Analysis: Offsite Water Use of Data Centers

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INTRODUCTION AND REFERENCE INFORMATION

Data center water use falls into two categories: direct and indirect. Direct water use refers to water withdrawn and consumed on-site at data centers for cooling and other operational needs. Indirect water use refers to water withdrawn and consumed off-site at power plants to generate the electricity that powers data centers.

Quantifying indirect water use of data centers is challenging due to limited transparency from data center developers, tech companies, and public utilities. Without knowing the type of fuel and cooling system used at each power plant, or the actual consumption rates of power for each data center, we cannot precisely assess off-site water use. That said, while we do not have specific information for power plants and data centers in the state, we do have general water use information for various types of electricity-generating technologies that could be used to power data centers. This can help us estimate the water demands we could expect from different operating scenarios. **Table 1** shows estimated water withdrawal and consumption rate averages at power plants by the three most commonly used fuel and cooling system types.

Table 1[1]

Estimated Average Water Withdrawal and Consumption Rates at Power Plants by Common Fuel and Cooling System Types

Fuel Type	**Cooling System Type**	**Average Water Withdrawal** (Gal/MWh)	**Average Water Consumption** (Gal/MWh)
Coal	Tower	788	621
	Once-through	28,676	310
	Pond	15,061	455
Natural Gas	Tower	650	467
	Once-through	23,190	170
	Pond	5,950	240
Nuclear	Tower	1,101	672
	Once-through	44,350	269
	Pond	7,050	610

Note: Water withdrawal is the amount of water removed from the ground or diverted from a water source. Water consumption is the amount of water used that is lost—through evaporation, transpiration, etc.—and not returned to the source. Returned water is generally hotter when discharged from power plants, causing thermal pollution, and contains pollutants from disinfection, anti-corrosion, fuel transformation, and other processes.

[1] *Adapted from Macknick, Jordan & Newmark, Robin & Heath, Garvin & Hallett, K. (2012). A review of operational water consumption and withdrawal factors for electricity generating technologies. Contract. 303. 275-300. 10.1088/1748-9326/7/4/045802.*

ASSUMPTIONS AND ANALYSIS

In the absence of information, we can apply the general information on indirect water withdrawal and consumption rates in **Table 1** to what we do know about specific data center operations, helping us better understand potential water use. For instance, Vantage Data Centers manages over 1,900 acres of annexed land in Port Washington and is currently developing 672 acres to support AI needs. The first phase is expected to use 1.3 gigawatts (GW), or 1,300 megawatts (MW), of power[2]. The full buildout has anticipated power needs closer to 3.5 GW, or 3,500 MW.[3]

- *If 1 GW = 1,000 MW, then 1.3 GW = 1,300 MW (1.3 GW x 1,000 MW) and 3.5 GW = 3,500 MW (3.5 GW x 1,000 MW).*

Although we lack detailed data on hourly or seasonal energy use, we can estimate daily power demands by assuming the facility operates consistently at full capacity. A watt measures the amount of power produced or consumed at any point in time; a mega- or gigawatt-hour (MWh or GWh) measures the amount of energy used. Thus, we do not know how consistently the power demand—here, 1,300 MW in the first phase and 3,500 MW at full build-out—will be needed. However, if we assume the data center will run at full capacity for 24 hours each day, we expect the daily energy use to be 31,200 MWh for the first phase and 84,000 MWh at the full buildout.

- *If a megawatt-hour (MWh) is one MW of power used continuously for one hour, then in a day, a 1,300 MW capacity will use 31,200 MWh (1,300 MW x 24 hours), and a 3,500 MW capacity will use 84,000 MWh (3,500 MW x 24 hours).*

And depending on the type of fuel used to generate electricity and the cooling system implemented, we can estimate how much indirect water withdrawal and consumption could be needed to support the data center, shown in **Table 2**.

Table 2

Estimated Average Daily Water Withdrawal and Consumption Amounts at Power Plants Needed to Support Port Washington Data Center Based on first phase (FP) 31,200 MWh and full buildout (FB) 84,000 MWh Energy Use

Fuel Type	Cooling System Type	Average Daily Indirect Water Withdrawal (Gallons)	Average Daily Indirect Water Consumption (Gallons)
Coal	Tower	FP: 24,585,600 FB: 66,192,000	FP: 19,375,200 FB: 52,164,000
	Once-through	FP: 894,691,200 FB: 2,408,784,000	FP: 9,672,000 FB: 26,040,000
	Pond	FP: 469,903,200 FB: 1,265,124,000	FP: 14,196,000 FB: 38,220,000
Natural Gas	Tower	FP: 20,280,000 FB: 54,600,000	FP: 14,570,400 FB: 39,228,000
	Once-through	FP: 723,528,000	FP: 5,304,000

[2] Lisheron, M. (2025, August 7). *Port Washington data center on track to by far be state's largest electricity user. Badger Institute*. https://www.badgerinstitute.org/port-washington-data-center-on-track-to-by-far-be-states-largest-electricity-user/
[3] *Id*.

		FB: 1,947,960,000	FB: 14,280,000
	Pond	FP: 185,640,000 FB: 499,800,000	FP: 7,488,000 FB: 20,160,000
Nuclear	Tower	FP: 34,351,200 FB: 92,484,000	FP: 20,966,400 FB: 56,448,000
	Once-through	FP: 1,383,720,000 FB: 3,725,400,000	FP: 8,392,800 FB: 22,596,000
	Pond	FP: 219,960,000 FB: 592,200,000	FP: 19,032,000 FB: 51,240,000

Average water withdrawal amounts during the first phase of the of the Port Washington data center development could range from 20.2 million gallons per day if accepting power from a natural gas power plant using a tower cooling system to 1.3 billion gallons per day if accepting power from a nuclear power plant using a once-through cooling system. The full buildout withdrawal amounts for the Port Washington data center could range from 54.6 million gallons per day if accepting power from a natural gas power plant using a tower cooling system to 3.7 billion if accepting power from a nuclear power plant using a once-through cooling system.

- *If the first phase of the Port Washington data center development is expected to need up to 31,200 MWh per day and the full buildout up to 84,000 MWh per day, then the average daily water withdrawals can be calculated by multiplying those numbers by the average water withdrawal rates in **Table 1**. (For example, the average daily water withdrawal for the first phase, if using natural gas fuel and a tower cooling system, is 31,200 MWh x 650 gallons/MWh = 20,280,000 gallons.)*

Most Wisconsinites withdrawal approximately 56 gallons of water per day, so this one data center's indirect water withdrawals could equal the amount withdrawn by between 975,000 and 66.5 million people each day at full buildout.

- *We can calculate this by dividing the low- and high-end full buildout withdrawal amounts in **Table 2** by the approximated 56 gallons/day each person withdrawals: 54,600,000 gallons / 56 gallons = 975,000 gallons and 3,725,400,000 gallons / 56 gallons = 66,525,000 gallons.*

Average water consumption amounts during the first phase of the Port Washington data center could range from 5.3 million gallons per day if accepting power from a natural gas power plant using a once-through cooling system to 20.9 million gallons of water per day if accepting power from a nuclear power plant with a tower cooling system. The full buildout consumption amounts could range from 14.2 million gallons per day if accepting power from a natural gas power plant using a once-through cooling system to 56.4 million gallons per day if accepting power from a nuclear power plant with a tower cooling system.

- *If the first phase of the data center development is expected to need up to 31,200 MWh per day, and the full buildout up to 84,000 MWh per day, then the average daily water consumption can be calculated by multiplying those numbers by the average water consumption rates in **Table 1**. (For example, the average daily water consumption for the first phase if using natural gas fuel and a once-though cooling system is 31,200 MWh x 170 gallons/MWh = 5,304,000 gallons.)*

Without detailed information on energy generation to power data centers, precise estimates of water demands remain difficult to calculate. Still, the results show that indirect water use by single data centers could rival that of major cities.