

UNITED ARAB EMIRATES
MINISTRY OF FOREIGN AFFAIRS



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CROSSCURRENTS

Navigating the
AI-Water-Energy Nexus

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Foreword



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Three years ago, in the *Ripple Effect* report, I wrote of the dangers posed by the cascading effects of unmitigated water scarcity. Since then, there have been encouraging steps towards stronger international action on water. Yet, in many parts of the world, the outlook has continued to worsen. At the same time, the extraordinary rise of artificial intelligence (AI) has brought with it a paradigm shift in both the nature of the global water crisis and our ability to address it.

The opportunities presented by AI are manifold, with the potential to advance significant progress across fields such as education, healthcare, agriculture, and climate adaptation. At the same time, AI is only as powerful as the resources that enable it. Unlocking this potential requires increasing amounts of energy and, in many cases, water to power and cool the infrastructure on which AI depends. As deployment accelerates and the risks of water scarcity increase, our opportunity is to future-proof the infrastructure powering AI by designing for energy and water resilience from the outset.

This report seeks to establish a clearer understanding of AI's water consumption across its value chain, and the risks these demands can pose to governments, the private sector, and communities if not managed responsibly. It also outlines how smart planning, innovation, and sound

governance could mitigate those risks. Renewable energy, in particular, holds potential to reduce AI's water and energy footprint substantially. In the United Arab Emirates, our leading institutions and brightest innovators are developing and continually improving more sustainable approaches to powering AI, in line with our national ambition to triple renewable energy capacity by 2030.

As we work to make AI more sustainable, there is good reason for optimism about what the technology itself can contribute to water resilience. From predicting demand and detecting leaks, to hydrological monitoring and weather forecasting, to optimizing irrigation, desalination, and water treatment, and managing water efficiency and depletion detection, AI is already helping us make every drop go further. AI helps us translate data and innovation into better decisions and real-world solutions for water management and use. The United Arab Emirates is catalyzing innovative solutions worldwide through initiatives such as the Mohamed bin Zayed Water Initiative and the Abu Dhabi Global Water Platform, as well as through the work of our national entities and academic experts.

Realizing these opportunities at scale, and successfully managing the growing interplay between water, energy, and AI, will require closer cooperation across borders and sectors. This report is being published as the United Arab Emirates and the Republic of Senegal prepare to Co-Host the 2026 United Nations Water Conference in Abu Dhabi this December. Only the third UN Water Conference in 50 years, the 2026 convening underscores the persistent challenge of generating sustained multilateral action on an issue fundamental to human life, development, and security.

As Co-Hosts, we are determined to make the 2026 UN Conference a catalyst for concrete action and a turning point for international cooperation on water. This report offers recommendations for navigating the AI-water-energy nexus in a way that supports human dignity, prosperity, and global security, addresses the water-scarcity risks identified in the *Ripple Effect* report, and speaks to how the Conference can mobilize stakeholders and contribute to these efforts.

Above all, this report is an invitation to the international community to help shape how we navigate this new frontier. AI is opening possibilities that could scarcely have been imagined only a few years ago. Used wisely, it could help us solve one of humanity's oldest and most fundamental challenges: ensuring safe and reliable access to water for all.

Executive summary

In 2023, the *Ripple Effect* report identified water scarcity as an underrecognized threat to global security and prosperity. Three years on, the water risk has intensified. The UN University declared in January 2026 that parts of the world have moved past scarcity into water bankruptcy, a state of depletion that cannot be reversed. Meanwhile, new technology is simultaneously offering new solutions and accelerating water consumption. Artificial intelligence (AI) is opening up groundbreaking new opportunities to enhance water management and efficiency but has also become a significant new claim on both water and energy, at present growing faster than efficiency gains alone can offset. As industry and political leaders across the world acknowledge the risks associated with AI development and try to regulate its role in society, resource use management remains a foundational concern.

*AI's water use is measurable. Global data center water use is projected to roughly double between 2025 and 2030, reaching **9.32 trillion liters**. The AI share within that total is expected to quadruple.*

Most of the water use is not at data centers, but upstream, in the power plants and chip fabrication plants that make AI possible.

This report makes three arguments:

AI's resource footprint cannot be assessed at data centers alone. It runs across the value chain, from semiconductor fabrication to cooling to power generation, and lands hardest on local basins, grids, and communities.

Efficiency gains will not resolve the problem. Every cooling and energy choice trades water against power, and cheaper computing tends to invite more resource use, rather than less. Managing that trade-off means planning water, energy, and digital infrastructure as one system rather than three.

The binding constraint is increasingly political, as well as technical. Community concerns and permitting decisions now shape where AI infrastructure can be built, a pattern this report traces through case studies from around the world, with a deeper dive into the UAE, where water constraints and rapid growth set conditions for integrated planning and innovation from the outset.

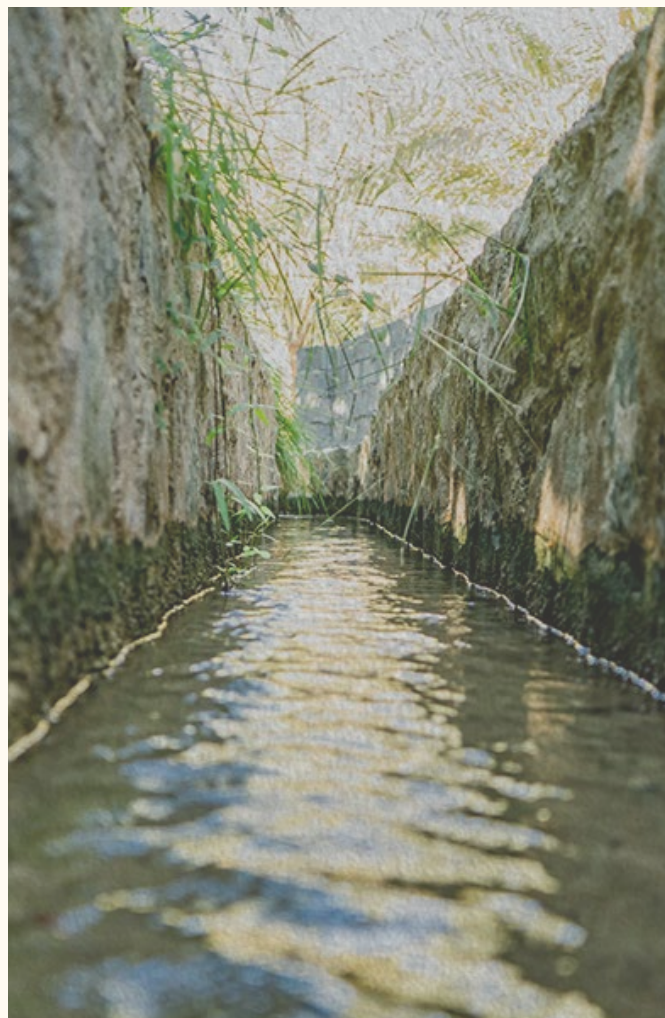


Each of these arguments points to a specific gap in how AI, water, and energy are governed today. The report then offers the five recommendations below built to close these gaps:

- 1 A global declaration on efficient water use in AI**, using the upcoming 2026 UN Water Conference in Abu Dhabi to build shared understanding among countries to promote strengthened international cooperation on responsible AI development.
- 2 Integrate AI infrastructure into national and basin-level water and energy planning**, so permitting reflects local realities and community input, and closes the gap between digital buildouts measured in months and water and energy infrastructure measured in decades.
- 3 Require transparent, comparable reporting of direct and indirect water and energy use**, covering both facility-level footprint and the harder-to-measure exposure embedded in electricity and supply chains.
- 4 Promote low-water, low-energy technologies, circular resource systems, and AI solutions for water**, built into new infrastructure design and retrofitted into existing installations.
- 5 Embed water and climate risk in corporate strategy, siting, and investment decisions**, treating resource efficiency as a competitive advantage and a strategic investment decision rather than a compliance cost.

Resource management concerns are already reshaping decisions on where AI infrastructure gets built and who bears the cost, whether governments, utilities, and companies are ready for it or not. Public and private sector stakeholders should invest early in smarter governance, more efficient technologies, and integrated planning to get ahead of this problem.

The December 2026 UN Water Conference, co-hosted by the UAE and Senegal, is the premier opportunity to turn responsible AI development into a shared global agenda, thereby harnessing AI to help address the risks named by *Ripple Effect* three years ago.



Part 1: Global water scarcity in the age of AI

AI is reshaping the world's relationship with water and energy. Since the *Ripple Effect* report in 2023, the rapid growth of AI infrastructure has pushed water and energy demand past earlier forecasts. While new resource-efficient solutions are being developed, total pressure on constrained resources continues to climb. The result is a set of risks that conventional planning, which treats water, energy, and digital infrastructure as separate domains, is poorly equipped to manage.

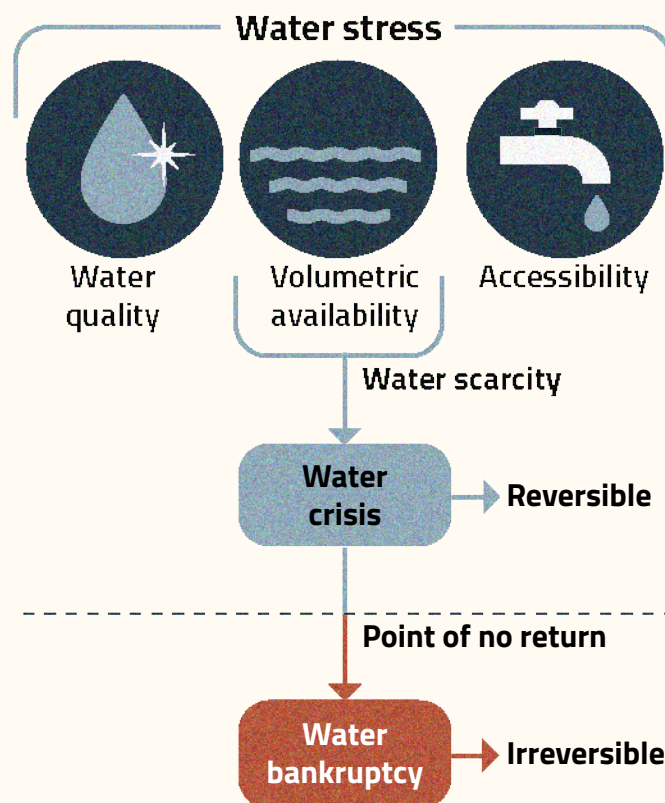
1.1 WHAT HAS CHANGED SINCE 2023?

Two shifts since 2023 have changed the picture. Water risk itself has been reclassified, with leading institutions now describing parts of the world as facing not stress but water bankruptcy, meaning depletion that cannot realistically be reversed. At the same time, AI has become a significant new claim on both water and electricity. Large scale capital mobilization in the sector is leading to ever-larger models and rapid integration into everyday services. The two developments compound each other. While AI offers real tools for managing water and energy more efficiently, these tools will need to advance and scale if their resource savings are to outweigh AI's own growing resource demands.

Redefining water risk: From scarcity to bankruptcy

In January, the UN University's Institute for Water, Environment and Health declared that the world had entered an era of global water bankruptcy. The distinction matters. Water stress (Figure 1) describes manageable pressure and water crisis as an acute but resolvable shock, while water bankruptcy denotes basins and aquifers drawn down past the point where recovery to historical conditions is realistic. The shift in language marks a shift in task, from preventing scarcity to managing irreversible decline, and it arrives just as AI adds a new and rapidly growing source of demand.

Figure 1. Water stress composition and role of water scarcity

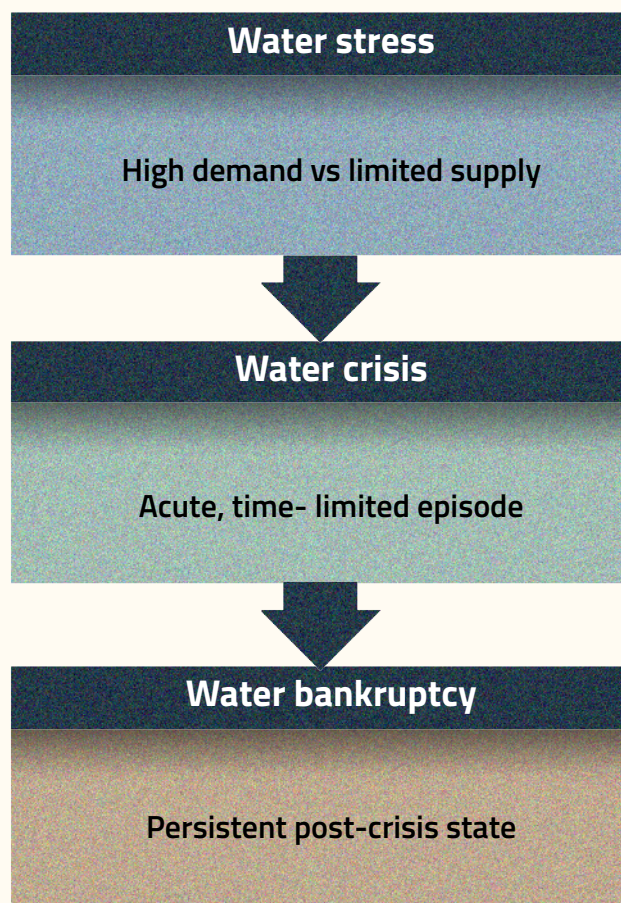


Source: CEO Water Mandate and Pacific Institute

*Nearly three-quarters of the world's population now lives in countries the UN classifies as water-insecure or critically water-insecure, and **roughly 70%** of the world's major aquifers are in long-term decline.¹*

Much of the current AI buildout still assumes water systems can recover along historical patterns, an assumption that no longer holds in regions such as the Middle East and North Africa, which the report names as one of its water-bankruptcy hot spots. That status does not make AI infrastructure impossible there, but it does change what building responsibly requires.

Figure 2. Water stress, crisis, and bankruptcy



Source: Adapted from Madani, K. (2026).

A bankrupt basin is a human-water system in crisis, where water use consistently exceeds what nature can support, causing damage that cannot be reversed in the near term.² Water stress, by contrast, refers to limited water quality, flow, access, or supply, which strains the system but does not necessarily permanently damage it.³

The two can overlap: A basin may be stressed but not beyond recovery. The Colorado River Basin, for example, is now seen as water bankrupt—Lake Mead and Lake Powell are at record lows, and use exceeds natural refill, likely preventing recovery. Australia’s Murray-Darling Basin, though severely stressed, still has a chance to recover with good management and favorable climate conditions. In stressed basins, tools like AI-based efficiency can aid recovery. In bankrupt basins, such tools can only slow decline and manage remaining water, not restore lost capacity.

The consequences of global water bankruptcy are significant. Communities may face permanent shortages that disrupt daily life and public health. Businesses could be forced to close or relocate due to insufficient water supplies, and supply chains rooted in bankrupt basins can fail even for firms with no direct water exposure of their own. Governments may need to implement measures such as rationing, emergency reallocations, or large-scale resettlement. These challenges are not isolated events but part of a broader, accelerating trend.

AI’s escalating resource demands

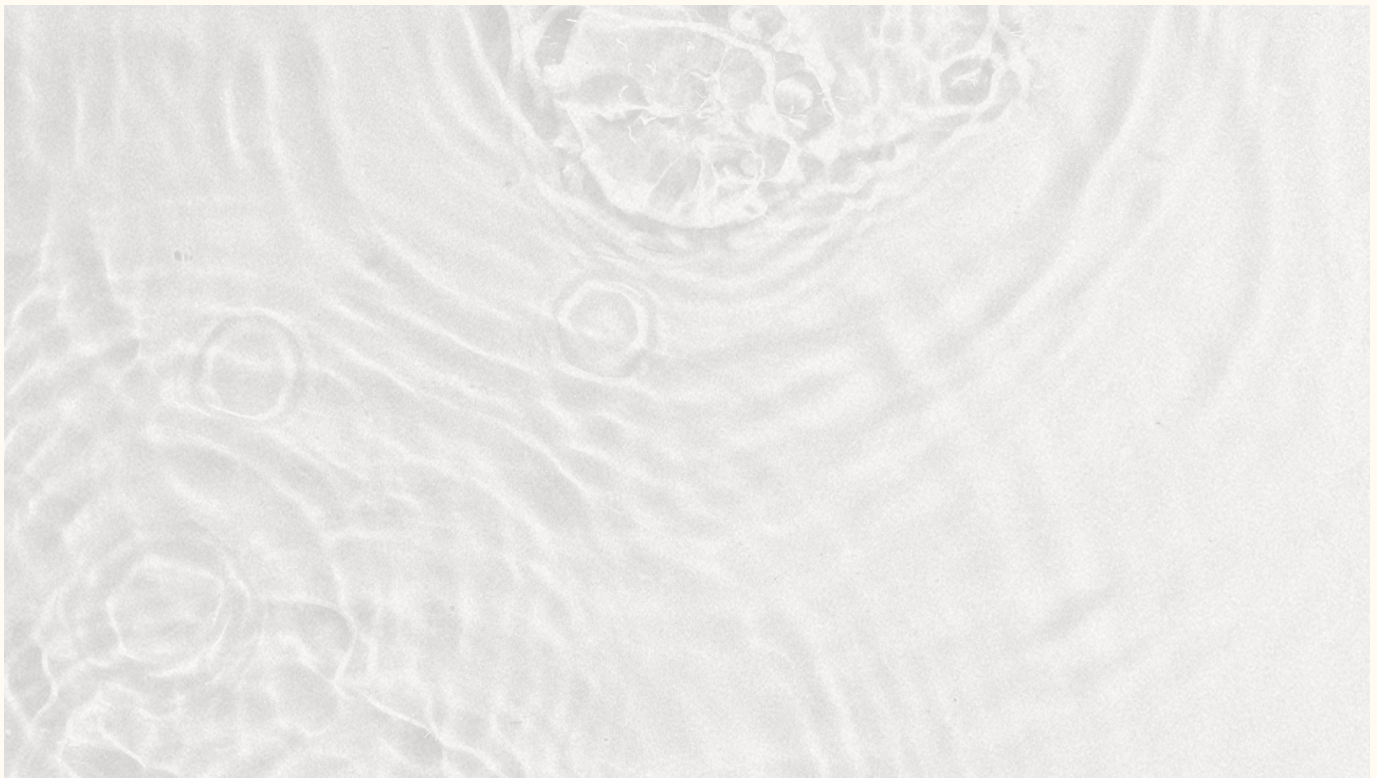
AI’s water and energy use is rising faster than efficiency gains can offset. Global data center electricity use is projected at 448 terawatt-hours (TWh) in 2025, with a water footprint of 4.5 trillion liters; AI-focused facilities account for 93 TWh and 900 billion liters of that total.

*By 2030 electricity use is projected to nearly double to 945 TWh and water use to **9.32 trillion liters**, with AI workloads responsible for 378 TWh and **3.7 trillion liters**.⁴*

The AI share of that total roughly quadruples in five years. Demand is not simply growing; it is concentrating in the most resource-intensive segment. Training costs alone have grown 40- to 55-fold in electricity terms across two recent model generations, with water use rising in step.⁵

That escalation is important, however, training is not where most of AI's footprint sits. Inference, where a trained model responds to a query, accounts for up to 90% of a model's total lifecycle energy use. Any single request is trivial, but the aggregate is not, and it grows with every new user and application. That aggregate is also unevenly distributed. A small number of advanced economies host most AI infrastructure and absorb most of the associated water and energy demand. Benefit from AI follows a related but distinct pattern: Adoption is spreading faster than earlier general-purpose technologies did, but unevenly, tracking countries' digital infrastructure, skills, and data readiness.⁶

As AI moves from experimentation into routine use across education, health, transport, and logistics, demand growth is outpacing efficiency gains. This is the efficiency paradox, where each unit of computing becomes cheaper and less resource-intensive, so usage increases, and total consumption rises anyway. Efficiency still matters, but under current growth trajectories, it cannot hold aggregate water and energy demand down on its own. Bending that trajectory requires public policy and regulation paired with efficient planning, as this report's recommendations set out.



1.2 HOW AI USES WATER: FROM ABSTRACTION TO MECHANISM

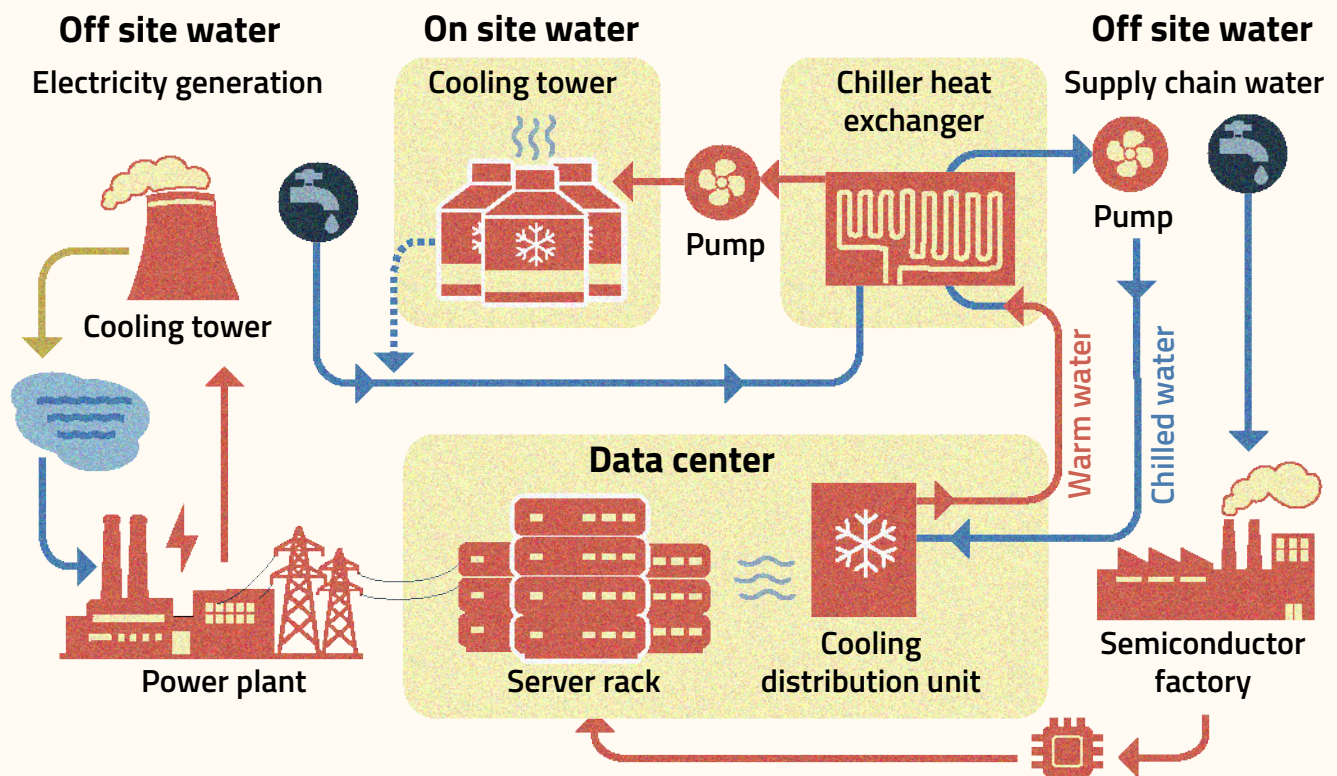
How much water AI actually consumes remains poorly understood, in part because most of the consumption occurs outside the facilities that run AI workloads. AI's water footprint extends well beyond data center cooling towers and is embedded in global manufacturing, supply chains, and power systems.

Two distinctions are necessary to make that footprint legible. First, withdrawals and consumption are not the same. Withdrawals are the total water taken from a source, such as a river, aquifer, or municipal system; consumption is the portion not returned, lost to evaporation during cooling or incorporated into products during manufacturing. High withdrawals stress local water systems immediately; high consumption removes water from the hydrological cycle permanently. Second, use is either direct or indirect. Direct (on-site) use occurs at the facility itself, for cooling,

humidification, or purification. Indirect (off-site) use is embedded in the supply chain, in the electricity generated or the servers and chips manufactured. Indirect use is typically less visible than direct use, but can account for most of the total footprint where energy sources or manufacturing processes are especially water-intensive. Assessing AI's impact on water resources requires measuring both.

AI's water use story is much bigger than the familiar image of data center cooling towers. If we follow a single drop of water through the AI ecosystem, we see it at work in three places: First, in the high-tech factories where chips and servers are made—semiconductor manufacturing is especially thirsty, demanding huge volumes of ultra-pure water. Next, at the data centers themselves, where water cools the humming servers and supports on-site systems, with the specifics depending on the technology used.⁷ Finally, the largest share of water use often occurs off-site, at the power plants that generate the electricity that fuels data centers—particularly if the local grid relies on thermal or fossil-based generation.

Figure 3. AI ecosystem value chain (off-site/on-site)



Source: Ana Pinheiro Privette, "AI and Water: Toward a Sustainable Digital Future"

By mapping water use across these stages, we turn the broad claim that “AI uses a lot of water” into a concrete, system-level map of impacts. This perspective sets the stage for the trade-off analysis and risk mapping that follows.

1.3 WHY EFFICIENCY ISN'T ENOUGH: ENERGY-WATER TRADE-OFFS

Section 1.2 showed that AI’s water footprint is systemic and embedded in the global value chain. Even with continuous advances in technology and efficiency, fundamental water-energy trade-offs remain. Coordinated, system-level planning

and integrated policies that account for local water availability, energy sources, and cooling technologies are needed to avoid simply shifting risks from one resource to another.

Most of AI’s water use happens away from data centers. Electricity generation accounts for roughly half of water consumption across the data center value chain, with on-site cooling at about 30% and primary energy supply and manufacturing making up the remainder. By 2030, total consumption is projected to more than double, as water used for cooling nearly triples and water tied to electricity generation roughly doubles.⁸

TABLE 1: WATER USE AND CHARACTERISTICS OF MAJOR ENERGY GENERATION SOURCES

WATER USE	CHARACTERISTICS
Coal-fired power	
High withdrawals and consumption, primarily for steam-cycle cooling and condensation; additional water is used in coal extraction, ash handling, and emissions control	Dispatchable, continuous power, but with very high carbon emissions and substantial local air-pollution and water-stress exposure
Natural-gas power	
Moderate to high use , mainly for cooling and steam cycles in combined-cycle plants; upstream extraction and processing can add to the water footprint	Flexible, dispatchable generation that can balance variable renewable output; lower CO ₂ emissions than coal but still exposes users to fossil-fuel and methane risk
Nuclear power	
High water withdrawals and potentially significant consumption for reactor and turbine cooling, with the scale depending on the cooling system, ambient temperature, and water source	Firm, high-capacity-factor, low-carbon electricity; droughts, heatwaves, and elevated river temperatures can constrain output
Hydropower	
Site-dependent : large water flows pass through turbines, while net consumption mainly reflects reservoir evaporation; dams can also change local flow regimes	Low operational emissions and, for reservoir plants, potentially dispatchable electricity and grid-balancing capacity
Wind power	
Very low during operation ; only limited water is needed for maintenance, while most water demand is embedded in materials production and construction	Very low operational water and carbon intensity; variable output requires flexibility, storage, or complementary supply
Solar PV	
Very low during operation ; water is mainly embodied in manufacturing and may be used periodically for panel cleaning, particularly in dusty areas	Low operational water and carbon intensity, modular deployment and potential for local generation; output depends on sunlight and cleaning can pose trade-offs in water-scarce locations
Geothermal power	
Variable , as water or other fluids may be injected and circulated underground and used for cooling; closed-loop and air-cooled systems can lower freshwater needs	Low-carbon, firm renewable electricity with a small land footprint; resource availability is geographically constrained and requires careful reservoir and water-quality management

Source: Eurasia Group

The water-energy nexus lies at the heart of this tension. The water sector is energy-intensive: Every stage from extraction to treatment and delivery requires substantial electricity. Conversely, the energy sector is water-dependent. Most fossil and nuclear generation relies on steam-cycle cooling, among the most water-intensive processes in the electricity system. Wind and solar photovoltaic (PV) avoid that cycle altogether, so neither requires the cooling water used by steam-cycle generation.

That makes the choice of power source one of the most direct levers available for reducing AI's water footprint.

That advantage comes with an operational catch. AI workloads run continuously and at near-constant intensity, with little of the flexibility that lets other electricity demand absorb renewable variability. Wind and solar generation is inherently weather- and time-of-day-dependent. Matching those outputs to AI infrastructure specifically, rather than to electricity demand in general, typically requires battery storage, hybrid generation, or backup capacity, often natural gas, to guarantee reliability. The water case for renewables still holds. However, capturing it fully requires pairing wind and solar with storage and grid flexibility investment.

As AI infrastructure expands, it deepens this interdependence and creates new vulnerabilities. This dynamic plays out most directly in the choice of cooling technologies and energy sources for data centers.

Data center cooling also represents a trade-off challenge. AI workloads produce much higher heat densities than traditional cloud computing workloads, making cooling critical and resource-intensive. Every cooling approach involves compromises: evaporative cooling is energy-efficient but water-intensive, while air-side economization and closed-loop liquid cooling save water but require more electricity. No technology can reduce both water and energy use at once without fundamentally changing the cooling method.

However, several emerging innovations are under development, including two-phase immersion cooling, direct-to-chip liquid cooling (DLC) with alternative fluids, and advanced heat dissipation materials. While these technologies may improve future trade-offs, most are still in pilot or early commercial stages and are not yet widely adopted.

For data center operators, this means there is no single correct answer. Reducing pressure on one resource almost always increases it on the other. Evidence indicates that the right choice depends on where a facility is located, including local water availability, energy costs, and grid conditions, climate, and the regulatory environment.⁹

TABLE 2: WATER AND ENERGY TRADE-OFFS ACROSS DATA CENTER COOLING TECHNOLOGIES

COOLING APPROACH	POTENTIAL ADVANTAGES	ENERGY IMPACT	WATER IMPACT	TRADE-OFF
Evaporative cooling	High energy efficiency	Low	High	Water-intensive, energy-saving
Closed-loop liquid cooling	Effective for high-density loads	Moderate	Low	Reduces water use, stable energy; environmental concerns on liquid composition
Direct-to-chip liquid cooling (DLC)	Next-gen efficiency, precise cooling	Depends on heat-rejection method		Higher upfront cost
Air-side economization	Near-zero water use	High	Minimal	Saves water, increases energy demand

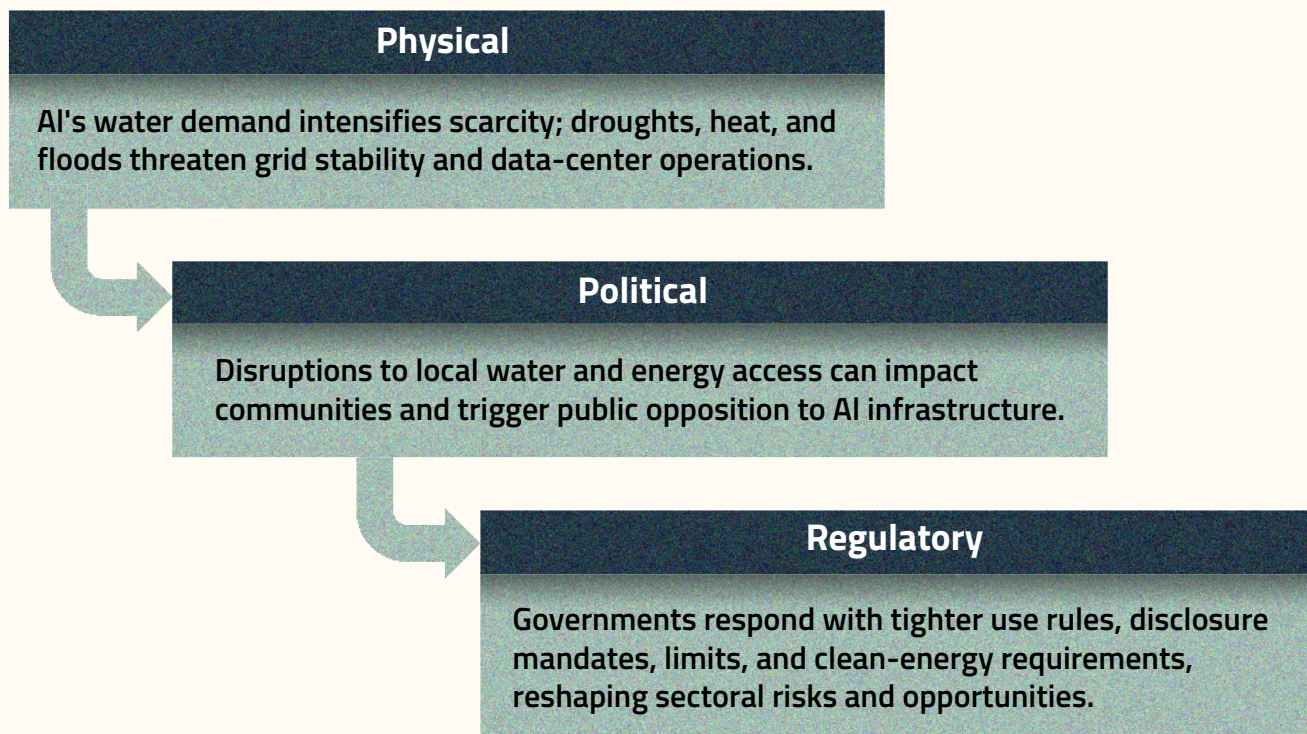
Source: Eurasia Group

Part 2: Risk and opportunity outlook

Building on the global mechanisms discussed in Part 1, Part 2 examines the specific geographies and political contexts where risks emerge. We analyze how AI's increasing water and energy demands lead to physical exposure, social conflict, and governance challenges, and identify opportunities for proactive response. The three risk types discussed here—physical, political, and regulatory—provide a framework for understanding these issues. In practice, multiple risk factors often occur together.

This typology guides policy and infrastructure decisions and helps identify where social and political tensions may arise. In practice, these three risk types often cascade. A single climate or water-stress event can affect physical, regulatory, and political domains, increasing overall exposure for AI infrastructure and host regions. The following sections examine each risk and their interconnections in detail.

Figure 4. Cascading risks



Source: Eurasia Group

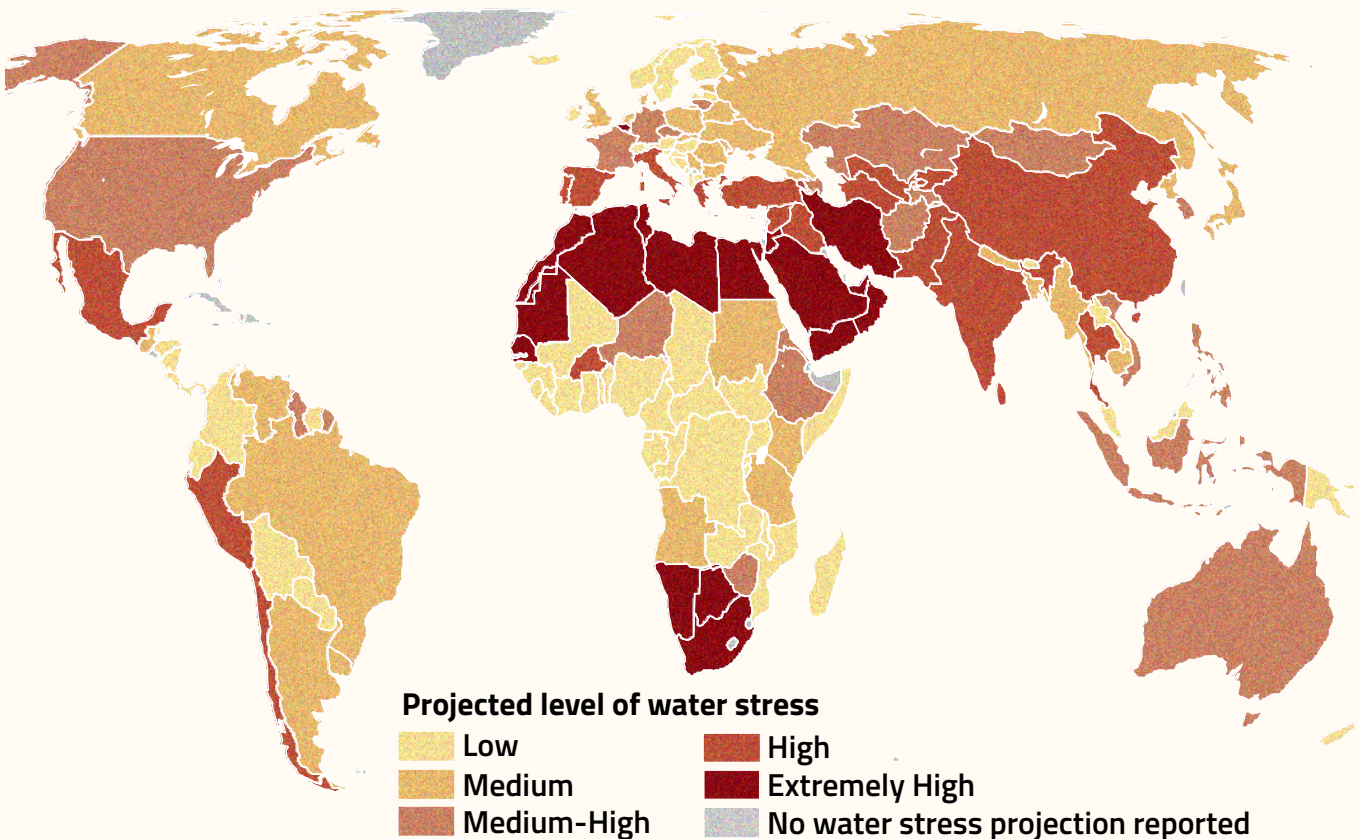
2.1 WHERE AI AND WATER STRESS COLLIDE

Water stress and AI infrastructure are converging on the same map. Setting projected water scarcity against the global distribution of data centers shows where that overlap is tightest, and where physical constraints are most likely to become political ones.

Figure 5 draws on the World Resources Institute's widely used water stress projections for 2030, reflecting where pressure is likely to build if current trends continue without further action.

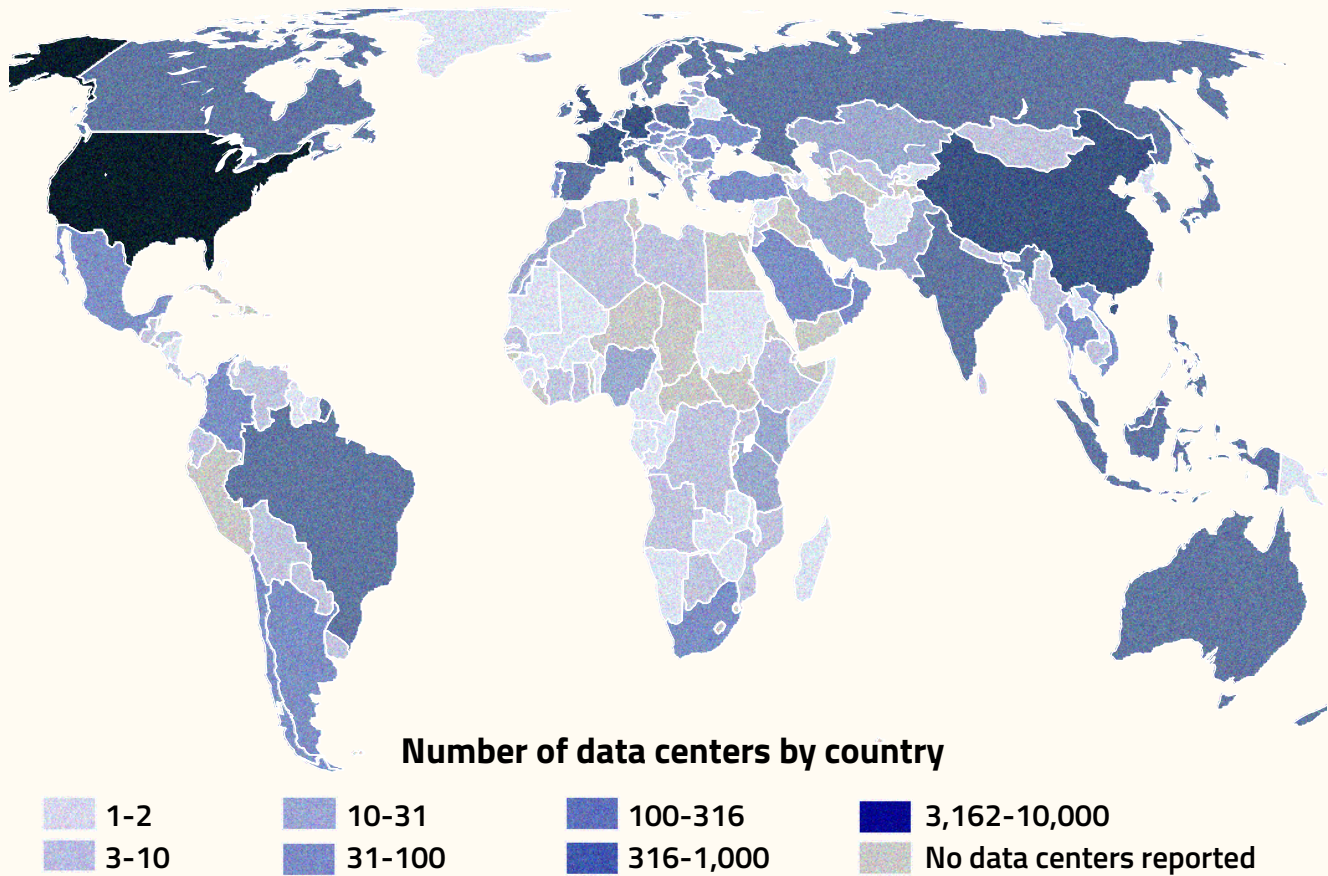
Projected water stress is highest across the Middle East and North Africa, Central and parts of South Asia, southern Europe, and pockets of southern Africa and Latin America; it is lowest in northern Europe, Canada, Brazil, Japan, Malaysia, and much of sub-Saharan Africa. These are national figures, and conditions vary widely within countries, so they are best read as an indication of where closer local examination is warranted rather than a verdict on any single locale.

Figure 5. Projected baseline water stress, 2030



Source: World Resources Institute (WRI),
Aqueduct 4.0 Current and Future Country Rankings.

Figure 6. Number of data centers by country, 2026



Source: Data Center Map ApS, via Statista (2026).

The global data center landscape is highly concentrated. The US is the clear leader, with more than 4,400 facilities, far surpassing every other country, cementing North America as the principal hub for hyperscale cloud infrastructure and AI-related computing.¹⁰ Elsewhere, the picture is more dispersed: Europe has no single dominant market, Asia-Pacific is expanding rapidly from a mix of established and high-growth countries, and Latin America, the Middle East, and Africa host comparatively few facilities overall.

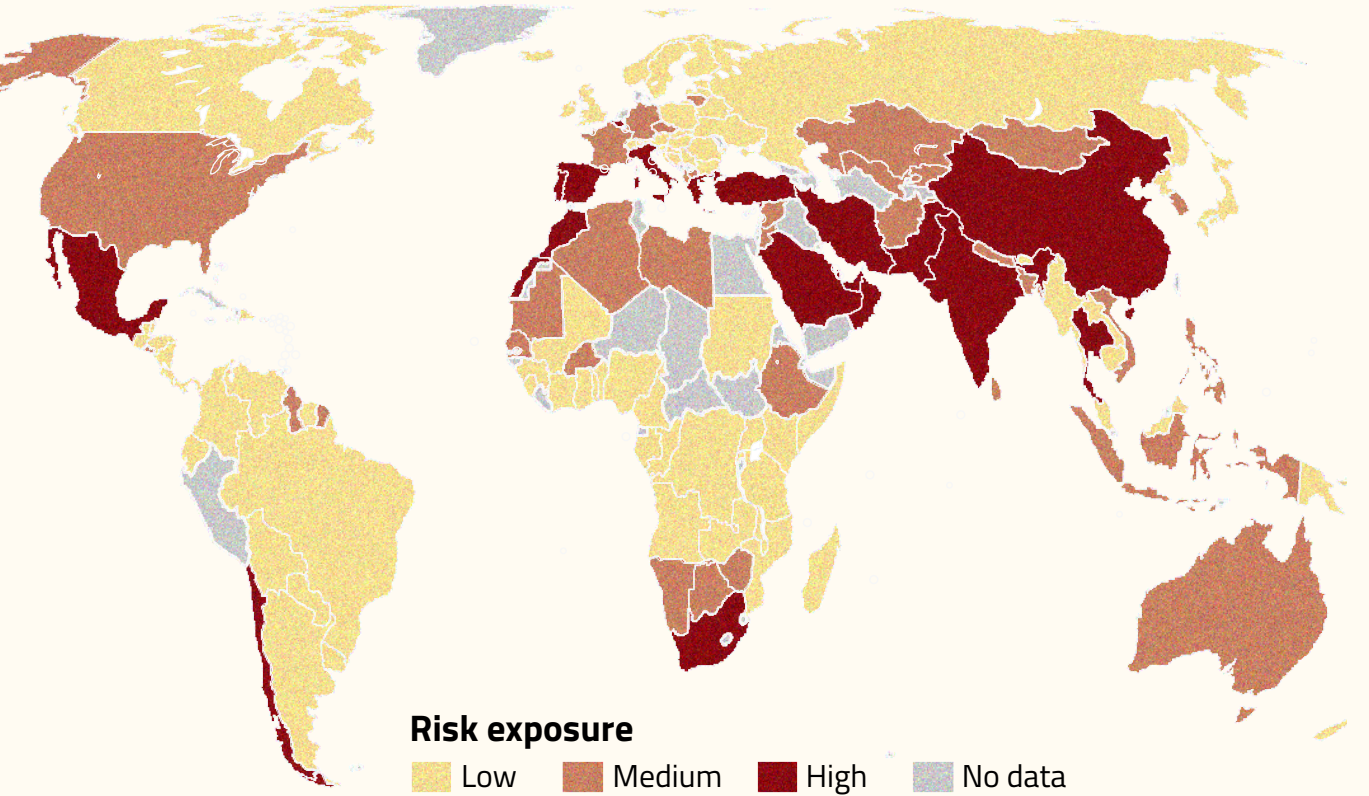
Where exposure is greatest

The two figures above point to the countries where AI infrastructure and water stress are most likely to collide.

Some countries already combine substantial AI infrastructure with high water stress, meaning pressures are largely locked in, and the priority is managing them well. Others combine high water stress with AI infrastructure that is still emerging, meaning the choices made now, before that infrastructure is built, will matter more than almost anywhere else. Both groups deserve particular attention, for different reasons.

The greatest overlap is concentrated in the Middle East and North Africa, southern Europe, and parts of South and East Asia, alongside a smaller number of countries elsewhere, including Mexico, Chile, and South Africa. These are the places where closer attention to water sourcing, cooling technology, and the relationship between power and water will matter most, given how closely digital infrastructure and constrained water resources already overlap.

Figure 7. Data centers by country and projected water stress in 2030



Source: Data Center Map ApS, via Statista (June 2026);
WRI Aqueduct 4.0 Country Rankings.

HIGH EXPOSURE	MEDIUM EXPOSURE	LOW EXPOSURE
Concentrated principally across the Middle East and North Africa, southern Europe, and parts of South and East Asia, extending to a limited number of countries elsewhere	Reflects a combination of large markets under moderate water stress and smaller markets facing greater stress but limited AI infrastructure to date	Encompasses the greater part of Europe, the Americas, and sub-Saharan Africa

Source: Eurasia Group

Some of the world's largest AI markets, including the US and several in Europe, face moderate water stress today, but their scale means outcomes are still being determined. Others face more extreme water stress but have not yet built significant AI infrastructure, meaning decisions taken now will shape their exposure for years to come. Countries with low water stress overall face less immediate risk, though specific basins or regions within them can still face real constraints.

This is a starting point for policy, not a verdict. Countries facing the greatest overlap have reason to set clear conditions on new AI infrastructure, from siting to water use to clean energy requirements. Those with more room to act can use it to build good practice in early, before pressure builds. In both cases, the value lies in acting before exposure becomes acute.

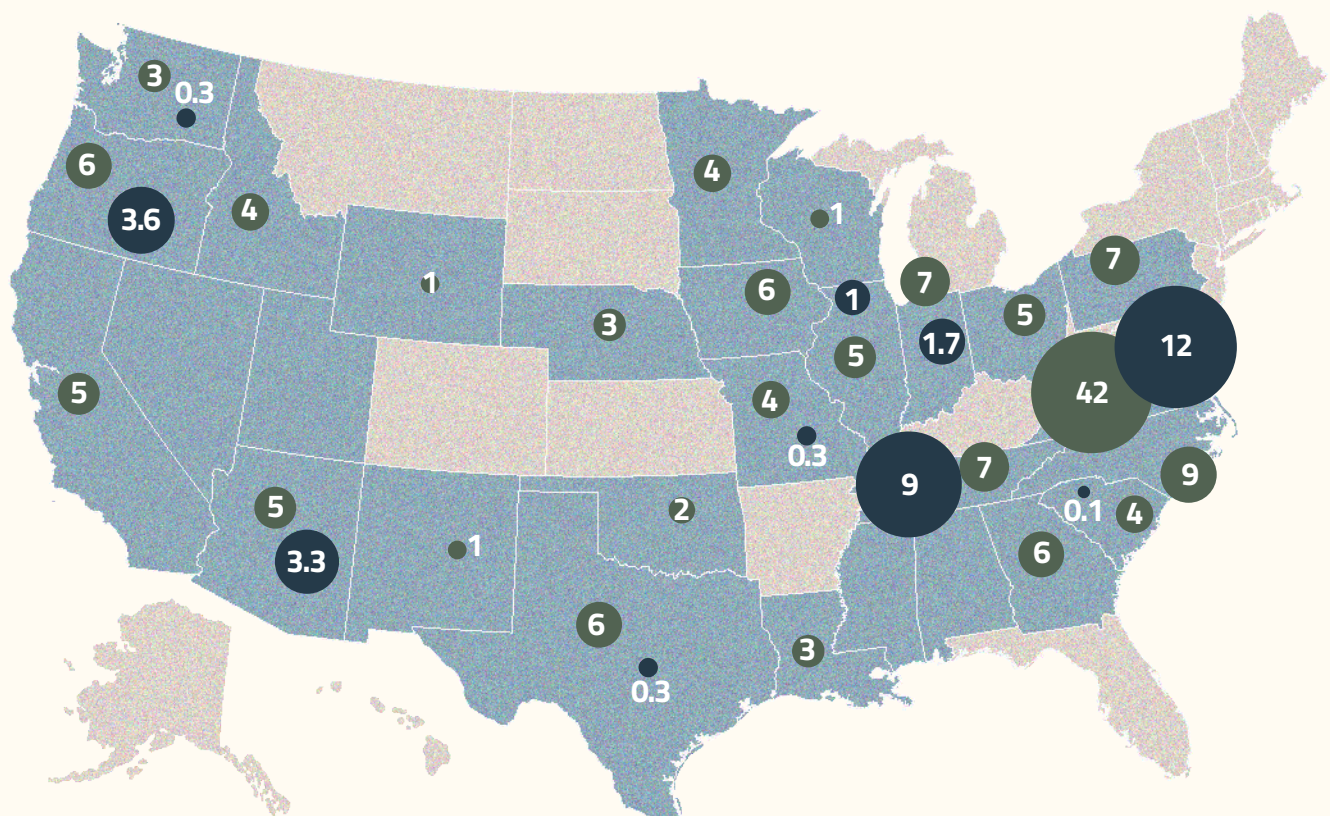


2.2 STRESS TESTS: COMMUNITY PUSHBACK

Community opposition has become one of the most immediate checks on AI infrastructure development, and it is no longer confined to the US. Water scarcity and energy demand rarely stay technical problems for long. Where residents see a new facility competing for these resources, disputes escalate quickly into permitting fights, litigation, and policy change. The cases below, drawn from the US, Malaysia, Chile, and Ireland, show how similar concerns about resource pressure, uneven local benefit, and limited consultation have produced very different responses.

In the US, opposition to data center development has become a broad constraint rather than a series of isolated incidents. Since 2023, nearly \$300 billion in projects have faced delays or cancellations, affecting more than 200 projects nationwide. In the first quarter of 2026 alone, at least 75 projects worth about \$130 billion were delayed or blocked, nearly matching the total for all of 2025 (\$156 billion).¹¹ The objections cluster around a familiar set of concerns, including rezoning of rural and agricultural land for industrial use, strain on electricity and water systems, noise, traffic, loss of green space, and doubt that tax incentives and modest job creation can offset local costs.

Figure 8. US large data center projects and community pushback



US large data center projects and community pushback

- States with large data center projects in the pipeline for Alphabet, Amazon, Meta, and Microsoft
- Signed petitions (in thousands)
- Number of activist groups

By early 2026, trackers counted several hundred organized opposition groups active across nearly every state, a sign of how quickly scattered complaints have consolidated into coordinated campaigns.

This represents a structural shift. Communities now mobilize through hearings, petitions, litigation, utility challenges, and local elections, and governments have responded with zoning amendments, renegotiated agreements, and tighter reviews. At least 15 states in the US have weighed moratoriums on new data center development and roughly 100 localities have adopted their own, with New York State passing a statewide pause in 2026. The opposition cuts across party lines, uniting groups in a way few political topics have. The US remains the epicenter because that is where the infrastructure is concentrated, but the same pattern is surfacing elsewhere.

*Singapore's 2019–2022 moratorium on new data centers, imposed after rapid expansion strained land, water, and electricity systems, shifted hyperscaler demand to Johor, Malaysia. Johor attracted about **\$35 billion** in investment due to strong cross-border connectivity.*

However, the scale of development led to local backlash. In February 2026, residents of Iskandar Puteri protested ZDATA's planned 300-megawatt (MW) facility, marking Malaysia's first reported data center protest. Immediate concerns included reduced household water pressure, competition for water and electricity, construction dust, and loss of nearby hills and greenery. Government and industry responses focused on stricter standards and mitigation rather than cancellation. Johor now requires electricity sourcing, with renewables increasingly mandated, and has banned the most water-intensive data center categories.¹² ZDATA pledged to use only treated wastewater and renewable energy, and to address dust complaints through mitigation measures.

*Google's proposed **\$200 million** Cerrillos data center in Santiago, Chile, became a case of community pushback because its original design relied on groundwater from the Santiago Central Aquifer for its cooling, in a city already facing prolonged drought and water security concerns.*

Residents and the Municipality of Cerrillos challenged its 2020 environmental approval, arguing the assessment did not adequately consider the project's potential pressure on the aquifer under climate-change conditions, as well as air-quality concerns and limited public participation. In February 2024, Chile's Second Environmental Court partially annulled the permit and instructed the Environmental Assessment Service to reassess water impacts, incorporating climate change. The dispute led Google to redesign the project and, in 2026, the company began exploring the possibility of restarting it.¹³ This time, the company shifted from water-based to air cooling, eliminated operational water use for cooling, and added backup power and stormwater storage.

In Ireland, local planning and environmental concerns over data centers escalated into a national debate. Surging demand, especially in Dublin, outpaced grid capacity, which triggered disruptions in some areas.¹⁴ Community opposition largely focuses on data centers competing with households for grid infrastructure, land, and water, as well as their reliance on fossil fuels. Since 2021, new assessment criteria have limited projects in grid-constrained areas. By 2025, a new policy required large data centers to meet most of their demand with new Irish renewables and, for the largest, to provide local dispatchable generation or storage. This approach aligns capacity with long-term grid and renewable planning.

Opposition rarely stems from a single issue. Overlapping concerns about resources, land use, and economic fairness combine into resistance that cuts across political lines and puts a project's social license at risk. What began as isolated local disputes now works as a constraint on where AI infrastructure can be built at all, and the governance gaps behind it are becoming harder to ignore.

2.3 REGULATORY AND GOVERNANCE GAPS

In under a decade, AI has become one of the most closely watched technologies in modern policymaking. As Figure 9 shows, a handful of countries had a national AI strategy in 2019; today, most of the world's governments have one, are drafting one, or are working to catch up. Almost all of that attention has gone to what AI does, how models are trained, what they are permitted to say, and who is accountable when they fail. By comparison, far less governmental attention has gone to the basic inputs AI needs to operate. The water and electricity needs behind every model are growing at a pace few governments planned for.

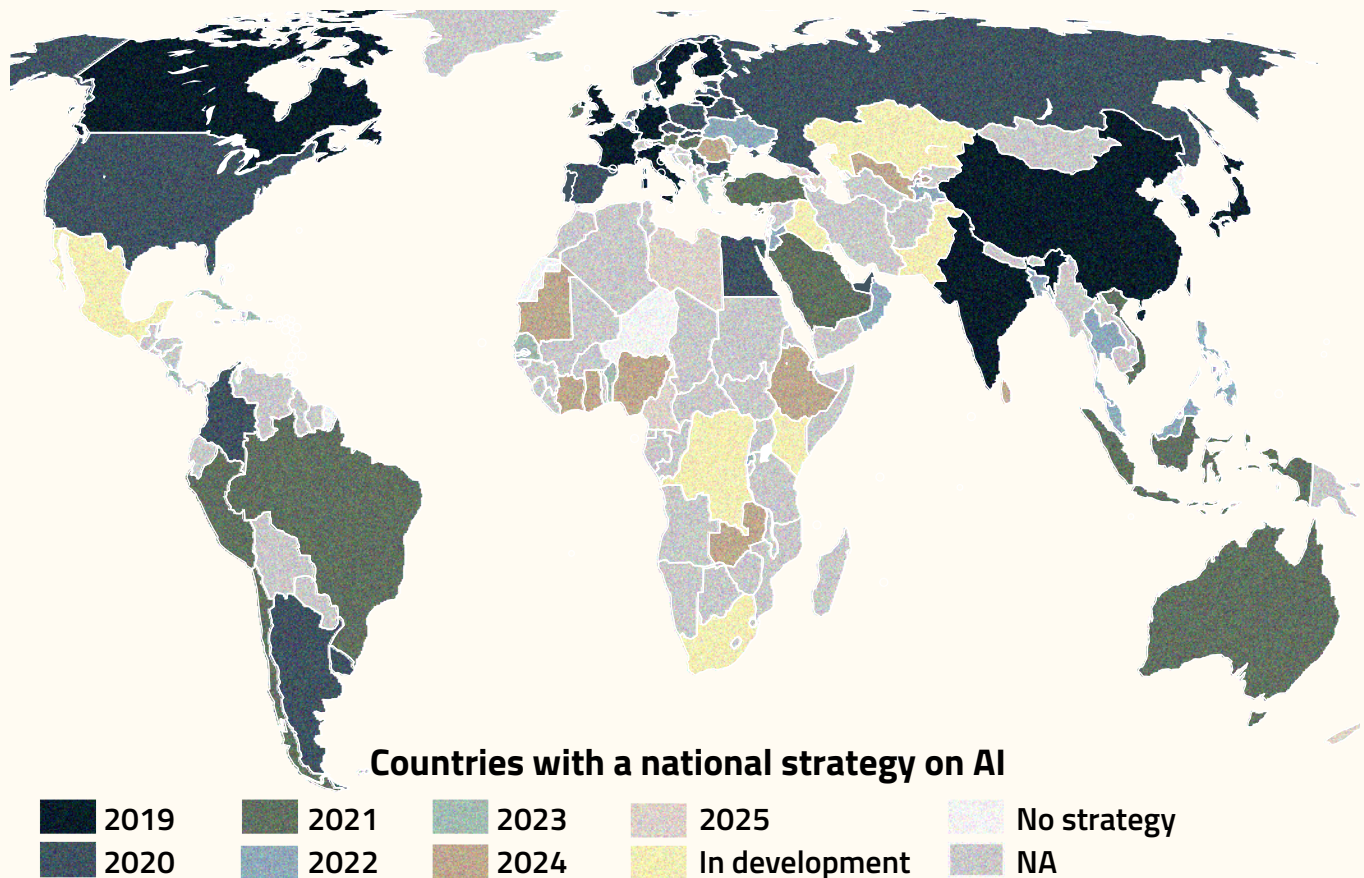
The disconnect shows up wherever digital growth has outpaced the planning cycles built around water and power.

In the US, the world's largest data center market, a government research report concluded in mid-2026 that federal oversight has not kept pace with data center water use.

*A single 100-MW facility can draw as much water each day as **2,600 households**, yet these projects are typically approved under the same rules as an ordinary warehouse.*

The multi-year plans that UK utilities use to forecast water supply were finalized without accounting for new data centers, even as new zones for AI investment are designated in some of the same areas those utilities already consider water-stressed. Energy planning tells a similar story.

Figure 9. Countries with a national strategy on AI



Source: Human-Centered Artificial Intelligence (HAI),
Stanford University, 2026

In one case, a US grid operator's request to expand a single data center's power draw was turned down by federal regulators, who judged that the existing grid could not absorb it safely. Fast-moving digital infrastructure keeps meeting resource-planning systems built for a slower world, with no shared framework connecting the two.

None of this is inevitable. The gap reflects policy choices rather than technological limits, and a small number of governments already show what closing it looks like. Singapore requires large water users, including data centers, to submit efficiency plans and install metering, and its national roadmap for the sector sets water-intensity targets as a matter of policy rather than voluntary practice. The EU now makes water and energy disclosure a mandatory condition of operating a data center anywhere in the bloc. These remain the exception rather than the rule. For most of the world, the systems that govern AI, water, and energy are still being written on separate tracks, by different institutions, on different timelines.

2.4 THE AI OPPORTUNITY FOR WATER

AI is not just a driver of new water and energy demand. It can also be a tool for managing water scarcity, including some of the pressure its own growth creates. This is a global effort; generative AI adoption in the water sector is accelerating across the US, Europe, Asia-Pacific, and the Middle East. Some major technology companies have made parallel commitments on the energy side, pledging carbon-free and net-zero power for their operations.

Deployment of AI is spread unevenly, varying internationally and with each region solving a different problem. US and European utilities apply machine learning to aging water distribution networks, finding leaks, forecasting demand, and deciding which pipes to replace first. China has gone furthest on the state-led approach, building digital replicas of its major basins and clearing the water sector's first generative AI model for flood control and reservoir operations.

TABLE 3: WHERE AI IS ALREADY WORKING IN WATER MANAGEMENT

WHAT IT COVERS	WHERE IT STANDS
Seeing the system	
Leak and loss detection, network sensing, aquifer and depletion tracking	In operation: AI-enhanced leak detection reaches 95–99% accuracy across dozens of studies and is recovering measurable volume in utility deployments, though system-wide results remain mostly pilot-scale. Satellite-based aquifer monitoring is reliable for long-term trends, though not yet for short-term decisions
Forecasting	
Water demand, streamflow, flood, drought	In operation at global scale: AI-based riverine flood forecasting now reaches most of the world's population, with warnings issued up to seven days ahead. Sudden-onset events give far less warning, and in all cases the models run ahead of the institutions meant to act on them, since few utilities or basin authorities have adapted their procedures to turn a forecast into a decision
Running operations	
Irrigation scheduling, treatment and desalination, pumping and dosing	In operation, unevenly: Commercial irrigation deployments report water savings of roughly 30%, and desalination and treatment plants report real energy savings in pumping, dosing, and aeration. Most systems advise operators, rather than controlling equipment directly, while reach for smallholder farmers for irrigation depends on mobile advisory rather than field hardware
Planning and allocating	
Digital twins, basin-scale modeling, permitting support, generative decision support	Early: Digital twins are in use, though full-scale deployments remain rare, and most systems advise rather than act. Generative and agentic tools for water planning and allocation are still at pilot stage. Investment is rising quickly, though questions remain over how governments can decide what role these systems should play in determining distribution of and access to water.

In South and Southeast Asia, AI-based flood warning now reaches populations that national gauge networks never covered. Across sub-Saharan Africa, where agriculture accounts for most water use, the work centers on irrigation timing and farm advice delivered over basic mobile and text networks rather than on sensors and hardware. In the Gulf, including the UAE, the focus falls on desalination, storage, and scheduling water production against available power.

These applications sit at very different stages of maturity. AI is furthest along where the task is narrow and operational. It is least proven where a model would shape a consequential decision, such as how a basin divides water among competing users, or what conditions a regulator attaches to a withdrawal permit. Few governments have settled how much influence a model should have over such calls, a matter that requires further exploration and regulatory guidance.

Hence, while the opportunities are ample and fast-expanding, wider deployment of these tools depends on conditions that have little to do with the technology. Utilities, basin authorities, and agriculture and disaster agencies need better data on the systems they manage, staff who can run these tools, and a mandate to act on what a model tells them. Those capabilities matter most where water systems are already stretched and new AI infrastructure is arriving, and they are far easier to build before demand grows than after. Scaling these solutions will take sustained public investment, clearer standards, and governance that keeps pace with the technology.

2.5 INNOVATION IN PRACTICE: CASE STUDIES FROM THE UAE

As one of the world's most water-scarce countries, the UAE has long had to balance water and energy against the needs of a growing economy, and it has invested early in digital approaches to both.

Installed renewable capacity in the UAE grew by 117% between 2022 and 2025 to more than 7.7 GW, with national policy targeting over 23 GW by 2031. Masdar's gigascale round-the-clock project in Abu Dhabi, developed with Emirates Water and Electricity Company (EWEC), reached financial close in July 2026 and pairs solar PV with battery storage to deliver continuous clean power.

Both developments matter for water, for different reasons. As detailed in section 1.3, power source is one of the most direct levers on a data center's water footprint, so a grid with more renewable capacity lowers the water intensity of every facility drawing on it. The round-the-clock design addresses a separate constraint. Data centers run at full load overnight and through cloudy periods, when solar output falls, and operators have generally covered that gap with gas. Gas-fired generation consumes water for cooling, while solar paired with storage consumes almost none beyond panel washing. Firming supply with batteries rather than gas therefore removes a water cost that would otherwise scale with AI buildout. The National Water and Energy Demand Management Program 2050 provides the federal framework for efficiency gains across both systems.

The UAE also moved early on AI. It published a national AI strategy in 2017 and appointed a dedicated AI minister the same year. Research now runs in both directions. Khalifa University's Center for Membranes and Advanced Water Technology applies AI to water treatment. At the Technology Innovation Institute, the Renewable and Sustainable Energy Research Center works on running AI infrastructure with less water. The UAE is therefore a useful place to examine what these technologies do in practice, and what they still cannot do.

The case studies below span AI technologies in development across strategic water storage, cross-sector monitoring, transboundary water management, facility design, and workforce capacity. These projects aim to improve water resource management both in the UAE and potentially beyond where replicable models prove effective.



Integrated cooling and campus planning

Khazna Data Centers, a G42 company

As the UAE's largest data center operator, with 30 facilities in its domestic portfolio and AI-optimized capacity under construction across the Gulf and beyond, Khazna has built under water constraints that operators elsewhere have only recently begun to face. Air-to-air and air-to-liquid systems limit water use across most of the fleet, treated sewage effluent replaces drinking water where supply allows, and new facilities are built to LEED Gold standard. One Abu Dhabi site draws its electricity from a dedicated solar plant developed under a 25-year agreement with a national renewable energy joint venture. AI workloads raise the difficulty, since higher chip temperatures call for liquid cooling, and the company's 100 MW Ajman facility, which received Tier III design certification in 2026, uses closed-loop and chip-level systems that hold coolant in circulation. How much water that saves depends on how the heat is rejected at the end of the loop, which is a question of local climate and grid conditions rather than cooling technology alone.

That makes the wider system as important as the facility. Khazna is developing the first gigawatt-scale cluster within Abu Dhabi's AI campus, where the national power and water utilities announced generation and grid programs explicitly tied to the country's AI strategy, committing that capacity while the digital buildout was still being planned. Those facilities draw on a grid that is itself being reshaped, with Abu Dhabi targeting 60% of its energy from renewable and clean sources by 2035 and near emission-free water production by 2030. Both bear directly on the water footprint of every data center on the system, since power generation accounts for roughly half of water consumption across the value chain.

Strategic Water storage

Environment Agency – Abu Dhabi (EAD)

Liwa Aquifer Storage and Recovery

The Liwa Aquifer Storage and Recovery (ASR) project is Abu Dhabi's strategic underground emergency water reserve in the Liwa Desert. It stores high-quality desalinated water in an aquifer and retrieves it through recovery wells if the regular supply is disrupted. Completed in 2017, the system holds about 26 million cubic meters of water, providing Abu Dhabi with approximately 90 days of emergency supply. By separating water production from immediate consumption, ASR enables water to be produced during periods of available or lower-carbon electricity and stored for later use. The project reduces reliance on coastal desalination plants and transmission infrastructure, and avoids the land, evaporation, and contamination risks of large surface reservoirs. It maintains a potable water buffer for severe supply interruptions and supports a more flexible, lower-carbon water and power system as the UAE's infrastructure evolves. Such a buffer can play a critical role in a landscape in which water-intensive industries and emerging technologies can add to the unpredictability of demand.



Cross-sector mapping

Environment Agency – Abu Dhabi (EAD)

The EAD is developing a digital replica of the emirate's natural environment, starting with air quality and its effects on health outcomes such as respiratory illness admissions. This digital twin combines policy decisions, environmental conditions, and social impacts in a single system, illustrating how choices in industry, transport, or land use affect air pollution and public health. The first phase will deliver a comprehensive three-dimensional model of Abu Dhabi by the end of 2026.

This model will integrate real-time air quality data with energy production and consumption information to simulate scenarios and forecast pollution risks. Generative AI and decision-support agents will allow managers to query the system in plain language, test policy scenarios, and receive AI-generated insights beyond static dashboards. EAD intends to expand the platform to cover additional environmental domains, including water, biodiversity, and waste, creating a cross-sector decision engine for the emirate's Environmental Vision 2030 and related strategies. By linking environmental data to health indicators, the project demonstrates how digital decision support can improve coordination among environment, health, and planning agencies and enable more evidence-based policy.



UNITED ARAB EMIRATES PRESIDENTIAL COURT INTERNATIONAL AFFAIRS OFFICE

Transboundary water management

International Affairs Office

MaiWater

MaiWater AI integrates hydrological science and AI to improve water forecasting, planning, and decision-making. Developed in the UAE with African basin organizations and global partners, including the International Water Management Institute (IWMI), ai71, and the American University of Sharjah (AUS), the tool provides better data on meteorological conditions and supply and demand variables. This supports decision-makers in flood planning, irrigation, water allocation, and drought response. Launching in the Limpopo Basin, MaiWater AI will deliver three tools by the 2026 UN Water Conference: an AI-powered hydrological model (backend), a global decision-support dashboard, and a digital twin of the Limpopo Basin. These resources will equip the Limpopo Watercourse Commission (LIMCOM) and its four member states—Botswana, Mozambique, South Africa, and Zimbabwe—with shared digital tools for transboundary water management. The Limpopo Basin serves as a demonstration site for broader AI-augmented hydrological modeling. Developed in the UAE and offered as a public good, these tools show how UAE-backed AI can expand from a single basin to global models for climate-resilient water governance.



Further work is underway across AI solutions for water, with potential applications beyond the UAE's borders. In areas where concepts prove effective and suited to local conditions, these approaches could offer models other water-stressed regions can adapt and build on, helping spur innovation on these challenges worldwide.

Workforce capacity

Mohamed bin Zayed Water Initiative

Water Pioneers

The Water Pioneers program, launched by the Mohamed bin Zayed Water Initiative, is a national youth initiative designed to develop future Emirati leaders in the water sector. Closely aligned with the AI–water–energy nexus, it brings together 15 Emiratis aged 18 to 35 from diverse backgrounds, alongside MBZWI leadership and members of national and international water-policy communities. The program focuses on learning, capacity building, knowledge exchange, and active participation in water dialogue. Areas of interest span public service and policy, STEM, environment, business, communications, social impact, and research. Participants are prepared to address water scarcity through multidisciplinary collaboration, innovation, and sustainable solutions. The program positions youth as key contributors to UAE water security and global water governance, to support the UAE's long-term water security and energy transition goals.

Part 3: Recommendations and call to action

3.1 FIVE CROSS-CUTTING RECOMMENDATIONS

AI's benefits for water and energy management are real. Capturing them without deepening the resource management issues of the twenty-first century requires better planning ahead of the further AI infrastructure buildout. The five recommendations below address AI's water and energy footprint across its value chain, and the physical, political, and regulatory challenges this report has identified.

A global declaration on efficient use of water for AI

The UN Water Conference offers a natural venue for countries and relevant stakeholders to exchange experiences and explore opportunities for greater international cooperation on the use of AI to monitor, conserve, and manage water resources. Such cooperation could address the water and energy footprints associated with AI systems and their supporting infrastructure.

A voluntary declaration on efficient AI resource use by willing countries, aimed at encouraging knowledge-sharing, good practices, capacity-building, and greater consideration of both the benefits and resource implications of AI for water management could be one way to formalize international cooperation.

More broadly, the Conference could help establish a shared dialogue on responsible, people-centered, and resource-efficient use of AI in the water sector and identify areas for continued voluntary cooperation beyond the Conference.

Integrate AI infrastructure into national and basin-level water and energy planning

Link permits for new AI infrastructure construction and expansion to local water and energy realities, and assess cumulative impact where multiple facilities compete for the same basin or grid.

- **Plan across the full infrastructure chain**, from power generation and water supply through cooling, connectivity, and emergency redundancy.
- **Close the timing gap between infrastructure types.** Digital infrastructure can be built out in months, while energy and water infrastructure takes a decade or more to expand. Permitting decisions for new AI facilities should account for this mismatch directly, sizing and phasing digital buildout to match water and energy capacity that already exists or is already committed.
- **Engage affected communities and local utilities** before siting decisions are made, not after permits are issued. The stress-test cases in Section 2.2 show that early consultation on water and power impacts is one of the strongest predictors of whether a project proceeds on schedule.

Require transparent, comparable reporting of direct and indirect water and energy use

Require facility-level disclosure that captures both **direct footprint** and **indirect exposure**, recognizing that indirect measurement, particularly for electricity and supply chains, is harder to standardize and will need common methodologies to become comparable across facilities. Scope 3 carbon reporting faced the same problem and is becoming standard practice as methodologies mature; water reporting can follow the same path.

- **Direct footprint:** Includes water withdrawals, consumption, reuse and cooling technology, alongside energy intensity and source
- **Indirect exposure:** Includes electricity and supply-chain water use, plus drought and heat risk

Promote low-water, low-energy technologies, circular resource systems, and AI solutions for water

Use standards, incentives, public procurement, and finance to propel AI-driven water technology forward and enable greater resource use efficiency. No single technology will be appropriate everywhere. Air cooling, evaporative systems, closed-loop liquid cooling, and immersion systems should be assessed against local climate, heat density, water availability, energy intensity, maintenance requirements, safety, and retrofit potential.

- **Smart water use:** Use reclaimed or non-potable water where safe, combined with closed-loop, direct-to-chip and other water-efficient cooling and semiconductor processes, supported by continuous water-quality monitoring and responsible cooling-fluid management.
- **Clean, efficient energy:** Pair low-energy water supply methods and heat recovery with renewable energy, storage, and demand flexibility to reduce both the carbon and water footprints of computing.
- **AI for water management:** Deploy AI where it already improves water system performance, from monitoring and forecasting to operational efficiency, and invest in the data and institutional capacity these tools require to work, as well as exploration into untapped opportunities.
- **Design principles:** Build new systems for water and energy efficiency from the outset, including local water availability and community input at the siting stage, rather than retrofitting either after the fact.

Embed water and climate risk in corporate strategy, siting, and investment decisions

Treat water and energy efficiency as a source of competitive advantage rather than a compliance cost:

- **Integrate water and climate risk** into site selection, capital allocation, and long-term investment decisions.
- **Encourage private sector commitments** that recognize and reward resource use efficiency, using procurement, finance, and reporting to make efficiency pay.

- **Align incentives across the value chain**, from developers to utilities to investors to the communities hosting this infrastructure, so efficient resource use benefits everyone bearing its costs, not just the most exposed party.

3.2 THE UN WATER CONFERENCE OPPORTUNITY

The 2026 UN Water Conference is designed as an implementation Conference for SDG 6, the UN's Sustainable Development Goal for clean water and sanitation for all. Its purpose is to move from dialogue to delivery, through finance, capacity, technology, and innovation.

Co-hosted by the UAE and Senegal, it is structured to produce country-level commitments, investable projects, and scaled resource-efficiency technology.

UNWC THEME RELEVANCE TO THE AI-WATER-ENERGY NEXUS

Water for people

Ensuring that AI-enabled allocation, forecasting, and infrastructure decisions, including for power and water utilities, support equitable access and do not prioritize strategic digital infrastructure over basic needs

Water for prosperity

Addressing the water-energy nexus across the economic sectors it touches, from agriculture and food security to industrial use and data-center demand, and the desalination and efficiency measures that serve them

Water for planet

Applying AI to climate resilience, biodiversity, drought, floods, aquifers, ecosystems, energy-intensive water systems, and disaster-risk reduction

Water for cooperation

Using shared data, basin and grid modeling, and scientific cooperation to support transboundary water and energy management

Water in multilateral processes

Establishing common principles, definitions, and reporting standards for responsible AI across water and energy systems at the global and regional scale

Investments for water

Mobilizing finance for AI-enabled monitoring, resilient water and energy infrastructure, capacity-building, and technology deployment

Source: Eurasia Group

The Conference's relevance extends well beyond the water sector. It brings together governments, cities, utilities, businesses, financial institutions, and investors alongside power-sector actors and operators, creating a rare opportunity to connect high-level pledges to on-the-ground infrastructure and operational decisions across the AI-water-energy nexus.

All six of the Conference's interactive dialogues are relevant to AI. What decides how AI's water and energy footprint plays out is increasingly political and regulatory, and that is exactly the terrain these dialogues cover.

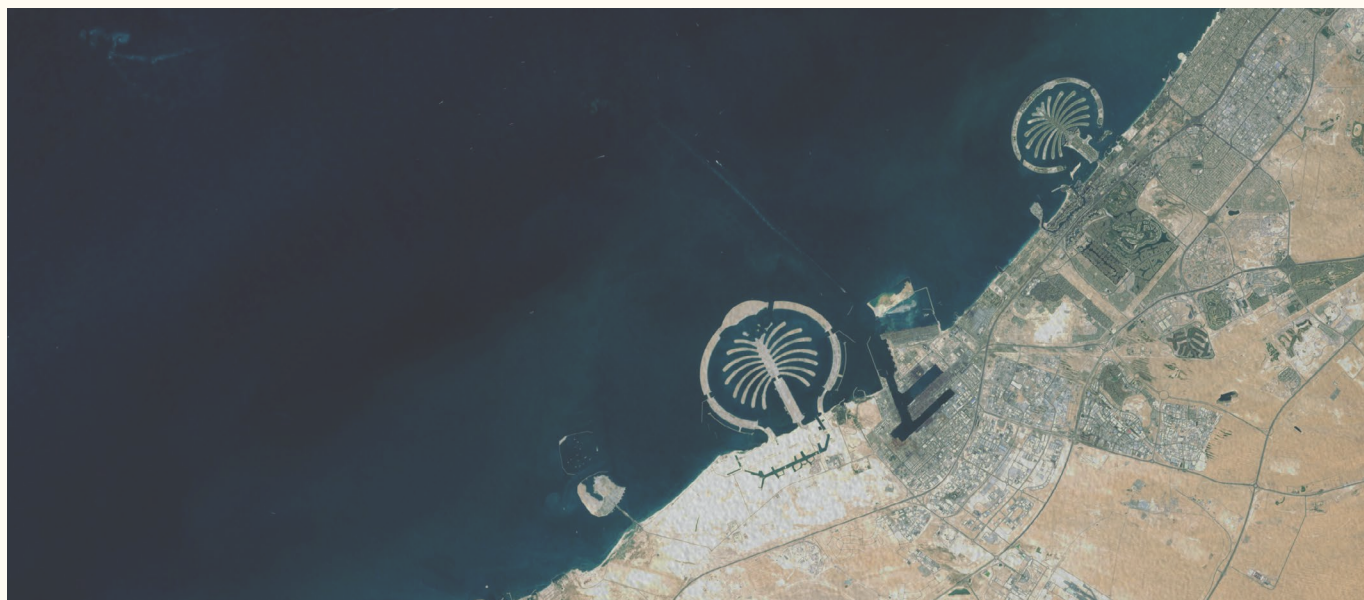
The same underlying challenges take different forms across the globe, and the Conference's opportunity lies in establishing an initial shared set of tools to work from. Water-abundant but grid-constrained regions, flood-prone agricultural deltas, and transboundary river basins all face their own version of the AI-water-energy nexus this report has described. The UAE, where water scarcity has driven early integration of water, energy, and AI planning, offers a fitting setting for that work to advance.

3.3 CONCLUSION

AI is becoming a structural force within the water-energy nexus. Its infrastructure can intensify demand for electricity, cooling, water, and materials, but its analytical capabilities can also improve forecasting, preparedness, allocation, and resilience.

The appropriate response is neither to treat AI as an inevitable threat nor to assume that technological efficiency will resolve water insecurity. The priority is integrated governance: planning water, energy, infrastructure, and data as mutually dependent systems; measuring direct and indirect impacts; financing shared infrastructure and public capacity; and ensuring that AI-for-water applications remain accountable to the institutions and communities they are intended to serve.

The 2026 UN Water Conference offers a natural platform to advance that agenda. It brings governments, utilities, and industry together at a moment when the case for coordinated action has never been clearer, with the chance to leave the world better equipped on finance, capacity, technology, and accountability alike. Approached with ambition, it can turn shared understanding of this risk into shared momentum toward addressing it.



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Crosscurrents
Navigating the AI-Water-Energy Nexus

UNITED ARAB EMIRATES
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