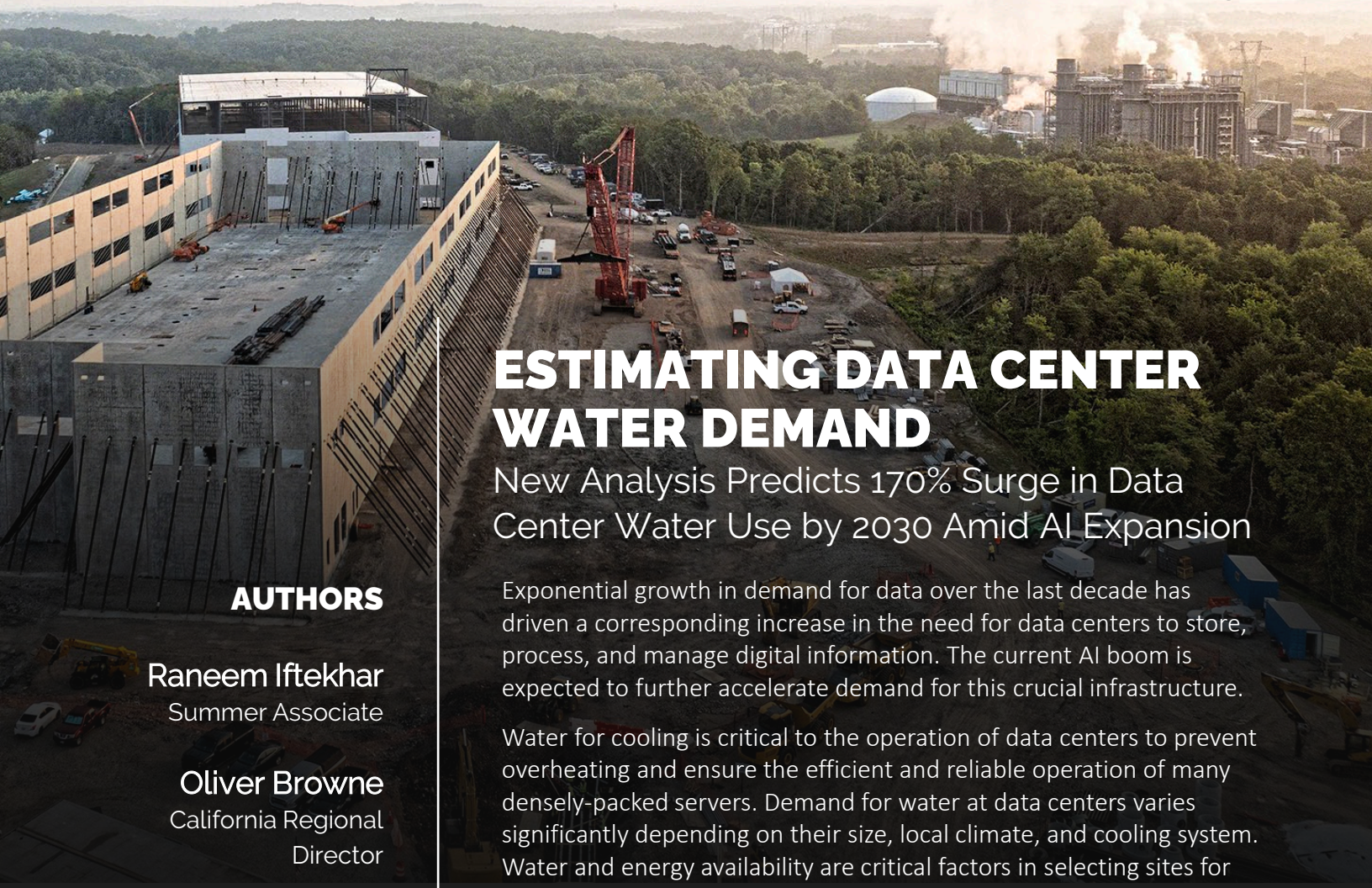
WATER MARKET INSIDER

Q2, 2025



ESTIMATING DATA CENTER WATER DEMAND

New Analysis Predicts 170% Surge in Data Center Water Use by 2030 Amid AI Expansion

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Exponential growth in demand for data over the last decade has driven a corresponding increase in the need for data centers to store, process, and manage digital information. The current AI boom is expected to further accelerate demand for this crucial infrastructure.

Water for cooling is critical to the operation of data centers to prevent overheating and ensure the efficient and reliable operation of many densely-packed servers. Demand for water at data centers varies significantly depending on their size, local climate, and cooling system. Water and energy availability are critical factors in selecting sites for data centers. For example, Google's facility in The Dalles, Oregon, is strategically located to leverage local hydroelectric power and water availability. The data center accounts for over 25% of the local municipality's water consumption. As the data center sector continues to expand there will likely be increased need for expertise in planning and acquiring local water resources for new data centers, particularly in water scarce regions such as the Western United States.

This market insider examines patterns data center water use, including the relationship between data center water consumption, energy consumption and square footage in order to forecast future data center water demand in the United States.

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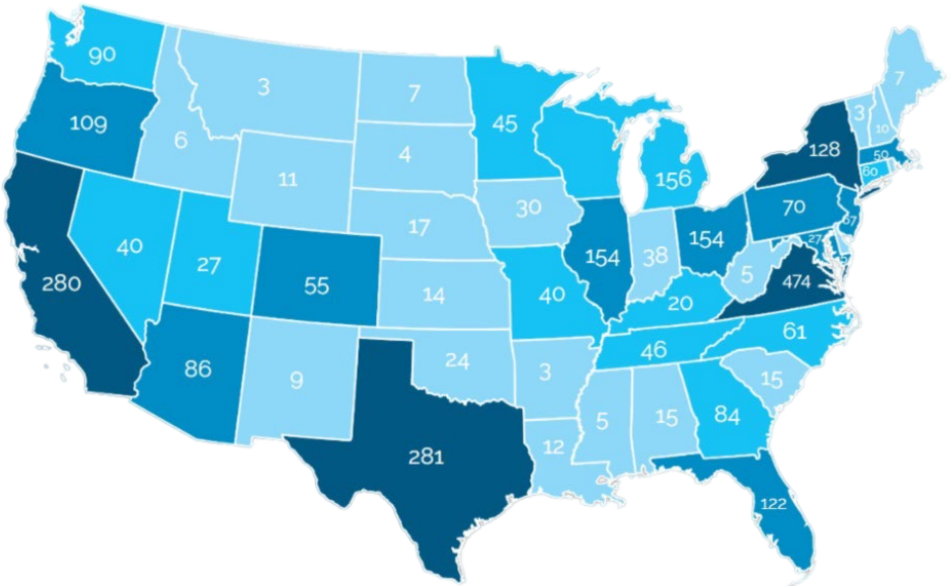
DATA CENTERS OVERVIEW

- Currently, there are over 1,000 hyperscale data centers in the United States, defined as data center facilities exceeding 10,000 square feet.
- Over the next decade, 120 to 130 new hyperscale data centers are expected to come online each year.[1]
- Hyperscale data centers are often strategically placed for access to the electrical grid and water sources.
- Operating a data center for a company like Microsoft or Google requires an outsized amount of land, capital and resources like water and energy. Typical development costs range from $600 to $1,000 per gross square foot, meaning that data centers of the scale developed by these can easily cost billions of dollars.[2]
- There is no regulatory requirement to register data centers, meaning site-specific power and water use data is often not published. Some companies elect to disclose data center power and water use as part of their sustainability reporting, providing a partial insight into water use.

DATA CENTERS IN THE US

An estimate of the current number of data centers in each state. (2024)[3]

Certain water-scarce regions such as California and Texas have been focal points of data center development.



Source: www.datacentermap.com/usa/

[1] *Synergy Research Group, "Hyperscale Data Centers… Total Capacity is Doubling Every Four Years"*
[2] *Cushman & Wakefield, "Data Center Development Cost Guide 2025"*
[3] *Data Center Map, "USA Data Centers"*

DATA CENTER WATER USE

- The primary use of water in data centers is for cooling.

- Consumptive water use is the difference between water withdrawn from a source, such as a river, groundwater, municipal supply, and the amount returned. Depending on the cooling system, the percentage of water either lost to evaporation or discharged at a higher temperature can vary significantly.

- Densely packed servers in data centers generate significant heat, which must be managed through various cooling processes.

- Cooling systems vary in their resource demands: air cooling systems consume minimal water but are generally less energy efficient, while water cooling systems use significantly more water but are preferred for larger data centers due to their much lower energy consumption.

- This creates a trade-off between reducing water use and reducing energy use (and associated greenhouse gas emissions).

- Climate considerations such as temperature and altitude can also influence the relative efficiency of different cooling systems.

METHODOLOGY

- This research focuses on 30 hyperscale data centers across the United States that utilize water-cooling systems. Data was collected from sustainability reports released by Google, Meta, Apple, Amazon, and Microsoft, which often include power and water metrics, sometimes detailed by facility.[4] Information was gathered on the location, size, power usage, and approximate water demand of these data centers.

- When specific data was unavailable, total facility power demand was estimated using power use efficiency (PUE) metrics. Additional insights into water demand were obtained from municipal records and press reports, which highlighted these centers as significant consumers of local water supplies.

[4]Meta, "2023 Sustainability Report"
Apple, "Environmental Progress Report"

BY THE NUMBERS

Characteristics of an average hyperscale data center

Size	1.09 million square-feet
Power	0.88 TWh
(PUE) Power Use Efficiency [5]	1.10
Consumptive Water Demand	378 acre-feet / year
Estimated Development Cost	$0.7-1.1 billion

Note: [5]Power Use Efficiency (PUE) measures a data center's energy efficiency as the ratio of total energy consumption to IT equipment energy consumption. Lower values, closer to 1, indicate better efficiency.

DATA CENTER POWER CONSUMPTION AND WATER CONSUMPTION ARE HIGHLY CORRELATED

- Using a regression model, we examined the relationship between data center power consumption and water consumption.
- In our analysis, power consumption is the largest and most statistically significant predictor of data center water consumption.
- Based on our model, each additional terawatt-hour (MWh) of power consumption is associated with a 1,100 acre-foot increase in water consumption.
- This relationship can be used to forecast future data center water demand based on projections of future power demand.
- We considered the relationship between data center square footage and water consumption. While a statistically significant relationship was found, the correlation was weaker compared to power consumption, likely due to variations in server density across facilities. For every million square-foot increase in facility size, consumptive water use increases by 54 acre-feet.
- We also considered the relationship between water consumption and environmental factors such as annual average temperature and elevation. However, our small sample did not reveal a statistically significant relationship with these variables.

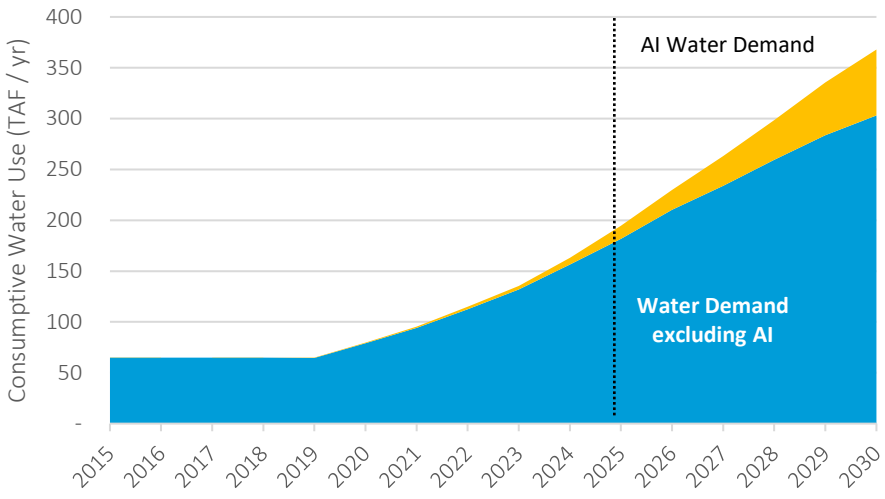
FORECASTING CURRENT AND FUTURE DATA CENTER WATER DEMAND

- We forecast future data center water demand based on future data center power demand. Specifically, we rely on forecast data center energy demand estimates produced by Goldman Sachs Research.[6]

- Goldman Sachs Research estimates that AI will drive an increase in data center power consumption equivalent to approximately 200 terawatt-hours (TWh) per year between 2025 and 2030, representing an 9% annual growth rate during this period.

- By 2030 AI is expected to account for roughly 19% of total data center power demand.

Data Center Water Consumption



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USING POWER DEMAND TO PREDICT WATER DEMAND

- Taking the relationship between power and water use identified earlier, it is possible to predict the rise in total data facility water demand from 2020-2030.

- Our findings show that between 2023 and 2030 data center water consumption in the US is projected to increase by 170%.

[6]*Goldman Sachs, "AI, data centers and the coming US power demand surge"*

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CONCLUSION

The ongoing development of hyperscale data centers by major tech companies such as Google, Meta, and Microsoft in regions like California, Arizona, and Texas is expected to significantly impact local water markets. These data centers primarily source their water through lease agreements with municipal or regional water utility companies. These regions, known for their arid climates and already high-water demand, could face increased competition for limited water resources. Currently, 20% of data centers rely on watersheds under moderate to high stress due to drought. Although data centers typically use less water than agriculture or municipal sectors, they can still represent a significant demand in localized areas, especially when multiple large-scale centers are developed concurrently, as seen in hubs like Arizona's Elliot Road Tech Corridor in Mesa and Silicon Valley's Santa Clara.

FURTHER READING

- Goldman Sachs Research report
- The Oregonian, "Apple will pay for Prineville water storage to meet data centers' enormous thirst"

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We work across the country with five regional offices to provide market intelligence, valuation, transaction advisory, strategic planning, and asset management services relating to water rights and water resources. We are known for our rigorous analysis, and information-driven water rights investment strategy formulation and execution

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