The Water Argument

How Technology Has Already Answered the Data Center Water Criticism

By Russ Walker
May 2026

Rainey Center

An Analysis of Data Center Water Usage, Emerging Cooling Technologies, and the Peer-Reviewed Case for Data Centers as Net Water Producers

Data center water usage has become one of the most prominent and emotionally powerful arguments deployed by opponents of new data center development across the United States. In the Coachella Valley and similar arid communities, activist campaigns, some funded by foreign-linked organizations, have seized on water as a rallying point, arguing that data centers threaten local water supplies in already water-stressed regions.

This paper demonstrates that the water argument, while grounded in a legitimate concern about legacy cooling technology, fundamentally misrepresents where the industry is today and where it is unambiguously heading. The public debate has a right to be conducted on accurate, current information, not on a caricature of 1990s-era evaporative cooling towers.

The public, elected officials, and community stakeholders deserve to make decisions about data center development based on what these facilities actually do today—not on outdated technology descriptions that no longer reflect industry practice.

This Paper Makes Four Central Findings

1. Traditional evaporative cooling does consume significant water, up to 85% of withdrawal is lost to vapor, but this describes legacy infrastructure, not modern deployments.
2. Three transformative cooling technologies, immersion cooling, direct-to-chip liquid cooling, and atmospheric water harvesting, are already in commercial deployment or late-stage development today, and can reduce freshwater consumption to near zero.
3. A 2025 peer-reviewed study in Energy & Environmental Science concludes that modern data centers, properly designed, could become net water producers, supplying potable water back to host communities by using waste heat for thermal water purification.
4. U.S. policymakers should require disclosure of cooling technology in permitting processes, not as a barrier, but to ensure communities receive accurate, current information and that best-available water-efficient technologies are actually deployed.

Why Truth Matters Here

When communities make consequential decisions about infrastructure investment, zoning, and long-term resource planning, the quality of their information directly determines the quality of their outcomes. A community that rejects a modern data center on water grounds, based on descriptions of a technology the facility will not use, has not exercised informed self-governance. It has been misled. The purpose of this paper is to equip policymakers, community members, and journalists with the factual foundation to evaluate these claims accurately.

Why Accurate Information About Data Centers Matters

The Stakes of Misinformation

Data centers are among the most consequential pieces of infrastructure the United States will build in the coming decade. They power artificial intelligence systems, cloud computing, financial networks, healthcare records, and national security systems. Where they are built, and whether they are built at all, matters enormously to U.S. economic competitiveness, national security, and the digital services that American citizens rely on daily.

When public opposition to data center development is grounded in factual inaccuracies, the costs are not abstract. Projects are delayed or cancelled. Investment migrates to other jurisdictions, including foreign ones. Communities that might have benefited from tax revenues, local employment, and, as this paper will show, potentially improved water security, lose those benefits. The downstream effects ripple into the competitiveness of the U.S. technology sector and the readiness of U.S. digital infrastructure.

Accurate information is not a courtesy; it is a prerequisite for legitimate democratic deliberation. This is especially true when the inaccurate narrative is being amplified by organizations with interests that may not align with the communities they claim to represent.

The Foreign Funding Problem

Several of the most prominent data center opposition campaigns across the United States have received funding from, or been coordinated by, organizations with foreign government or foreign corporate connections. The pattern is concerning: a legitimate local concern, water usage in an arid region, is amplified by well-resourced outside groups whose interests may be less about local water security and more about constraining American AI infrastructure development.

This does not mean every community member who raises a water concern is acting in bad faith. Most are not. They are responding, reasonably, to information they have been given, information that happens to be outdated, incomplete, or selectively framed. The problem is not the concern; it is the accuracy of the information underlying it. That is precisely why it matters that the public, and the policymakers who serve them, have access to the full, current, and accurate picture.

Democratic Deliberation Requires Accurate Facts

In a healthy democratic process, communities should absolutely have the right to weigh the benefits and costs of data center development—including water usage, power consumption, land use, and local economic impact. That deliberation is legitimate and important.

What is not legitimate is conducting that deliberation on the basis of a technology description that is fifteen to twenty years out of date—or one that has been deliberately kept outdated to serve an advocacy agenda.

The goal of this paper is simple: to ensure that anyone engaging in this debate has access to what the industry actually looks like today, and what the peer-reviewed science says about what it can become. From that foundation, communities, legislators, and regulators can make genuinely informed decisions.

How Conventional Cooling Actually Works

To understand why the water argument requires updating, it is necessary to understand what it is actually describing, and what it is not.

The Evaporative Cooling Model

Traditional data center cooling operates on an evaporative principle: hot air from server rooms is passed through cooling towers containing water, and the evaporating water absorbs and carries away heat. The key distinction is between **water withdrawal** and **water consumption**.[1] Water withdrawal is the total amount drawn from a water source. Water consumption is the amount that does not return to the local water supply.

1 The distinction between water withdrawal and water consumption is standard in water resource accounting. See: Sunbird DCIM, "Data Center Water Consumption," https://www.sunbirddcim.com/glossary/data-center-water-consumption; and MOST Policy Initiative, "Data Center Water Use," April 2026, https://mostpolicyinitiative.org/science-note/data-center-water-use/.

In evaporative cooling systems, up to 85% of the water drawn is lost as water vapor, it does not return to the local water supply.[2] This is the legitimate basis for water concerns about data centers. It is a real phenomenon, and in water-stressed regions like the Coachella Valley or the arid Southwest, the consumption of water that does not return to the hydrological cycle is a serious matter.

However, and this is the critical point, this describes the old model. It describes the cooling infrastructure of data centers built ten, fifteen, or twenty years ago. It does not describe the direction the industry is heading, or the cooling technologies being deployed in new construction today.

Why This Distinction Has Been Obscured

Critics of data centers have, in many cases, deliberately conflated legacy cooling with current and future practice. This conflation serves an advocacy purpose: by describing evaporative cooling as if it were the only option, and by omitting the transformative shift underway in the industry, critics can present the water problem as permanent and inherent to data centers as a category, when in fact it is specific to an aging technology that the industry has strong economic and regulatory incentives to abandon.

Energy efficiency improvements alone have driven much of this transition. Modern AI workloads generate significantly more heat than conventional server tasks, making advanced cooling not just environmentally preferable but economically essential. The market has been moving toward low-water-consumption cooling for reasons that have nothing to do with activism, and that transition has now reached the point of commercial-scale deployment.

---

2 MOST Policy Initiative, "Data Center Water Use," April 2026, https://mostpolicyinitiative.org/science-note/data-center-water-use/ ("Up to 85% of the water data centers use evaporates and does not return to the water supply"); see also Environmental and Energy Study Institute, "Data Centers and Water Consumption," https://www.eesi.org/articles/view/data-centers-and-water-consumption.

New Technologies: Closing the Loop on Water

Three categories of innovation are rapidly displacing evaporative cooling as the industry standard. Each dramatically reduces or eliminates freshwater consumption. Each is already in commercial deployment. Together, they represent a categorical shift in the relationship between data centers and water.

Immersion Cooling (Dielectric Fluid)

The most transformative shift underway is immersion cooling: submerging servers directly in a thermally conductive, electrically non-conductive (dielectric) fluid that absorbs heat without any water evaporation. The fluid circulates in a closed

loop, functioning precisely like a radiator, once filled, ongoing freshwater consumption is essentially zero.[3]

Two-phase immersion cooling systems using advanced dielectric fluids such as Chemours' Opteon 2P50 can reduce cooling energy usage by up to 90%, nearly eliminate water use across most climates, and enable up to a 60% reduction in the physical data center footprint.[4]

Shell, ExxonMobil, and Chemours are among the major companies now supplying dielectric fluids commercially, with large-scale deployments already underway.[5] This is not a laboratory curiosity or an emerging technology in early trials. It is a commercially mature product line being purchased and deployed at scale by some of the world's largest data center operators.

Immersion cooling does not reduce water usage—it eliminates it. A properly designed immersion-cooled data center uses approximately zero ongoing freshwater for its primary cooling function.

Direct-to-Chip Liquid Cooling

Direct-to-chip cooling circulates coolant directly across the processor's cold plate, absorbing heat at the source before it

3 The Chemours Company, "Chemours Announces Development of New Specialty Fluid for Two-Phase Immersion Cooling: Opteon™ 2P50," Press Release, August 15, 2023, https://www.chemours.com/en/news-media-center/all-news/press-releases/2023/chemours-announces-development-of-new-specialty-fluid-for-two-phase-immersion-cooling-opteon-2p50.

4 Opteon by Chemours, "Liquid Cooling Solutions for Data Centers," https://www.opteon.com/en/applications/two-phase-immersion-cooling ("Reduce cooling energy usage by up to 90%—with a Power Usage Effectiveness (PUE) approaching 1 (as low as 1.05); nearly eliminate water use across most climates; and enable up to a 60% reduction in the physical data center footprint"); see also ExxonMobil, Data Center Frontier, "Meeting Data Center Cooling Demands with Immersion Cooling Fluids," https://www.datacenterfrontier.com/sponsored/article/55261111 ("Some immersion cooling systems today achieve partial PUE as low as 1.03").

5 On Shell and ExxonMobil: Journal of Petroleum Technology, "Running Hot and Cool for a Power Boost," November 2024, https://jpt.spe.org/running-hot-and-cool-for-a-power-boost. On ExxonMobil commercial products: ExxonMobil Product Solutions, "Data Center Liquid Immersion Cooling," https://www.exxonmobilchemical.com/en/industries/industrial-applications/data-center-immersion-fluids. On Chemours: see footnote 3 above.

ever enters the room air. This targeted approach can reduce water consumption by 20–90% in water-scarce regions and decrease total facility power needs by 18%.[6]

Major hyperscalers including Google and Microsoft are deploying this technology at scale in new facilities.[7][8] For communities evaluating new data center proposals, the relevant question is not whether data centers in general consume water, some older ones do, but what cooling technology the proposed facility will use and what its actual water consumption footprint will be. That is a question permitting processes should require developers to answer explicitly.

Atmospheric Water Harvesting: From Consumer to Producer

The most remarkable development in data center water technology, and the one that most directly answers the concerns raised by water-stressed communities, is atmospheric water harvesting (AWH). This emerging technology uses the waste heat that data centers already generate to extract water from the surrounding air.[9][10]

---

6 World Economic Forum, "What new water circularity can look like for data centres," November 2025, https://www.weforum.org/stories/2025/11/data-centres-and-water-circularity/ ("This innovation can reduce water consumption by 20–90% in water-scarce regions and decrease facility power needs by 18%, depending on the technology and climate").

7 Datacenters.com, "Why Liquid Cooling Is Becoming the New Standard in Hyperscale Facilities," May 2025, https://www.datacenters.com/news/why-liquid-cooling-is-becoming-the-new-standard-in-hyperscale-facilities ("In 2025, hyperscalers like Google, Meta, AWS, and Microsoft are rolling out liquid-cooled environments across their newest facilities").

8 Data Center Dynamics, "How hyperscalers are scaling direct-to-chip liquid cooling in Europe," October 29, 2025, https://www.datacenterdynamics.com/en/opinions/how-hyperscalers-are-scaling-direct-to-chip-liquid-cooling-in-europe/.

9 TechRepublic, "AI Data Centers Face Water Backlash—Can Air Solve the Crisis?" March 27, 2026, https://www.techrepublic.com/article/news-ai-data-centers-atmospheric-water-harvesting/; Upsite Technologies, "Can Atmospheric Water Harvesting Reshape How Data Centers Source Water?" April 9, 2026, https://www.upsite.com/blog/can-atmospheric-water-harvesting-reshape-how-data-centers-source-water/.

10 Water Online, "The Data Center Water Challenge: How Atmospheric Water Harvesting Can Secure AI's Thirsty Future," https://www.wateronline.com/doc/the-data-center-water-challenge-how-atmospheric-water-harvesting-can-secure-ai-s-thirsty-future-0001; AIChE, "Atmospheric Water Harvesting: A Path Toward Global Water Security," December 2025, https://chenected.aiche.org/2025/12/atmospheric-water-harvesting-path-toward-global-water-security.

A startup called Atoco has developed nano-engineered reticular (net-like) materials powered by the temperature differential between cold ambient air and the low-grade waste heat from servers, a differential as small as 7°C (13°F). Critically, the atmosphere contains seven times more fresh water than all rivers and lakes combined, and this system can harvest that water in any climate, including arid desert environments, exactly the conditions found in the Coachella Valley.[11]

AirJoule, backed by a joint venture with GE Vernova, has developed a complementary system based on metal-organic frameworks, the subject of the 2025 Nobel Prize in Chemistry, that extracts pure water from data center waste heat using a patented sorbent material, delivering clean water ready for reuse in cooling systems or release to the community.[12]

The significance of this development cannot be overstated. The same waste heat that critics cite as a liability, thermal energy produced by computing that must be managed, turns out to be a resource that can generate potable water from thin air. A well-designed modern data center in a desert community is not simply a zero-water-consumption facility. It can be a water production facility.

---

11 TechRepublic, "AI Data Centers Face Water Backlash—Can Air Solve the Crisis?" March 27, 2026, https://www.techrepublic.com/article/news-ai-data-centers-atmospheric-water-harvesting/ (quoting Omar Yaghi, Founder and Chief Science Officer of Atoco: "The atmosphere contains seven times more fresh water than all rivers and lakes combined"; "Even with a differential as low as 7°C (13°F), it is possible to power a water generation process"; system can operate "even in ultra-dry and arid environments").

12 AirJoule Technologies Press Release, "Memorandum of Understanding with Data Center Developer to Advance Onsite Water Production Using Waste Heat," GlobeNewswire, June 17, 2025, https://www.globenewswire.com/news-release/2025/06/17/3100735/0/en/AirJoule-Technologies-Announces-Memorandum-of-Understanding-with-Data-Center-Developer-to-Advance-Onsite-Water-Production-Using-Waste-Heat; Investing.com, "AirJoule to supply water from waste heat for Nexus data center," December 2, 2025, https://www.investing.com/news/company-news/airjoule-to-supply-water-from-waste-heat-for-nexus-data-center-93CH-4385965 ("AirJoule's technology employs metal-organic frameworks—the subject of the 2025 Nobel Prize in Chemistry"). The Nobel Prize in Chemistry 2025 was awarded for the development of reticular chemistry, including metal-organic frameworks. atacenterdynamics.com/en/analysis/how-airjouleplans-to-extract-water-from-data-centerwaste-heat/

The Peer-Reviewed Conclusion: Net Water Producers

A 2025 peer-reviewed study published in **Energy & Environmental Science**, conducted by researchers and reported by the European Commission, evaluated six potential uses for data center waste heat. Two applications stood out as particularly promising, both economically viable and environmentally transformative: direct air carbon capture, and thermal water purification.[13]

The Study's Findings

The study's conclusion is striking: thermal water purification, using data center waste heat to convert seawater or brackish groundwater into potable water, could turn data centers into net water producers for the communities that host them. Under the researchers' assumptions, a single kilowatt-hour of computing energy could simultaneously remove half a kilogram of CO_2 from the atmosphere and generate half a kilogram of clean water.[14]

The study's authors concluded that with advanced cooling and intelligent heat management, data centers could 'flip the switch', from facilities that consume water and produce carbon, to facilities that produce water and capture carbon.[15]

13 Diaz-Marin, C.D. and Berquist, Z.J. (2025), "Flipping the switch: carbon-negative and water-positive data centers through waste heat utilization," Energy & Environmental Science 18: 8403-8413, DOI: 10.1039/d5ee02676h; reported by European Commission DG Environment News Alert Service, "AI data centre waste heat could be used for water purification and carbon capture," March 30, 2026, https://environment.ec.europa.eu/news/ai-data-centre-waste-heat-could-be-used-water-purification-and-carbon-capture-2026-03-30_en.

14 European Commission DG Environment, "AI data centre waste heat could be used for water purification and carbon capture," March 30, 2026, https://environment.ec.europa.eu/news/ai-data-centre-waste-heat-could-be-used-water-purification-and-carbon-capture-2026-03-30_en.

15 Id.

In a water-stressed desert environment like the Coachella Valley, a data center designed to the current state of the art is not a liability. According to peer-reviewed science, it is a potential community asset.

Why This Finding Matters for the Public Debate

This study was not produced by the data center industry. It was published in a peer-reviewed scientific journal and reported by the European Commission, institutions with no particular interest in promoting U.S. data center development. The finding that data centers could become net water producers reflects the genuine state of the science, not industry advocacy.

When communities in the Coachella Valley or elsewhere are presented with the water argument, as if water scarcity and data center development are permanently and inherently in conflict, they are being given an incomplete picture. The complete picture, drawn from current technology deployments and peer-reviewed science, is very different: properly designed modern data centers can be net water producers in the very environments where water scarcity is most acute.

The question is not whether to allow water-consuming infrastructure. It is whether to allow, and encourage, water-producing infrastructure. Those are not the same question, and conflating them has real costs for communities that deserve accurate information.

Policy Implications: What Policymakers Should Do

The findings in this paper have direct implications for how data center development should be regulated, permitted, and evaluated by local, state, and federal policymakers.

Require Cooling Technology Disclosure in Permitting

The single most important reform policymakers can make is to require data center developers to specify their cooling technology in any permitting application.

This Requirement Should Include

- The cooling technology to be used (evaporative, immersion, direct-to-chip, or hybrid)
- Projected water withdrawal and water consumption figures
- Any water recovery or water production capabilities (atmospheric harvesting, thermal purification)
- Power Usage Effectiveness (PUE) targets and commitments

This disclosure requirement is not an obstacle to development. It is the information infrastructure necessary for communities to make genuinely informed decisions, and for regulators to distinguish between developers who have adopted best-available technology and those who have not.

Establish Best-Available-Technology Standards for Water

State legislatures and relevant federal agencies should work with the data center industry to establish best-available-technology (BAT) standards for water efficiency in new data center construction, particularly in water-stressed regions. These standards should be updated regularly to reflect the pace of technological change in the cooling sector.

Invest in Atmospheric Water Harvesting Research

The potential for data centers to become net water producers, particularly in arid Western states, represents a significant opportunity that federal research investment can accelerate. The Department of Energy's Office of Science and the National Science Foundation should prioritize atmospheric water harvesting and thermal water purification research in the context of data center waste heat utilization.

Conclusion

The water argument against data centers is built on a foundation that is already shifting beneath it. Yes, legacy evaporative cooling systems consume significant water. But the industry has already moved toward cooling technologies that reduce freshwater consumption to near zero or eliminate it altogether. And the peer-reviewed science now shows that the next generation of data centers, in the very desert communities where water concerns are most acute, could actually supply potable water back to the communities that host them.

The public deserves to know this. Elected officials deliberating over data center permitting deserve to know this. Journalists covering water protests against data center development deserve to know this.

The relevant question is not whether 1990s-era evaporative cooling towers use water. They do. The relevant question is what the next generation of data centers will actually do to water supplies in communities like the Coachella Valley, and the honest answer, based on current technology and current science, is the opposite of what most protesters have been led to believe.

Properly designed modern data centers, using immersion cooling and atmospheric water harvesting, can operate with near-zero freshwater consumption, and future facilities could supply potable water back to the communities that host them.

In a water-stressed desert environment, that is not a liability. It is a potential asset. And ensuring that communities understand the difference is not just good policy. It is essential to the integrity of the democratic process itself.

Rainey
Center

info@raineycenter.org
raineycenter.org