Water Use by Data Centres in the United Kingdom:
Current State, Projections to 2050, and Strategies for Water Efficiency amid High Power Costs
(11minute read)


## 1. Introduction.

Data centres are the backbone of the UK's digital economy, supporting cloud computing, artificial intelligence (AI), and the Internet of Things (IoT). However, their operational demands—particularly for water and power—pose significant environmental challenges. In the UK, where water resources are abundant relative to arid regions but still under pressure in certain areas, and where power costs rank among the highest in Europe, the sustainability of data centres is a pressing concern. This report examines current water use by UK data centres, projects its increase to 2050 driven by technological and economic trends, and proposes water-efficient solutions for new facilities, mindful of the nation's costly energy landscape.

## 2. Current Water Use by Data Centres in the UK

Data centres primarily consume water for cooling servers, which generate substantial heat during operation. Cooling methods such as evaporative cooling towers and chilled water systems rely heavily on water to dissipate this heat. While precise UK-specific data is limited due to inconsistent reporting, estimates can be derived from global benchmarks and regional studies.

A typical 1-megawatt (MW) data centre using traditional cooling methods consumes approximately 26 million litres of water annually—enough to supply over 200 UK households. In 2021, Google's global data centres averaged 1.7 million litres daily per facility, with the UK likely aligning to similar figures given its temperate climate and reliance on water-based cooling. The UK hosts around 450-500 data centres, ranging from small enterprise facilities to hyperscale operations. Assuming an average of 10 MW per facility (a conservative estimate for larger sites), annual water use could range between 100-130 billion litres nationwide. This is a small fraction of the UK's total water consumption (approximately 14 billion litres daily), but localised impacts in water-stressed areas like the southeast are significant.

Water use varies by cooling technology. Traditional cooling towers evaporate vast amounts (e.g., 18,220 $m^3$ annually for a 1000 kW unit), while hybrid systems (8,647 $m^3$) and adiabatic coolers (92 $m^3$) are less thirsty. Indirect water use—via power generation—also contributes, as thermal power plants supporting the grid require water. With data centres accounting for 1-2% of UK electricity demand (around 3-6 TWh annually), their total water footprint is amplified by this dependency.

## 3. Projected Increase in Water Use by 2050.

The demand for data centre capacity in the UK is set to soar, driven by digitalisation, AI, and government policies like the Digital Development Strategy 2024-2030. The UK data centre market, valued at $10.69 billion in 2024, is projected to grow at a compound annual growth rate (CAGR) of 13.33%, reaching $22.65 billion by 2030. Beyond 2030, growth may slow but remain robust, with forecasts suggesting a tripling of capacity by 2050 as AI workloads and IoT devices (projected to reach 29.3 billion globally by 2030) proliferate.

Water use will rise in tandem unless efficiency improves. Key drivers include:

1. **Increased Capacity**: Plans for 40 new AI-ready data centres by 2030, announced by operators like Latos, signal a construction boom. By 2050, the UK could host 700-1000 facilities, reflecting a 50-100% capacity increase.

2. **Higher Rack Densities**: AI and machine learning demand high-performance computing, pushing rack power densities from 5-10 kW to 20-50 kW or more, necessitating more intensive cooling.
3. **Climate Change**: Rising temperatures will increase cooling demands. The Met Office predicts UK summers could be 1.5-3°C warmer by 2050, potentially boosting water use by 10-20% per facility in evaporative systems.
4. **Power Grid Reliance**: Despite renewable energy growth (15.3 GW in Scotland by 2023), high power costs may deter a full shift from water-intensive cooling to energy-heavy alternatives like air conditioning.

Assuming a linear correlation between capacity and water use, a doubling of data centre numbers and a 50% increase in per-MW consumption (due to denser racks and warmer climates) could see annual water use rise to 300-400 billion litres by 2050—three to four times current levels. In water-stressed regions like London and the southeast, this could strain supplies, especially if Thames Water's warnings about restricting data centre use materialise amid ongoing leakage issues.

## 4. Strategies for Water Efficiency in New UK Data Centres.

New data centres must balance water efficiency with the UK's high power costs — among the highest in Europe at around £0.20-£0.25 per kWh for industrial users in 2025, compared to £0.10-£0.15 in countries like France or Sweden. Below are practical, cost-sensitive strategies:

1. Advanced Cooling Technologies.
   - Adiabatic and Hybrid Cooling: These systems use minimal water compared to traditional towers. Adiabatic coolers, leveraging the UK's cool, wet climate, can reduce water use by over 90% (e.g., from 18,220 m³ to 92 m³ annually for a 1000 kW unit). While they require fans (increasing power use), the UK's temperate conditions minimise operational hours, offsetting energy costs.
   - Closed-Loop Systems: Recirculating water within the facility eliminates external replenishment needs. VIRTUS Data Centres' LONDON2 facility, built above an aquifer, uses non-potable groundwater, cutting potable water use by 55%. Initial setup costs are high (£500,000-£1 million extra per facility), but long-term savings on water bills (£50,000-£100,000 annually) and reduced regulatory risk justify the investment.
   - Liquid Immersion Cooling: Submerging servers in dielectric fluids transfers heat more efficiently than water or air, reducing water use to near zero. Though power-intensive pumps are needed, the technology suits high-

density AI racks, and its energy penalty (10-20% higher than air cooling) is manageable given cooling efficiency gains.

2. Water Recycling and Harvesting.
   - Rainwater Harvesting: The UK's average rainfall (1,200 mm annually) offers a free resource. A 10,000 m² roof could collect 12 million litres yearly, offsetting 50% of a 1 MW facility's needs. Installation costs (£50,000-£100,000) are recouped within 5-10 years via lower water bills (£0.002-£0.003 per litre saved).
   - On-Site Treatment: Recycling greywater or condensate from cooling systems can halve freshwater demand. Systems costing £200,000-£500,000 per facility reduce reliance on municipal supplies, critical in water-stressed areas.

3. Site Selection and Design.
   - Location Optimisation: Siting data centres in water-abundant regions like Scotland, with its cool climate and renewable energy (reducing indirect water use), minimises cooling needs. High power costs can be mitigated by co-locating with wind or hydro plants offering cheaper rates (£0.15/kWh or less).
   - Free Cooling: Leveraging ambient air for 70-80% of the year in the UK's climate cuts water use by 30-50%. While fans increase power consumption (e.g., 50-100 kW extra per MW of IT load), this is cheaper than water-intensive cooling towers when power is sourced renewably.

4. Energy Efficiency to Reduce Indirect Water Use.
   - Renewable Integration: Shifting to solar, wind, or hydro reduces the water footprint of power generation. Scotland's renewable capacity supports this, though high grid tariffs necessitate on-site generation or power purchase agreements (PPAs) to lower costs below £0.20/kWh.
   - Server Optimisation: Virtualisation and energy-efficient hardware (e.g., ARM processors) lower heat output, reducing cooling demands. A 20% efficiency gain could save 5-10 million litres of water per MW annually, with power savings offsetting high upfront costs (£100,000-£200,000 per facility).

5. Policy and Industry Collaboration.
   - Regulatory Incentives: The UK's designation of data centres as critical infrastructure could tie planning approvals to water efficiency targets (e.g., 400 litres/MWh by 2040, per EU goals). Tax breaks for low-WUE (Water Usage Effectiveness) facilities would offset high power costs.
   - Industry Standards: Adopting metrics like WUE (litres/kWh) alongside PUE (Power Usage Effectiveness) ensures transparency. Operators like Microsoft (targeting water positivity by 2030) set precedents for UK firms to follow.

## 5. Challenges and Trade-Offs.

High power costs complicate water efficiency. Air-based or fan-driven systems (e.g., free cooling) reduce water use but increase electricity demand, raising operational expenses by £50,000-£100,000 annually per MW at UK rates. Liquid immersion cooling, while water-efficient, requires costly retrofits and power for circulation pumps. Balancing these trade-offs requires site-specific analysis—water-scarce southeast England may prioritise closed-loop systems, while energy-rich Scotland can lean on free cooling.

## 6. Conclusion.

Data centres in the UK currently consume an estimated 100-130 billion litres of water annually, a figure that could triple to 300-400 billion litres by 2050 without intervention. This escalation, driven by capacity growth, denser computing, and climate change, demands urgent action. New facilities can adopt adiabatic cooling, closed-loop systems, and rainwater harvesting to slash water use, while renewable energy and efficient design mitigate the impact of high power costs. By integrating these solutions, the UK can sustain its digital economy without exacerbating water stress, setting a model for global data centre sustainability.

PM (+Grok) March 2025