SPECIAL REPORT — TECHNOLOGY & SUSTAINABILITY

DATA CENTERS AND WATER: HYPE VS. REALITY

The full story behind the headlines — direct and indirect consumption, cooling technology, and projections through 2030

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Data Centers and Water: Hype vs. Reality

The full story behind the headlines — why AI infrastructure's thirst for water is rising fast, and what the industry is doing to slow it down

The contamination story that has dominated water-sector attention in recent years — PFAS, lead, aging infrastructure — is now being joined by a very different kind of pressure on water systems: computation. Every AI query, video render, and cloud transaction ultimately traces back to a physical facility that must dissipate heat, and for decades the cheapest way to do that at scale has been evaporating water. As AI data center construction accelerates, that dependence is colliding with water-stressed regions across the United States and the world.

Water enters a data center's footprint through two distinct channels: direct, on-site consumption for cooling towers and humidification, and indirect consumption embedded in the electricity generated to power servers and cooling systems — most of it withdrawn and consumed by thermoelectric power plants. Understanding the scale of the problem, and the technology now emerging to address it, requires looking at both halves of that equation.

> ***Indirect, energy-related water consumption accounts for roughly 75% of a data center's total water footprint on average — meaning the power plant behind the meter often matters more than the cooling tower on site.***

The scale of the problem, in numbers

U.S. data centers directly consumed an estimated 17–20 billion gallons of water in 2024–2025, up from 17.4 billion gallons in 2023 — roughly the annual water use of 155,000 to 185,000 U.S. households, using EPA benchmarks of about 300 gallons of daily household water use. Analysts project that figure could reach 38–73 billion gallons by 2028 — enough to supply a population of roughly 870,000 to 1.7 million people, similar in size to San Francisco or Phoenix, Arizona — with some projecting a quadrupling by 2030. North American AI data centers alone are estimated to have used roughly 264 billion gallons of water in 2025 once indirect, energy-related consumption is included — a figure comparable to New York City's entire annual water demand.

DIRECT ON-SITE USE	INDIRECT (POWER-PLANT) USE	WATER USAGE EFFECTIVENESS	LIQUID COOLING GAIN
17–20B gal US direct water use, 2024–25	**75%** share of total water footprint from power generation, on average	**1.80 L/kWh** industry-average WUE	**90%** less water vs. air cooling
+170% projected US growth by 2030	**+25–35%** extra electricity needed if on-site water cooling is replaced with air cooling	**0.27 L/kWh** Microsoft's fleet-average WUE, 2025	**1.03–1.08** PUE achieved with immersion cooling

Figure 1: The Data Center Water Equation

Four measures that define how data centers consume water, and how new cooling technology is changing the math.

WUE (Water Usage Effectiveness) measures liters of on-site water consumed per kilowatt-hour of IT equipment energy — lower is better. It is the water-focused counterpart to PUE (Power Usage Effectiveness), which measures a facility's total energy use per unit of IT energy. The "+25–35%" figure captures an important trade-off: removing on-site evaporative water cooling in favor of air-cooled chillers avoids direct water use, but the facility then draws more electricity — which shifts, and can increase, water demand at the power plant instead of eliminating it.

Where the growth is coming from

Nearly every recent projection points the same direction: sharply rising demand through the end of the decade, driven overwhelmingly by AI infrastructure rather than traditional enterprise or cloud workloads. Global data center electricity demand is projected to roughly double from about 485 terawatt-hours (TWh) in 2025 to 950 TWh in 2030, reaching close to 3% of global electricity consumption. By 2030, that is nearly three times the electricity Pakistan, Bangladesh, and Nigeria use today combined — enough that, treated as a single country, data centers would rank as roughly the sixth-largest electricity consumer in the world. Because indirect water use tracks electricity demand, the water footprint is on a similar trajectory even where facilities eliminate on-site cooling water entirely.

A 2026 UN-affiliated analysis projects that global data centers could consume 9.3 trillion liters (roughly 2.46 trillion gallons) of water annually by 2030 — comparable to the basic domestic water needs of the 1.3 billion people of Sub-Saharan Africa for a year, or roughly 300 gallons for every person on Earth, about a single day's water use for an average American household. In the U.S., AI servers alone are projected to consume between 200 and 300 billion gallons of water annually across the 2024–2030 window. Texas illustrates how concentrated this growth can be: water use there is projected to climb from about 49 billion gallons in 2025 to as much as 399 billion gallons by 2030 — equivalent to draining Lake Mead, the country's largest reservoir, by more than 16 feet in a single year.

Geography	Current (2025)	2030 Outlook
United States (direct)	17–20 billion gal/yr	38–73B gal/yr by 2028; potential quadrupling by 2030
United States (total, incl. AI)	n/a	+170% vs. 2023 baseline
North America (AI, total footprint)	~264 billion gal/yr	Tracking toward global 2030 figure below
Texas	~49 billion gal/yr	Up to 399 billion gal/yr by 2030
Global (total footprint)	n/a	9.3 trillion liters (~2.46T gallons) by 2030

Figure 2: Current vs. Projected Water Demand by Geography

Estimates vary by methodology, particularly whether indirect, energy-related water is included.

New cooling technology is changing the math

The most significant shift underway in the data center industry is the move from evaporative-tower cooling toward liquid cooling delivered directly to the chip or rack — and, most recently, toward closed-loop systems designed to consume close to zero water after their initial fill.

Direct-to-chip (cold plate) cooling. Coolant is circulated through cold plates mounted directly on CPUs and GPUs, removing heat at the source. This is currently the fastest-growing segment of the liquid cooling market.

Immersion cooling. Servers are submerged in a dielectric fluid that absorbs heat from all components directly, cutting water use by roughly 90% relative to air cooling and cooling costs by around 40%, while achieving a Power Usage Effectiveness (PUE) of 1.03–1.08 versus 1.50–1.80 for conventional air-cooled facilities.

Closed-loop, zero-water design. Sealed liquid loops are filled once and continuously recirculated, rejecting heat to outside air via dry coolers rather than evaporation. Microsoft states that all of its data center builds since August 2024 use zero-water designs, and its CEO has said next-generation closed-loop facilities under construction in Phoenix, Arizona, and Mount Pleasant, Wisconsin use roughly as much water annually as a single restaurant.

Warmer, fan-free liquid cooling. Nvidia's newest AI server platforms are entirely liquid-cooled, circulating coolant at approximately 45°C (113°F) — warm enough that outside air can passively remove heat via radiators in most climates without evaporation or fans. Nvidia estimates a 50-megawatt facility adopting this design could save more than $4 million per year in combined cooling energy and water costs.

Cooling Technology	Relative Water Intensity	Key Metric
Evaporative tower / air-cooled		**PUE 1.5–1.8**
Water-cooled chiller		**25–35% less power**
Direct-to-chip liquid		**High-density capable**
Immersion cooling		**PUE 1.03–1.08**
Closed-loop / zero-water		**~0 gal after fill**

Figure 3: Relative Water Intensity by Cooling Technology

Illustrative comparison; shorter bar indicates lower on-site water intensity. Actual performance varies by climate, load, and design.

PUE (Power Usage Effectiveness) is the standard data center efficiency metric: total facility energy use (IT equipment plus cooling, lighting, and power distribution) divided by IT equipment energy use alone. A PUE of 1.0 would mean zero energy overhead beyond the servers themselves; the industry average is roughly 1.5–1.8, while immersion-cooled facilities have reported 1.03–1.08. Lower PUE means less wasted energy — and, because most electricity is generated by water-cooled power plants, less indirect water use as well.

Bigger, denser, hotter: is new capacity outpacing the cooling gains?

A parallel trend complicates every efficiency claim above: newly planned data centers are not simply replacing old capacity with more efficient equivalents — they are far larger and far more power-dense than the facilities they are joining. A legacy enterprise rack drew roughly 1–16 kilowatts (kW). Today's flagship AI training racks, such as Nvidia's GB200 NVL72, draw 120–140 kW, and next-generation Blackwell Ultra and Rubin-based systems are expected to reach 250–900 kW per rack as soon as 2026–2027 — an increase of roughly one to two orders of magnitude (10x to well over 100x) in power, and therefore heat output, per rack.

Because virtually all the electricity a server consumes is ultimately converted into heat that must be removed, rack-level power density and cooling load rise together — this is exactly why air cooling, adequate for facilities in the 10–15 kW-per-rack range, becomes physically inadequate above roughly 30–40 kW per rack and forces the shift to the liquid and immersion cooling described above. At the same time, individual facilities are scaling up even faster than rack density: where a large hyperscale data center a decade ago drew tens of megawatts, new AI campuses are being planned at gigawatt scale. Meta's Hyperion campus in Louisiana is designed for 5 gigawatts (GW), with a 2 GW first phase due by 2030; OpenAI's Stargate program has reached roughly 7 GW of planned capacity on its way to a stated 10 GW target; and Meta's CEO has said the company plans to build "tens of gigawatts this decade, and hundreds of gigawatts or more over time." Industry-wide, more than 670 planned hyperscale and colocation projects are expected to bring over 129 GW of new capacity online.

Metric	Legacy / Traditional	Today (2026)	Planned / Next-Gen
Rack power density	1–16 kW/rack	120–140 kW/rack (Nvidia GB200 NVL72)	250–900 kW/rack (Blackwell Ultra / Rubin, 2026–27)
Typical facility scale	Tens of MW	500 MW – 1 GW+ campuses	Multi-GW campuses (Meta Hyperion: 5 GW; OpenAI Stargate: ~7–10 GW target)
Global planned pipeline	n/a	n/a	129+ GW across 670+ announced projects

Figure 4: Rack Density and Campus Scale, Then vs. Now vs. Next

Higher rack density means proportionally more heat to remove per rack; larger campuses mean proportionally more total heat and power across the facility.

This is the tension underlying every efficiency claim in this report. Per unit of compute, new cooling technology is genuinely reducing water and energy intensity — immersion cooling alone cuts water use by around 90% and improves PUE from 1.5–1.8 down to 1.03–1.08. But those gains are being measured against a base of installed capacity that is itself growing by one to two orders of magnitude in rack density and by roughly 10x or more in aggregate campus size. A single next-generation gigawatt AI campus, even built with the most water-efficient closed-loop cooling available, still requires enough electricity to power hundreds of thousands of homes — and the indirect water footprint tied to generating that electricity (roughly three-quarters of the total, as discussed above) does not disappear just because the cooling loop at the rack no longer evaporates water. That is the core reason total sector water and energy demand is still projected to rise sharply — a 170% increase in U.S. data center water use and a near-doubling of global data center electricity demand by 2030 — even as the newest individual facilities are, rack for rack, far more water-efficient than the ones they are replacing.

Corporate commitments: the 2030 'water positive' pledge

Microsoft, Google, Amazon, and Meta have each pledged to be water positive by 2030 — replenishing more water than they consume. Microsoft says it reached that milestone globally in 2025, five years ahead of schedule, through efficiency gains, recycled and reused cooling water, and watershed replenishment projects. Meta's strategy relies on dry cooling that uses zero water for most of the year, combined with closed-loop systems for high-density AI racks, and a commitment to restore 200% of water consumed in high-water-stress areas. AWS uses recycled or reclaimed water for cooling at 20 data centers worldwide and reported global data center water use of about 2.5 billion gallons in 2025 — comparable to the annual water use of a small city of roughly 55,000 to 60,000 residents. Google's disclosed water use, by contrast, has continued climbing — from 4.3 billion gallons in 2021 to 6.1 billion gallons in 2024, or roughly the annual water use of a city the size of Syracuse, New York (about 140,000 residents) — illustrating the tension between efficiency pledges and rapid capacity growth.

Where the conflict is playing out locally

Because new capacity is concentrating in a small number of regions, local water conflicts are escalating even as national-level efficiency improves. In California's Imperial Valley, a data center developer that had pledged not to draw on the Colorado River is now suing a local irrigation district for roughly 260 million gallons per year — enough to supply about 6,000 residents, or nearly 2,400 households, for a year. The facility is expected to need around 750,000 gallons of water per day — more than the volume of an Olympic-sized swimming pool (about 660,000 gallons) — every single day. Iowa regulators found 40 unpermitted wells at a Cedar Rapids data center site. Georgia's governor declared a drought emergency amid a wave of data center announcements. Amazon reached a $20.5 million settlement over nitrate pollution tied to data center operations. In the first quarter of 2026 alone, lawmakers in more than thirty states introduced over 300 data-center-related bills, and local opposition contributed to roughly twenty projects being cancelled or stalled.

> ***Water availability — not just electricity interconnection — is emerging as a genuine constraint on where new AI data center capacity can be built.***

Is the water criticism warranted? A balanced look

Coverage of data center water use has grown sharply alongside the facilities themselves, and the tone is often alarmist. An honest assessment requires holding two things at once: nationally, data centers remain a small share of total water withdrawals, and locally, in specific communities and river basins, the strain is real, fast-moving, and often poorly disclosed.

The case that coverage overstates the problem. A July 2026 analysis from the Information Technology and Innovation Foundation (ITIF) found that U.S. data centers account for roughly 0.3–0.4% of total daily water withdrawals nationally — not even a third of a percent — and that indirect, energy-related consumption is more than ten times larger than direct, on-site cooling water. The report concludes the water problem is technically "soluble": new closed-loop and liquid cooling technology can already push a facility's direct water use toward zero, and the main barriers remaining are institutional — inconsistent metrics, weak disclosure requirements, and fragmented state-level oversight — rather than a fundamental resource constraint. Google has separately argued that evaporative cooling, in places where local supplies are not stressed, can be the better overall environmental trade-off because it reduces electricity demand, and therefore indirect water use, relative to all-liquid designs.

The case that concerns are warranted. National averages mask a highly uneven distribution of new capacity. xAI's Colossus 2 campus in Memphis, one of the largest AI data center projects under construction, is expected to use up to 1 million gallons of water per day once complete, in a community already navigating separate disputes over the facility's on-site gas turbines. In California's Imperial Valley, Iowa, Georgia, and Texas — all discussed above — specific projects have triggered lawsuits, unpermitted-well discoveries, and drought emergencies precisely because new capacity is landing in water-stressed basins faster than local planning processes can absorb it.

> ***"The single most common concern — more than noise, more than water usage, more than rising utility bills — is the one word that keeps appearing in submission after submission: transparency." — Erin Brockovich, The Brockovich Report, 2026***

Environmental activist Erin Brockovich, best known for the 1990s Hinkley, California groundwater contamination case that inspired the film bearing her name, launched a crowdsourced "Brockovich AI Data Center Reporting" map in April 2026 to track community-level complaints about data center projects nationwide. The project logged more than 5,000 resident reports across nearly all 50 states within its first six weeks. Brockovich has been explicit that the single most common complaint is not water or noise but transparency: many of the projects logged were approved through non-disclosure agreements and expedited zoning variances, with residents reporting they learned of a facility's true scale — and its water and power draw — only after construction had already begun. Partly in response to organized local opposition, the Georgia municipalities of Palmetto and Fayetteville joined Atlanta in restricting or banning new data center construction in early 2026.

Both sides of this debate are, in a narrow sense, correct. Measured against total national water withdrawals, data centers are a rounding error — the ITIF's 0.3–0.4% figure is a legitimate rebuttal to headlines implying a nationwide water crisis. But water is a local resource, and the industry's own siting pattern — concentrating gigawatt-scale campuses in a handful of drought-prone regions, often with limited advance disclosure to residents — means the communities directly affected are not experiencing a rounding error. The most defensible conclusion: the "bad press" is directionally warranted at the local and procedural level (concentrated water stress, and a genuine transparency deficit), even where it is frequently overstated at the national, aggregate level.

What this means for water professionals

1. Track both sides of the ledger. A facility's direct WUE tells only part of the story; the water intensity of its regional power grid matters just as much.

2. Expect closed-loop and liquid cooling to spread quickly. What is a 2026 pilot at a handful of hyperscale sites is likely to become a baseline design assumption for new AI-optimized capacity within a few years.

3. Watch permitting, not just power queues. Water allocation, well permitting, and drought emergency declarations are increasingly deciding where projects can proceed — utilities and regulators in growth corridors should expect more scrutiny, not less.

4. Efficiency gains are not the same as lower total consumption. Per-facility water intensity is falling, but the sheer scale of new capacity being built means total sector water demand is still projected to rise sharply through 2030.

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