European Data Centre Association's
**Technical Committee**

# Seeing Through the Mist: Data Centres and Water Usage

EUDCA Viewpoint

EUROPEAN DATA CENTRE ASSOCIATION



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**Water is a precious resource whose use in data centres is often misunderstood. What is the real picture of water usage in the industry and what is being done to address concerns?**

There has recently been much debate around the energy consumption of data centres, and particularly so concerning artificial intelligence (AI). This focus has also led many to question data centre water use, which is arguably less well understood than energy usage.

How much water does an average data centre use? How does it compare with other industries, and what is the difference between water usage and water consumption? Perhaps most importantly, what is the industry doing about its water usage?

## Water Intensive Industries

There are many industries that use a lot of water, from food to energy production and recreation. Unsurprisingly, agriculture is the most intensive, and within that, cereal, fruit and vegetable production is the most intense. Common crops such as barley, wheat, rice, and sugar cane are all highly water intensive. For example, it is estimated that a single kilogram of rice takes 3,400 litres of water to produce. Taking into account the full lifecycle of production, a single cup of coffee requires around 140 litres.

The meat industry is often highlighted as water intensive, and with good cause; a kilo of beef could take around 15,450 litres to produce, while chicken can take 3,900 litres per kilo.

In non-food industries, energy generation is high on the water intensive list, as is the clothing and textiles industry. A single pair of jeans can require between 3 and 4,000 litres of water. In general, the textile industry and particularly dyeing, is one of the most water intensive industries, as the water used requires treatment before it can be either returned to source or repurposed for agriculture or human consumption.

On another point of context, a typical American golf course can use more than 1,181,048 litres of water per day, adding up to almost 431,537 cubic metres per year. By comparison, a midsize data centre (1-5MW) is estimated to use slightly less at 416,395 cubic metres per year. That equates to water for around 1,000 households per year.

Other estimates say that large data centres, such as hyperscale facilities, can consume up to 18,927 m3 per day, or 6.9 million cubic metres per year.

Looking proportionally, in Europe, data centre water represents a very small percentage of overall water abstraction as reported by the European Environment Agency report in 2025.

In terms of water abstraction, the proportions are:

- Power plant cooling: 36%
- Agriculture: 29%
- Public water supply (including households and tourism): 19%
- Manufacturing: 14%

The above adds up to 98% of water abstraction, leaving data centres and other users the remaining 2% However, the report does recognise data centres, along with hydrogen production, as "emerging sectors" that are likely to have an increasing impact on water abstraction in the future.

As large energy users, data centres should acknowledge the water usage in the generation of the energy they consume. This information should be readily available from energy producers under measures such as Corporate Sustainability Reporting Directive (CSRD) as well as the Energy Efficiency Directive (EED), and would help improve transparency in reporting.

## Data Centre Water Usage

Having established a context for the volumes of water used, it is important to understand how a data centre uses water and make a distinction between water usage and water consumption.

The primary use of water in data centres is for cooling equipment. While some data centres also use water for humidification, this is not generally necessary outside of arid climates. Water is also used for more familiar purposes, such as for staff use in kitchens and washrooms, but this is negligible compared to the primary use.

Water is used for cooling because of its physical characteristics as a good heat transfer medium, and because in evaporation in particular, it is a highly efficient cooling medium. The use of water in data centre cooling systems also helps to avoid the use of chemical refrigerants which not only carry higher global warming potential (GWP) but are also regulated in their use specifically to protect the planet.

## Types of Data Centre Cooling Systems

The design of cooling systems in data centres can vary greatly depending on the cooling requirement as well as other factors such as location and climate. Broadly speaking, there are a number of common components or subsystems: There is a heat source - the main one being the IT equipment - from which heat needs to be removed to prevent thermal shutdown; a heat transfer system by which the heat is transferred to a transport medium containing the heat while it is moved; and a heat rejection system that exhausts the heat from the building. Every data centre cooling set up involves these basic systems in some form and configuration.

When describing the various cooling approaches, they tend to break down into closed loop, open loop, evaporative cooling, dry cooling, liquid cooling and free cooling.

Closed loop systems contain a transfer medium, such as water treated with glycol that circulates back and forth removing heat from the heat source to a heat rejection system and back again. A closed loop, once filled, requires very little additional water and is often referred to as a dry system.

An open loop system is one where water is taken in as it operates, and is used through a process, such as evaporation, for example, that requires replenishing. This term can be applied, e.g., to evaporative cooling systems, where heat is rejected to atmosphere as water changes phase from liquid to gas. Evaporative, or adiabatic systems, are said to be wet systems as the water in use is open to the atmosphere, as opposed to a closed system where it is circulated in a sealed system.

There are many variations on these basic approaches that can involve additional equipment such as chillers, cooling fans, and cooling towers.

Liquid cooling is another technique that can be used in conjunction with water-based heat rejection systems. Liquid cooling can be achieved through immersion of IT equipment in special enclosures – tanks, baths or cassettes - filled with a dielectric fluid that through direct contact with the heated components provides a heat transfer medium that is then circulated through some kind of heat exchanger, where the heat can be removed into one of the previously described subsystems.

Another variation on liquid cooling is direct to chip (DTC) cooling where a hollow metal plate (or, cold plate), allows a cooling medium to circulate and draw the heat away for rejection as described before. The two liquid cooling methodologies are commonly used in high performance (HPC) computing and artificial intelligence workloads and equipment. Liquid cooling is seen as the enabling technology for AI, facilitating the high power density IT racks for these technologies to function.

Free cooling systems can be operated in situations where external ambient air is regularly at a temperature that is sufficient to require no treatment before being used to cool equipment. Ambient air can be drawn into the data centre, where it is used to remove heat from the IT equipment and then exhausted externally.

## Water Usage versus Water Consumption

The nature of these cooling systems, where some require a one-time fill with minimal top up in operation, and some require a constant throughput, highlights the issue of water usage versus water consumption.

Water usage may be described as the total volume withdrawn from a source for use in the data centre. Water consumption is the portion of water not returned to the source and is lost through processes such as evaporation or contamination.

Evaporative cooling, for example, consumes water insofar as the water that is converted from a liquid to a gas is lost to the atmosphere and not recovered.

A closed loop cooling system that uses water as the heat transfer medium can have the water treated for return to a source such as an industrial supply or municipal system.

This is an important distinction because measurement and management are only possible when there is transparency on exactly how water is used.

## Water Sources

There are several different water sources used by data centres. Many facilities use municipal water which has the advantages of availability in urban or suburban areas, and is treated and often ready for use. Groundwater can come from sources such as bore holes or wells, sometimes located on the facility site or campus. Surface water comes from rivers or lakes, though requires filtration and treatment before use. Surface water may be subject to seasonality and can have environmental impacts, especially if being returned to source. Recycled or greywater is increasing in use, especially in water constrained areas.

In some areas treated or desalinated sea water is used, such as Google's Hamina facility in Finland. Green Mountain's mountain hall facility, SVG-Rennesøy, uses 8 degrees C fjord (sea) water in a gravity fed closed loop system which operates without negative environmental impact. A UK example with NTT Global Data Centres uses a reverse osmosis system to purify non-potable water for data centre use.

Most operators are moving away from potable water sources, such as municipal supplies, and exploring alternative sources, though currently this proportion remains low.

## What Is the Industry Doing about Water Usage?

The data centre industry long ago developed a metric for efficiency in power usage known as power usage effectiveness (PUE). This divides the total facility power usage by the IT equipment power usage to produce a ratio of efficiency.

Similarly, there is a water usage effectiveness (WUE) metric that sets water usage against the energy usage of IT equipment. WUE is expressed in litres per kWh, or m3 per mWh.

In combination, these metrics allow data centres to measure their efficiency in the utilisation of two key resources, illustrating where improvements are necessary and achievable.

According to the EUDCA State of European Data Centres 2025 Report, colocation facilities in Europe reported an average WUE of 0.31 l/kWh, which is well below the target figure agreed in the Climate Neutral Data Centre Pact (CNDCP) of 0.4 l/kWh. Colocation data centres are the most numerous type in Europe, though they are surpassed in overall facility capacity by the hyperscalers.

Hyperscale data centres often exhibit even better WUE performance, as the operating temperature of IT equipment can be higher and therefore more efficient due to standardised designs and more predictable utilisation. This can translate into better WUE scores: Microsoft in 2024 reported a global average of 0.3 l per kWh WUE, improved from 0.49l/kWh in 2021. Amazon reported a global WUE of 0.15l/kWh in 2024, claiming a 17% improvement over 2023, and a 40% improvement since 2021.

## AI Effect

There is little doubt that the growing deployment and usage of AI will mean a greater requirement for cooling, and the liquid cooling techniques described above will become widely deployed. This will mean the heat transfer and rejection systems using water as a medium will also have to scale up to cope. It is estimated that the GPT-3 AI model consumes 500 ml of water per 10-50 responses, but overall the service boasts some 800 million active users with 5 billion visits per month. The sheer volume of users, and projected growth gives an indication of the trajectory of capacity and cooling requirements.

It is worth noting that AI will also be deployed to manage and constantly optimise cooling infrastructure to ensure efficiency and sustainability targets are met. As seen with energy usage, the application of AI and the digitalisation of cooling will produce new opportunities for efficiency as well as innovation in cooling generally, and water usage in particular.

## The Bottom Line

Whilst in some locations data centres are significant water users, the sector cannot be labelled as a water intensive industry in the same way that agriculture, energy generation, or manufacturing are described. At the same time, the rapid pace of development in the industry does mean that resource use, including water, must be carefully monitored and transparently reported to ensure efficiency and responsible stewardship. There is significant scope for improvement in data centre water usage, such as aiming for near zero potable water usage and increased water re-use. New and innovative solutions are emerging in these areas that provide room for advancement in the short term.


Through regulation, such as the developing Energy Efficiency Directive (EED), and voluntary frameworks such as the CNDCP, the data centre industry can ensure that its relentless focus on efficiency translates into optimised usage of this most valuable resource, and drive innovation for the future.

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