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Testimony for the Pennsylvania Senate Majority Policy Committee Hearing

The Growth of Data Centers, Archbald, PA

August 11, 2025

With Pennsylvania poised to become a hub for data centers, there are many things to consider. In most media coverage of the potential development, power demands and the possible impact to grid reliability and consumer prices gain the most attention. There is also coverage of land use, job creation, and tax revenue; these are all certainly important discussions to be had. But one of the most critical aspects of data center development, the dramatic demand for water, is often left out of the conversation despite water being our most basic human need.

That may be because many data centers have existed in Pennsylvania for years without the need for very much water, or very much power for that matter. It is the newest generation of data center – often called hyperscale data centers that are designed to handle massive amounts of data with growing demands of cloud computing for things like artificial intelligence and cryptocurrency – that are proving to require larger amounts of power and an associated high demand for water.

Why the high demand for water at a building running computers? The high-speed computing that is performed at hyperscale data centers generates a lot of heat that must be dissipated to avoid harm to the servers. Traditionally, water based cooling methods have provided a convenient and cost effective way to achieve the needed cooling by transferring the excess heat to the water and evaporating it. But it needs to be noted that, at the hyperscale level, a single data center campus can evaporate millions of gallons of water per day, potentially putting a significant strain on the local water resources.

As large tech companies look for data center homes in Pennsylvania communities, an expanded tax base and good jobs make them an attractive option for municipalities. And Pennsylvania is attractive to AI thanks to our large energy resources and relatively rich water supply compared to other parts of the country. But with the anticipated water demands, hyperscale data centers have the potential to be among the largest consumers of water in Pennsylvania, especially when considered as a whole. To put it in perspective, millions of gallons a day is more water than is used by most communities with public drinking water systems. Most industrial facilities use less than one million. A typical fully irrigated golf course will potentially use up to half a million when the sprinklers are all turned on.

So where will the data centers get the water they need? Most communities do not have large surpluses of excess water supply readily available to provide to hyperscale data centers. And data centers can be constructed quickly – in under two years – but it can take many years longer than that to identify and develop new sources of water supply.

This potential problem is compounded by the reality that new power plants are being proposed solely to provide the electricity needed to run these facilities. Just like data centers, power plants also generate heat that must be dissipated, and typically rely on evaporative cooling using water. Power plants are already by far the largest users of water in the Susquehanna River Basin, and in Pennsylvania as a whole.

So hyperscale data centers pose high demands on water supplies in two ways when traditional cooling techniques are used – both in cooling the centers and in operating the power plants that fuel them. A modern gas-fired combined cycle power plant, which is what are typically proposed, can have evaporative water demands of 6 to 10 million gallons a day.

As technology advances, the power demands, and therefore likely the water demands, will only increase. According to researchers at the University of California, it takes a little more than a 16 oz. bottle of water to write one 100-word email with OpenAI's ChatGPT. Approximately a quarter of Americans have used the AI tool, according to the Pew Research Center. It's a safe bet more will use it in the future, even those that initially resist new technology.

Using traditional evaporative cooling methods, it is unlikely that a hyperscale data center will be able to obtain enough water from the local public water supplier. So if the data center is proposing to supply its own water from groundwater wells or a nearby stream or river, careful review will be necessary to ensure that the volume of water needed can be safely supported by the source without depleting it, without denying water to existing users, and without harming aquatic habitat and wildlife that rely on the water.

But again, developing new water sources can take some time – for permitting, to build infrastructure such as pipelines and large pumps, to secure the power needed to run the pumps – so these centers run the real risk of wanting to be up and running before the water supply is in place. That's why it is critical that we have discussions about water now, before companies finalize site selection and begin design and construction of hyperscale data centers.

Pennsylvania Department of Environmental Protection's Permit Application Consultation Tool (PACT) has proven effective at identifying potential challenges early in the process. The Susquehanna River Basin Commission (SRBC) should continue to be included in group coordination meetings that arise from use of the tool. In addition, it is important that data center developers schedule pre-application meetings with us very early in the planning process.

But the conversation shouldn't just be about how much water is needed and where it's going to come from. We don't need to simply accept the traditional methods in 2025. The good news for our water resources is that there are alternatives, if companies are willing to explore them. Innovative technologies such as dry and hybrid cooling may greatly reduce the water demands at these facilities without compromising feasibility.

We're also hearing a lot of big tech companies pledging to go greener with new, less water-intensive cooling methods at new data centers. It is incumbent upon elected officials in Pennsylvania to ensure they follow-through on their promises.

At the SRBC it's our job to plan ahead to sustainably manage the amount of water available in our basin. We recognize the need to balance strong economic growth with everyday human needs and a healthy environment, and when a new industry with high water demand comes along, we figure it out, like we did with water needs for fracking in the Marcellus Shale.

Part of striking that balance is looking for ways to conserve, reduce and mitigate water use. We saw such an opportunity in 2015, when 93 million gallons per day of all reported consumptive water use in the basin was attributed to existing power generation and new gas-fired power plants were being proposed left and right, each with 6-10 million gallons of additional demand.

In response, our commissioners adopted a resolution that encouraged and offered incentives to use dry cooling technology for new power generation. Dry cooling uses ambient air to cool and condense steam, drastically lowering the amount of water consumed. Although at first resistant to the additional up-front costs and the threat of loss of efficiency in power generation, each of the four new plants that were constructed employed dry cooling, with impressive results.

Through 2024, more than 45 billion gallons of water use has been avoided by the four plants. That's as much as a 98% reduction of demand. One facility significantly reduced their public water supply demand, which helped them to meet their NPDES/discharge requirements. And because they didn't have to co-locate with a water source, one was sited at the intersection of transmission and gas lines, avoiding the need to extend expensive electrical transmission line. Each plant also saved, and continues to save, operational costs through permitting incentives and lesser fees.

Now, witnessing another large water user enter the scene, our commissioners expanded that resolution to encourage data centers and other emerging facilities to consider the use of dry, hybrid, or other water-saving technologies for cooling purposes. And, along with the 10-year track record of the power plants and the commitment to sustainable development by the AI companies, we're expecting to see similar success in reducing water demands while still fostering development.

To date in the Susquehanna River Basin, we have only received and permitted one data center project, in Luzerne County. We know this is just the very beginning of an expanding industry, one we're ready to accommodate with the proper balancing – not unlike, in many ways, the dawn of fracking in our basin.

Our regulations exist so that all users of the basin's water resources have reliable, conflict-free, and sustainable water supply for current and future generations, even as demographic, economic, and climate conditions evolve. We believe we have the necessary technology, knowledge and structure in place to incorporate hyperscale data centers into the mix in the same fashion.