Northumbria University NEWCASTLE

Data center server racks, gettyimages/quantic69

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EXPERT COMMENT: AI is gobbling up water it cannot replace – I'm working on a solution

In this article originally written for The Conversation*, Dr Muhammad Wakil Shahzad, Associate Professor and Head of Subject, Mechanical and Construction Engineering at Northumbria University, discusses a possible solution to the environmental impact of AI data centres.

Data centres are the invisible engines of our digital world. Every Google search, Netflix stream, cloud-stored photo or ChatGPT response passes

through banks of high-powered computers housed in giant facilities scattered across the globe.

These datacentres consume a staggering amount of electricity and increasingly, a surprising amount of water. But unlike the water you use at home, much of the water used in datacentres never returns to the water reuse cycle. This silent drain is drawing concern from environmental scientists. One preprint study (not yet reviewed by other scientists) from 2023 predicted that by 2027 global AI use could consume more water in a year than half of that used by the UK in the same time.

Datacentres typically contain thousands of servers, stacked and running 24/7. These machines generate immense heat, and if not properly cooled, can overheat and fail. This happened in 2022 when the UK endured a heatwave that saw temperatures reach a record-breaking 40° Celsius in some areas, which knocked off Google and Oracle datacentres in London.

To prevent this, datacentres rely heavily on cooling systems, and that's where water comes in.

One of the most common methods for cooling datacentres involves mechanical chillers, which work like large fridges. These machines use a fluid called a refrigerant to carry heat away from the servers and release it through a condenser. A lot of water is lost as it turns into vapour during the cooling process, and it cannot be reused.

A 1 megawatt (MW) datacentre (that uses enough electricity to power 1,000 houses) can use up to 25.5 million litres annually. The total data centre capacity in the UK is estimated at approximately 1.6 gigawatts (GW). The global data centre capacity stands at around 59 GW.

Unlike water used in a dishwasher or a toilet, which often returns to a treatment facility to be recycled, the water in cooling systems literally vanishes into the air. It becomes water vapour and escapes into the atmosphere. This fundamental difference is why data centre water use is not comparable to that of typical household use, where water cycles back through municipal systems.

As moisture in the atmosphere that can return to the land as rain, the water

datacentres use remains part of Earth's water cycle – but not all rain water can be recovered.

The water is effectively lost to the local water balance, which is especially critical in drought-prone or water-scarce regions – where two-thirds of datacentres since 2022 have been built. The slow return of this water makes its use for cooling datacentres effectively non-renewable in the short term.

The rise of AI tools like ChatGPT, image generators and voice assistants has made datacentres work much harder. These systems need a lot more computing power, which creates more heat. To stay cool, data centres use more water than ever.

This growing demand is leading to a greater reliance on water-intensive cooling systems, driving up total water consumption even further. The International Energy Agency reported in April 2025 that datacentres now consume more than 560 billion litres of water annually, possibly rising to 1,200 billion litres a year by 2030.

What's the alternative?

Another method, direct evaporative cooling, pulls hot air from datacentres and passes it through water-soaked pads. As the water evaporates, it cools the air, which is then sent back into server rooms.

While this method is energy-efficient, especially in warmer climates, the added moisture in the air can damage sensitive server equipment. This method requires additional systems to manage and control humidity, which necessitates more complex datacentre design.

My research team and I have developed another method which separates moist and dry air streams in datacentres with a thin aluminium foil, similar to kitchen foil. The hot, dry air passes close to the wet air stream, and heat is transferred through the foil without allowing any moisture to mix. This cools the server rooms in datacentres without adding humidity that could interfere with the equipment.

Trials of this method at Northumbria University's datacentre have shown it can be more energy-efficient than conventional chillers, and use less water.

Powered entirely by solar energy, the system operates without compressors or chemical refrigerants.

As AI continues to expand, the demand on datacentres is expected to skyrocket, along with their water use. We need a global shift in how we design, regulate and power digital infrastructure.

*This article was originally published by The Conversation. Please see here for republishing guidelines.

Find out more about Optimum Air Con, a pioneering cooling system developed by EcoTechX, an academic start-up founded by Dr Muhammad Wakil Shahzad which is in the process of 'spinning out' from Northumbria University.

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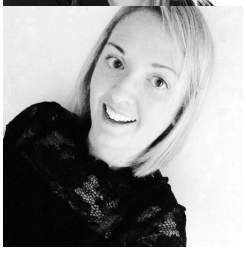

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