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Issue Brief

How Much Water Do Data Centers Use? And Why Does It Matter?

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Anticipated growth in artificial intelligence (AI) and other cloud-based computing services is driving an unprecedented expansion of data centers across the globe. As new data centers have become much larger and more concentrated than in the past, concerns about impacts on water and energy systems have intensified. Many are calling for greater transparency about the impacts of proposed data centers, and in some instances, citizen opposition has temporarily or permanently halted their development (Roelberg 2026; Mural 2026).

Despite growing concerns, basic information about data centers is limited. This brief uses a Q&A format to summarize what we know about data center water use, point those interested to additional details, and address common misunderstandings. We find that:

- Data centers store, process, and transmit digital information and range in size from small server rooms in office buildings to massive hyperscale facilities that occupy at least 10,000 square feet of floor space. Large co-location and hyperscale facilities account for most of the growth in data center capacity.

- While data are limited, available information suggests that data centers are concentrated in a relatively small number of states but are expanding into new areas, including water-scarce and rural parts of the United States.

- Data centers use water directly onsite for cooling, humidification, and domestic uses and indirectly through the water required to generate electricity powering them and to manufacture microchips and other equipment. Indirect water use is typically much larger than direct use but is often ignored in water use reporting.

- While data centers represent a small share of global and even national water use, their impacts are experienced locally. Available data indicate that water withdrawals by a data center are highly varied, ranging from 270 gallons to 3.9 million gallons per day. For a typical facility, 74% of the water withdrawn is consumed and unavailable for other uses within the water basin.

- The water demands of large data centers differ sharply from most commercial buildings, and these differences may create unique challenges for municipal water systems serving them. They withdraw far more water than most commercial water users; concentrate their use during the hottest periods; and consume a much larger share of the water withdrawn.

Section 1: Data Center Basics

Question: What Is a Data Center?

Takeaway: Data centers store, process, and transmit digital information and range in size from small server rooms in office buildings to massive hyperscale facilities that occupy at least 10,000 square feet of floor space. Large co-location and hyperscale facilities account for most of the growth in data center capacity.

Data centers house the hardware, such as servers and networking equipment, that underpin the digital services that most people use every day. Watching videos, storing files in the cloud, searching the internet, making video calls, using an AI chatbot, and processing credit card payments all depend on the continuous operation of data centers.

There are several different types of data centers. These include:

- *Hyperscale data centers:* [1] These facilities are operated by major technology companies, such as Amazon, Meta, Google, and Microsoft, to support their cloud computing and AI services. They are massive facilities that utilize at least 5,000 servers and occupy at least 10,000 square feet of floor space. These facilities can operate at relatively high water and energy efficiency compared to small data centers but are also at the forefront of expanding energy and water demands because of their sheer size (Shehabi et al. 2024).

- *Colocation data centers*: These facilities are owned by companies that lease space to multiple tenants, allowing organizations to host their

[1] Note there is no standardized definition for a hyperscale data center. In some instances, “hyperscale” refers to the size of the facility, and in other instances it refers to ownership by major technology company often referred to as “hyperscalers.”

servers and other hardware offsite in a shared space. They range in size from small to very large facilities, and their water and energy use are thought to vary widely.

- *Enterprise data centers*: These are relatively small facilities owned and operated by large organizations to support their own internal computing needs.

- *Edge data centers:* These are small facilities located close to the end user, such as in an office building or at a network hub. Although they are generally less efficient in their energy and water use, their smaller size means they typically use far less water and energy than large data centers.

- *Internal data centers*: These are small rooms of servers that exist within and are run by organizations for their own use and purposes.

While data centers have been around for decades, their development and operation are evolving rapidly. Early data centers were relatively small, integrated into larger buildings, and managed by organizations for their own IT needs. With the introduction of cloud computing in the early 2000s, however, organizations began outsourcing their computing resources to larger, off-site facilities (Susnjara and Smalley 2024). As a result, smaller data centers have become less common, while large co-located and hyperscale facilities have become more common.

The first hyperscale data center opened in Oregon in 2006 (Susnjara and Smalley 2024). Since then, the number and size of facilities have grown rapidly, driven by the expansion of cloud computing and, more recently, AI applications. As shown in Figure 1, hyperscale data centers account for a larger share of data center capacity, rising from about 20% of total capacity in 2018 to 48% in 2025 and are projected to reach 67% by 2031 (Synergy Research Group 2026).

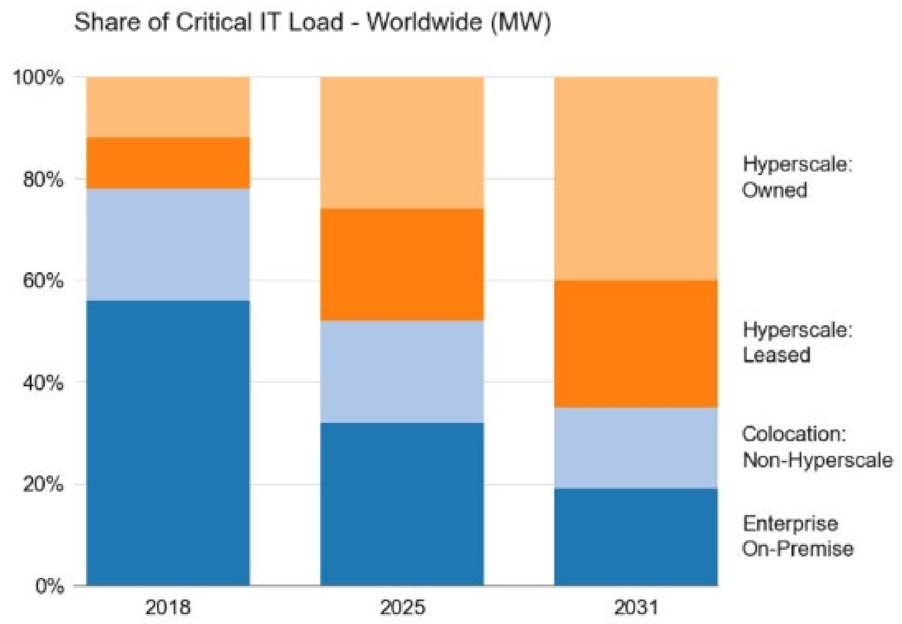

Figure 1. Data Center Capacity, 2018–2031, by Facility Type.
Source: Synergy Research Group (2026)

Question: How Many Data Centers Are There in the United States? Where Are They Located?

Takeaway: While data are limited, available information suggests that data centers are concentrated in a relatively small number of states but are expanding into new areas, including water-scarce and rural parts of the United States.

The number, type, and location of data centers are not well documented. Current estimates for the United States, which leads the global data center market, range from 1,500 to nearly 5,000 facilities (IM3 and U.S. Department of Energy 2026; Beckler and Srisuantang 2026; Baxtel, n.d.). The U.S. Department of Energy, for example, identified 1,479 data center facilities across the U.S. as of February 2026 (Mongird et al. 2026). However, industry sources like Data Center Map and Baxtel report 4,499 and 4,982 data centers, respectively, operating across the United States. Major reasons for this uncertainty include inconsistent definitions of data centers and the lack of standardized reporting. Additionally, internal and edge data centers are often overlooked in these estimates because they are rarely stand-alone facilities but rather integrated into larger buildings, such as office buildings. In combination, this uncertainty makes it difficult to compare or aggregate estimates to develop a reliable national total.

Available data indicate that data centers are found in every U.S. state but are concentrated in a few regions (Figure 2). In 2023, just 15 states accounted for 80% of U.S. data center power demand, an indicator of the number and size of data centers. These states, ranked from highest to lowest energy load, are: Virginia, Texas, California, Illinois, Oregon, Arizona, Iowa, Georgia, Washington, Pennsylvania, New York, New Jersey, Nebraska, North Dakota, and Nevada. For these states, data centers represented 2.8% (in New York) to nearly 26% (Virginia) of statewide electricity consumption in 2023 (EPRI 2024).

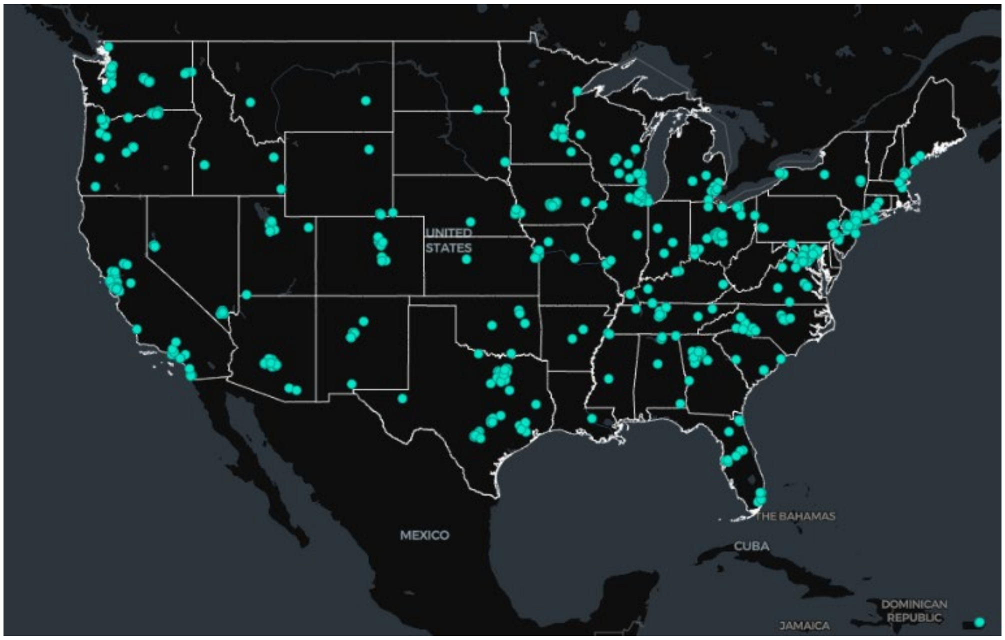

Figure 2. Data Center Locations in the United States
Source: Mongird et al. 2026

There are several publicly accessible, interactive maps that provide data center locations and other information, for example:

- **IM3 Open Source Data Center Atlas - https://im3.pnnl.gov/datacenter-atlas**
- **Datacentermap.com - https://www.datacentermap.com/**
- **Baxtel Data Center Map - https://baxtel.com/map**

Commercial platforms, like Datacentermap.com and Baxtel, exist to connect and sell data to buyers, sellers, investors, and other stakeholders in the data center and technology sectors. Therefore, only certain information on these platforms is freely available to the public. Some have also produced static maps with current and proposed facilities, including Campbell and Beckler (2025) and academic researchers, though these can be out of date quickly due to the rapid expansion of data centers.

Increasingly, data center development is shifting from urban to rural areas. A recent Pew Research Center analysis found that while 87% of existing data centers are in urban areas, more than two-thirds of *planned* data centers are in rural areas (Seets and Radde 2026). In California, for example, most of the energy demand for operational data centers is in major urban centers, including counties in the San Francisco Bay Area and Los Angeles County (Figure 3). While additional capacity is under construction or planned in these areas, data centers are rapidly expanding into rural counties like Imperial, Kings, and San Joaquin Counties that until recently had no known data centers. This expansion can strain local infrastructure and create challenges for more capacity-limited operators.

Several factors drive data center siting, including electricity availability and cost, tax incentives and favorable regulations, access to high-capacity internet networks, and land availability and cost (Shehabi et al. 2024; EPRI 2024; Washington State Department of Revenue 2025; Bessasparis et al. 2025).

A growing number of data centers are in water-stressed areas. One study found that nearly one-third of U.S. data centers are in areas with high or extremely high water stress, including in Arizona, Colorado, Nevada, New Mexico, Nebraska, and Wyoming (Planet Tracker 2024). This concentration may be intensifying: a recent Bloomberg analysis found that two-thirds of new data centers built or in development since 2022 are in high water stress areas (Nicoletti et al. 2025). This suggests that water is not a major factor driving data center siting.

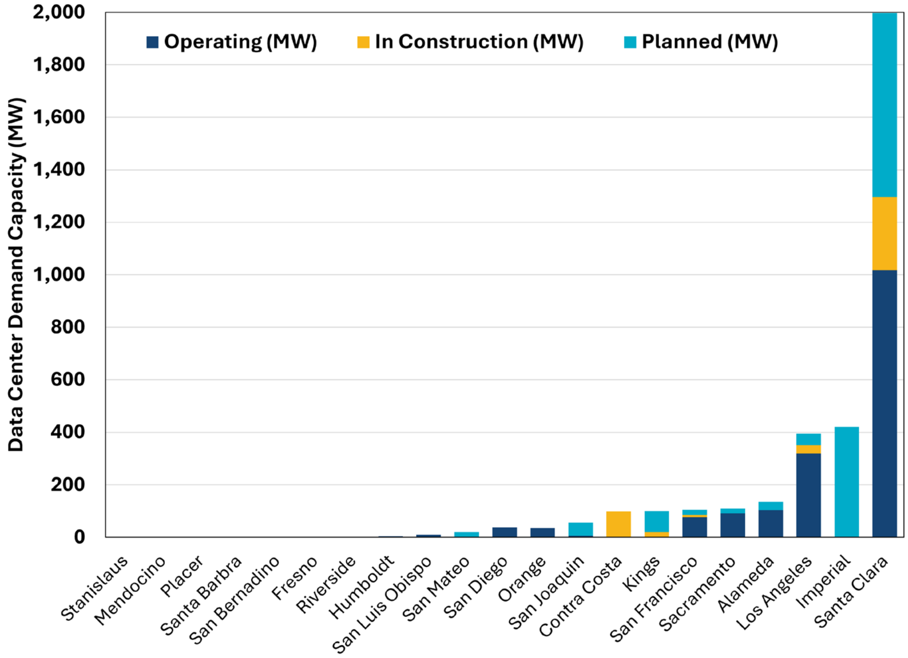

Figure 3. Existing and Future Data Center Demand Capacity, as Measured by Power Demand Capacity (MW), in California Counties.
Data Source: National Laboratory of the Rockies (2025)

Section 2: Data Center Water Use

Data centers – especially large co-location and hyperscale facilities – can use a large amount of water. While water has not been a major factor when siting data centers, it has been a major driver of community opposition. This section provides answers to key questions about the water use of data centers. While "water use" is a commonly used term, it lacks a standard definition. To understand data center water use, it's important to differentiate between two major types of water use: water withdrawal and water consumption.

- **Water withdrawal** refers to the total amount of water taken from a source (e.g., a river, lake, or groundwater aquifer) for use in a facility. A portion of this water may be returned to the original water source, although often of a different quality than when it was withdrawn.

- **Water consumption** refers to the portion of water withdrawn that is not returned to the original water source, for example because it is lost through evaporation or plant transpiration. Water that is consumed is not available for use by another user within the same watershed.

Published figures for data centers often use the generic term "water use" and fail to specify whether they refer to water withdrawal or consumption, making it difficult to reliably compare estimates across sources. *We urge the reader to exercise caution when comparing water use estimates to ensure they are done on a consistent basis.*

Water Usage Effectiveness (WUE) is a metric commonly used by industry to evaluate data center water consumption. Much like Power Usage Effectiveness (PUE) is a measure of data center energy efficiency, WUE provides a measure of the amount of water a data center consumes onsite divided by the energy consumed for its IT equipment. WUE is commonly expressed in liters of water per kilowatt-hour of IT energy (L/kWh), with a lower value indicating a more water-efficient facility. Across all U.S. data centers, the modeled average WUE in 2023 was about 0.36 L/kWh (Shehabi et al. 2024). By comparison, WUE for AI-specific data centers is nearly five times higher, or about 1.8 L/kWh, because more cooling is required to manage denser heat loads of AI servers (Xiao et al. 2025). Other factors that affect WUE include the cooling technology employed, climate, and season.

WUE is a useful metric for assessing the water efficiency of a data center but is insufficient for evaluating the impacts of data center development on local and regional water systems. For example, operators may use WUE to evaluate and ultimately optimize water consumption through design and operational improvements. They may also couple it with PUE to assess onsite water-energy tradeoffs.[2] Focusing exclusively on WUE, however, may miss the local and regional impact of a data center's total water use. In this brief, we focus on facility-level water withdrawals and consumption to provide a better indication of the local impacts of a data center.

Question: How Do Data Centers Use Water?

Takeaway: Data centers use water directly onsite for cooling, humidification, and domestic uses and indirectly through the water required to generate electricity powering them and to manufacture microchips and other equipment. Indirect water use is typically much larger than direct use but is often ignored in water use reporting.

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2 While WUE is more narrowly focused on onsite water consumption, some have also proposed WUEsource, which takes a broader view by combining onsite water consumption with water consumption associated with electricity generation (Mytton 2021).

Data centers use water directly and indirectly. Direct use occurs onsite, primarily to cool computers and other equipment and to control humidity. Much of the water withdrawn for cooling is consumed through evaporation and is not returned to the original water source, and the remainder, often referred to as effluent or blowdown, typically requires treatment prior to disposal. Water is also used onsite for construction activities and for domestic purposes, such as by employees in restrooms and kitchens (Han et al. 2026).

Indirect water use typically occurs offsite to generate electricity needed to power data centers, as well as to manufacture microchips and other equipment. Water requirements for electricity generation depend on the energy sources supplying the grid. Renewables like solar photovoltaics and wind withdraw and consume little water, while thermoelectric power plants, including natural gas, coal, and nuclear plants, withdraw and consume more, and in some cases, substantially more (Meldrum et al. 2013).

Available studies suggest that indirect water consumption of a data center is 2.4 to 12 times greater than direct consumption (James et al. 2025; Siddik et al. 2021; Shehabi et al. 2024; Xiao et al. 2025), though it is often ignored in water use reporting. The water intensity of electricity generation highlights the need to consider indirect water use, especially as the adoption of some cooling technologies may reduce onsite water use but increase energy use and, by extension, indirect water use.

Question: How Much Water Do Data Centers Use? How Much Does Water Use Vary Between Data Centers?

Takeaway: While data centers represent a small share of global and even national water use, their impacts are experienced locally. Available data indicate that water withdrawals by a data center are highly varied, ranging from 270 gallons to 3.9 million gallons per day. For a typical facility, 74% of the water withdrawn is consumed and unavailable for other uses within the water basin.

On a cumulative basis, data centers account for a relatively small percentage of global and even national water withdrawals (Shehabi et al. 2024). However, the impacts of data centers are primarily experienced locally, and communities must understand and address the water requirements for individual developments. Yet, the volume of water used directly by data centers is not well understood due to limited transparency and a lack of standardization in water-use reporting, substantial variation among facilities, and the rapid pace of change within the sector.

To help address this gap, we compiled facility-level data from industry sustainability reports (Google 2025; Microsoft 2026), as well as a peer-reviewed journal article (Han et al. 2026). Facility-level data may reflect a single building or a campus with multiple buildings at a single location; the sources do not clarify. Information was also not provided on the size of these facilities, but we assume they represent large facilities because they are operated by major technology companies. Reported volumes were converted to annual values where necessary. All estimates represent water use in 2024 or 2025, and when multiple years of data were available, the most recent year was used.

The resulting dataset includes annual withdrawals for 65 facilities around the world, and annual discharge and consumption for 36 of these facilities. Where consumption was not reported, we estimated it using a consumptive ratio of 0.74 based on the median value for the reported data, which is consistent with values reported in Han et al. (2026). We also calculated average daily withdrawal by dividing annual withdrawal by 365. Average daily values are useful for comparing with other water users and for expressing values in terms more intuitive to most readers. However, they understate *actual* daily demand because water use is not evenly distributed throughout the year – rather it is concentrated during hot periods when cooling needs are highest. Some data centers rely on waterless cooling systems during cooler periods. As a result, peak daily withdrawals and consumption can be considerably higher than the average values reported here (for more on this, see page 11).

As shown in Table 1, water withdrawals were highly varied. Across 65 data centers, water withdrawals ranged from 100,000 gallons to 1.4 billion gallons per year. This equates to an average daily withdrawal of 270 gallons per day to 3.9 million gallons per day. The large range is likely due to differences in facility size, cooling technologies, climate, and potentially data center management approaches. Water withdrawals for a typical facility, as represented by the median value, were 44.3 million gallons per year (or 121,000 gallons per day), while the average withdrawals were much higher at 159 million gallons per year (or 436,000 gallons per day). The average value was much higher than the median because a small number of facilities withdrew exceptionally large volumes of water (Figure 4).

Table 1. Summary of Facility-Level Data Center Water Use (in Millions of Gallons).

	Average[f]	Median	Minimum	Maximum	Sample Size
Annual Withdrawal[a]	159	44.3	0.10	1,410	65
Annual Consumption[b]	123	32.1	0.01	1,010	65
Annual Discharge[c]	56.1	22.6	0.10	400	36
Estimated Daily Withdrawal[d]	0.436	0.121	0.00	3.86	65
Consumptive Ratio (Unitless)[e]	0.59	0.74	0.10	0.94	36

Data Sources: Facility-level data from Google 2025; Microsoft 2026; and Han et al. 2026. Notes: These values represent (a) reported annual withdrawal or calculated withdrawal from the sum of monthly values; (b) reported or calculated annual consumption assuming a consumptive ratio of 0.74 based on reported data; (c) reported annual discharge; (d) calculated as reported annual withdrawal divided by 365; (e) reported consumptive ratio; and (f) averages calculated as the mean of the sample.

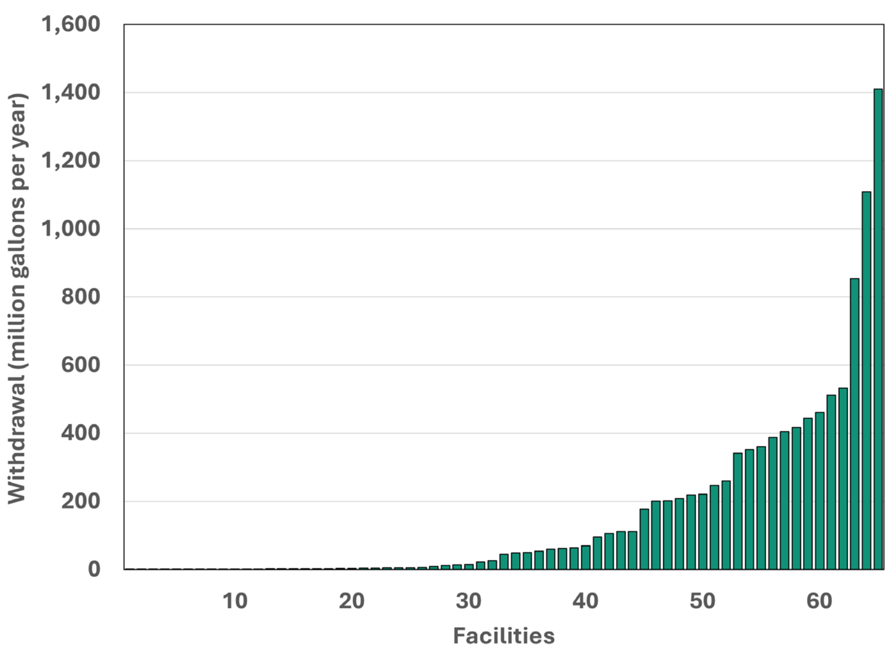

Figure 4. Water Withdrawal in Million Gallons Per Year of 65 Data Centers.
Data Sources: Facility-level data from Google 2025; Microsoft 2026; and Han et al. 2026

Water consumption among data centers also varied considerably, ranging from as little as 10,000 gallons to 1.0 billion gallons per year (Table 1). Among the 36 facilities reporting both water withdrawals and consumption, an estimated 10% to 94% of the water withdrawn was consumed (Figure 5). A typical facility, as indicated by the median value, consumed 74% of the water withdrawn. However, the overall average for the data centers was considerably lower at 59%. The lower mean value reflects a subset of facilities likely using air or once-through cooling systems that consume less of the water withdrawn. However, cooling technology was not consistently reported, making it difficult to draw robust conclusions with the available data.

Municipal drinking water systems were the primary water source for the data centers. Of the estimated 11 billion gallons of water withdrawn by the facilities evaluated, 76% was potable water, meaning that the water was treated so that it was safe for drinking and cooking. The remaining 24% came from non-potable water sources, including recycled water and seawater.

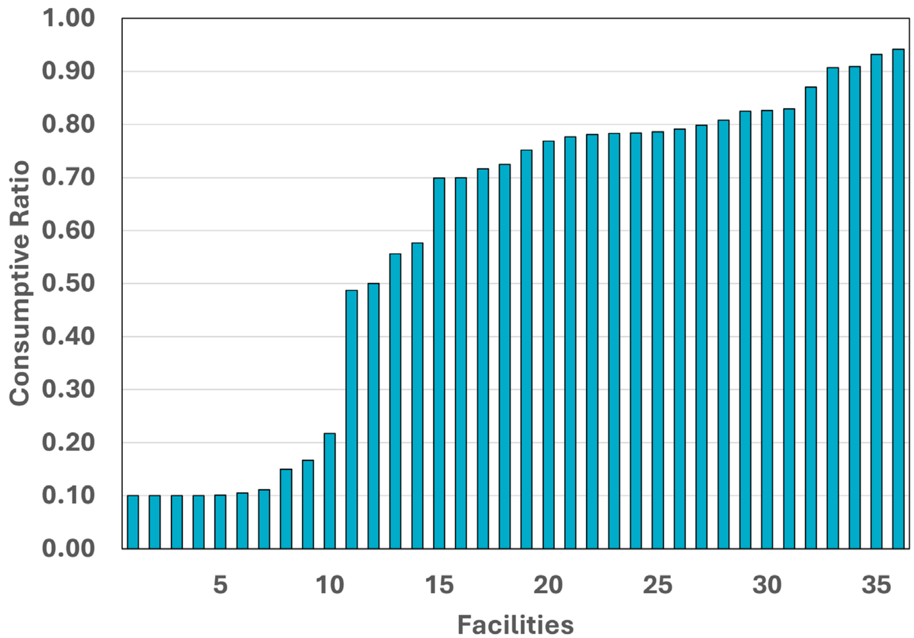

Figure 5. Water Consumptive Ratio of 36 Data Centers.
Data Sources: Facility-level data from Google 2025; Microsoft 2026; and Han et al. 2026

Question: How Does Data Center Water Use Compare With Other Water Users?

Takeaway: The water demands of large data centers differ sharply from most commercial buildings, and these differences may create unique challenges for municipal water systems serving them. They withdraw far more water than most commercial water users; concentrate their use during the hottest periods; and consume a much larger share of the water withdrawn.

Citing a 2024 study from Virginia (Joint Legislative Audit and Review Committee 2024), industry representatives have asserted that most data centers use the same amount of water or less than a large office building (see, for example, *Data Center Coalition Comments* 2026 and *Silicon Valley Leadership Group*, n.d.). In this brief, we compare reported water withdrawals for data centers with other commercial buildings. Figure 5 shows average water withdrawals from reported data along with other large commercial buildings, i.e., those occupying more than 200,000 ft^2, from the 2012 US Energy Information Administration (EIA) Commercial Buildings Energy Consumption Survey. While focused on energy, the survey collected water data in 2007 and 2012 but has not collected these data since then. According to the data, average daily water withdrawals for commercial buildings ranged from 3,000 gallons per day for large warehouses to 74,000 gallons per day for inpatient health care buildings (Figure 6). Commercial office buildings were at the lower end of this range, averaging 18,000 gallons per day.

By comparison, for the 65 data centers shown in Figure 4, 91% withdrew more water than commercial office buildings, and 72% withdrew more water than inpatient health care buildings – the most water-intensive commercial building surveyed. In fact, the median daily water withdrawals of large data centers (121,000 gallons per day) were about 6.7 times higher than a large office building, and the reported withdrawals of the three most water-intensive data centers (average of 3.1 million gallons per day) were 172 times greater than a large office building (Figure 6).

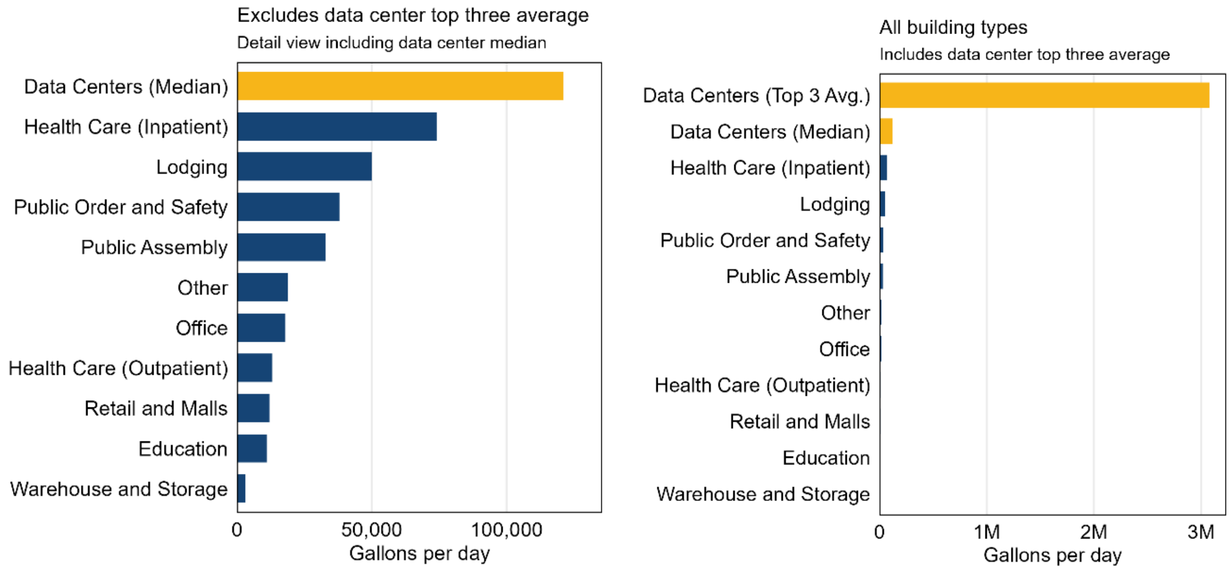

Figure 6. Average Daily Water Withdrawals of Commercial Buildings, by Type.
Data Sources: Commercial building daily water withdrawals from 2012 US EIA Commercial Building Energy Consumption Survey (CBECS). Data center water withdrawals are based on reported data from Google 2025, Microsoft 2026, and Han et al. 2026.
Notes: Left panel includes all CBECS buildings and the facility-level median for data centers (n=65). Right panel includes the same data, as well as withdrawals for the average of the top 3 largest water-using data centers from the reported data. Yellow is used to represent data centers, whereas blue is used to represent other commercial buildings.

Another quality of data center water use is that it has higher "peaking factors" than other large water users. A peaking factor provides a comparison of a facility's maximum daily water demand and its average daily demand. For data centers, peak daily water demand can range from 3 to 30 times the average - a much larger swing than other high-demand sectors like hospitals, where peaking factors are typically below 3 and often closer to 1.5 to 2 (Han et al. 2026). The high peak use of data centers is due to the need for more intensive cooling on the hottest days of the year. These characteristics are rarely reported publicly but are critically important for water managers who must plan infrastructure to reliably meet peak demand.

Finally, data centers consume a much higher proportion of the water withdrawn. According to the reported data, a typical data center, as indicated by the median value, consumed 74% of the water withdrawn (Table 1). Other sources report typical consumptive ratios for data centers of 70% to 90% (Han et al. 2026). These compare to an average of about 12% consumed from all public water supplies across the contiguous US (Medalie et al. 2025). High rates of consumption mean that less water sent to data centers is available for other uses within the watershed, including for downstream ecosystems.

Conclusion

There is growing concern about the water requirements of data centers, especially large AI data centers. Available data indicate that water withdrawals and consumption are highly varied. However, most large data centers – which represent a growing share of the market – use far more water than a typical large commercial building. While data centers represent a relatively small proportion of global or even national water use, data center water use can be locally significant, especially in water-scarce and rural areas. Additionally, data center water use is concentrated in hotter periods and is more consumptive than most uses of municipal water. High peak water use has important implications for sizing and cost of water supply and treatment infrastructure, and the consumptive nature of data center water use reduces water availability for other uses within the water basin.

We conclude that water must be a key consideration for the siting, design, and operation of data centers. Furthermore, these decisions must be made openly and transparently. The lack of standardized reporting on the number, size, location, and water use of data centers makes it difficult for communities, water managers, and decision-makers to understand and adequately address potential impacts. While data are limited for all commercial and industrial water users, this issue is especially important for data centers because of the rapid pace and scale of development and expansion into new areas. More and better water and energy data are needed, including facility-level measurements of monthly water withdrawals and consumption, monthly energy consumption, daily peak and non-peak demand, water and energy sources, WUE, energy capacity, and cooling technologies employed. These data can help analysts evaluate emerging trends and help communities anticipate and mitigate local and regional impacts. More broadly, greater data availability enhances transparency and ultimately trust.

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