SSES? The only way these behind-the-fence customers lose power is if the grid blacks out.

Other Questions:

1. Is the data center supply agreement based on only Talen's 90% ownership share of Susquehanna Steam Electric station?
2. Is this an energy-only transaction? SSES 1 & 2 are listed as must-offer capacity resources through the 2025- 2026 delivery year. It is not clear how this factors into the data center deal.

Up and Atom: Microsoft and Three Mile Island.

The dynamic at TMI is much different. Last May, Constellation put in an application for a \$1.6 billion guaranteed loan. Constellation plans to open the plant in 2028. Three Mile Island Unit-1's proposed resurrection will be foisted on the backs of ratepayers and taxpayers. TMI-1, like Peach Bottom and Susquehanna, was built with rate payer dollars.

Three Mile Island Unit 1 is an 835 MW pressurized water reactor located in Dauphin County ten miles south of the City of Harrisburg. TMI-1 came on-line in 1974, and was born out of atomic “wonder lust.” 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.

Constellation complained they couldn’t compete in the market place. They were right. TMI-1 lost \$300 million over eight years, and the free market closed the plant in 2019.

Microsoft has reportedly entered into an agreement that they would buy all the electricity the 835-megawatt TMI Unit 1 would generate over 20 years. TMI has a contract to sell Microsoft all of its energy for 20 years at an estimated rate of \$120 per megawatt subject to a Non-Disclosure Agreement. The market rate is around \$50.

Plant owner Constellation said it would need \$1.6 billion to revive the reactor. The company applied for a guaranteed federal loan to finance the restart. The guarantee would allow the company to save Constellation up to \$122 million in borrowing costs, according to John Parsons, an energy

economist at the Massachusetts Institute of Technology. It would come on top of the federal tax credits on the sale of the power passed in the Inflation Reduction Act of 2022, which could be worth nearly \$200 to \$300 million for Constellation and Microsoft.

The announcement of the planned reopening in September was met with an unabashed enthusiasm by President Biden, Governor Shapiro, the legislature, and organized labor.

Governor Shapiro, like other Democratic governors, is pushing hard to extend or restart nuclear plants. He urged PJM to put TMI at the front of the queue and insisted the dormant plant was shovel ready. Mr. Shapiro also lobbied FERC to approve the co-location agreement between Microsoft and Talen Energy.

The Pennsylvania Public Utility Commissioner (“PUC”) Vice Chairwoman gushed about the TMI project at the DEP Citizens Advisory Council meeting on January 14, 2025. However, Pennsylvania is a deregulated state, and the PUC has limited oversight. The PUC can have an impact on distribution costs. Chairman Stephen DeFrank cautioned that we should not repeat the “mistakes of the past,” and noted co-location and large loads benefit from the PJM grid. (FERC, October 24, 2024).

There is a fly in the ointment: Three Mile Island's permit to withdraw water expired in 2019. The case came before the Susquehanna River Basin Commission. The SRBC's Order on December 15, 2022 means that TMI-1 no longer has access to enough water to operate a nuclear power plant. TMI Unit-2 has no rights to withdraw water. Moreover, TMI-2 has no water infrastructure or intakes, and would have to construct a water line or install storage tanks for a water supply. Water use at TMI is complicated by the fact that ownership is split between two separate licenses – Constellation and TMI-2 Solutions.

Peach Bottom and Three Mile Island are located on the Lower Susquehanna River, and have the capacity to draw in as much as half the flow of the Susquehanna River in a day.

Consumers, taxpayers, and citizens have been told that nuclear power deserves a second chance because it is now been rebranded as environmentally friendly— simply because it's not coal— and because without nuclear, the lights will go out on cold, windless nights.

How does exporting TMI-1's energy to another zip code keep the lights on in central Pennsylvania?

How does switching a fuel addiction from OPEC to Russian uranium make us energy independent?

If nuclear power production is so safe and improved, why does the cleanup of Three Mile Island Unit-2 continue to vex the industry?

If Bill Gates wants the power, shouldn't he take out the trash?

Eric Epstein was formerly the coordinator of the Susquehanna Valley Alliance, based in Lancaster, and former chairman of Three Mile Island Alert, based in Harrisburg.

“AI and Nuclear Power on the Susquehanna River: More Questions than Answers” was submitted at the 2025 Energy Service Provider Experience, “Sustainable Energy: Where Do We Go From Here?” The event took place at the Kalahari Resorts and Conference Center, Pocono Manor, Pennsylvania, from January 31 to February 1, 2025. The event was for the Energy Service Providers Network and interested future ESPs.

