

Data centre energy efficiency – look to water quality

Glenn Simpson explains why, in the search for further energy savings in data centres, water quality is a crucial factor to consider as energy and carbon reduction regulations bite harder.

Glenn Simpson

UK manager at
Enwa Water Technology UK
www.enwa.co.uk



Data centres currently account for around 3% of global electricity consumption, and estimates suggest that this could increase to at least 4% by 2030. However, the International Energy Agency estimates that energy consumption in data centres could double by 2026, fuelled by AI and cryptocurrency growth.

To be fair, the data centre industry has worked to improve its energy efficiency. Power Usage Effectiveness (PUE) is the key measure used in the sector. It expresses the ratio of energy used as a whole to the energy used just by IT equipment. So, the energy used by cooling systems is a major contributor to PUE ratios.

The Uptime Institute, a leading data centre advisory body, has conducted an annual industry survey for the past fifteen years. Since 2020, the average PUE has been between 1.55 and 1.59. In 2023, the average was 1.58. The Institute notes that larger facilities tend to be more energy efficient because they have more modern equipment and more efficient cooling designs.

Energy efficiency improvements are becoming more challenging for the sector to find. A growing number of countries that host data centres are now legislating to limit their energy use through higher efficiency targets.

For example, the European Union has approved a data centre emissions

reporting scheme which applies to all data centres over 500kW. It will require operators to report factors such as floor area, installed power, data volumes, energy consumption, PUE, temperature set points, waste heat reuse, water use and application of renewable energy.

Cooling systems

In the UK, data centres are also under pressure to improve their energy and carbon performance. This includes local regulations such as the London Plan, which requires all new buildings (including data centres) to achieve a minimum 35% improvement in carbon emissions over Part L requirements.

For data centre designers and operators seeking to optimise energy performance, the cooling system is often the first place to look. This system can use up to 40% of the centre's energy, so any savings here can significantly reduce long-term energy use.

Data centres tend to use water-cooled or air-cooled cooling systems. Water plays a key role in both types, and the quality of that water impacts cooling delivery and energy use. While water quality can be overlooked when seeking better energy performance in HVAC systems, there are significant benefits to considering water treatment as a key element of building services performance.

Water in these systems can be beset with several issues, including suspended solids, biofilm, corrosion and fouling. The presence of these in water leads to a number of problems for HVAC systems.

By-products of corrosion and scale formation, installation debris and general fouling can create a high

suspended solids loading in closed systems. This can impact the energy transport characteristics of the water and disrupt fluid flow rate and distribution. Particles can become lodged in moveable components such as automated valves and will block strainers, accelerate erosion and lead to sludge deposits in low-flow areas.

Insulating layers caused by corrosion or biofilm formation can dramatically reduce heat transfer. Unchecked, harmful processes, including corrosion, debris erosion and deposition, can significantly reduce the effective lifespan of equipment, presenting a major cost and environmental impact.

If water is contaminated with debris, its energy transport characteristics are reduced. Iron particles, for example, hold heat and reduce the transfer efficiency at heat exchange surfaces.

It's clear that chillers will, therefore,

operate less efficiently in poorly treated water since Delta T values cannot be achieved. Pumps may also have to work harder to meet demands or overcome local flow restrictions. These issues add up to higher energy use and poorer cooling system performance.

Lack of effective water treatment will almost inevitably reduce the working life of critical components, including chillers, CRAC units and heat exchangers. Breakdowns also become more likely, raising the risk of cooling system failure, which is a mission-critical issue in 24-7 data centre facilities. This is in addition to the capital cost of replacing equipment.

Side stream filtration

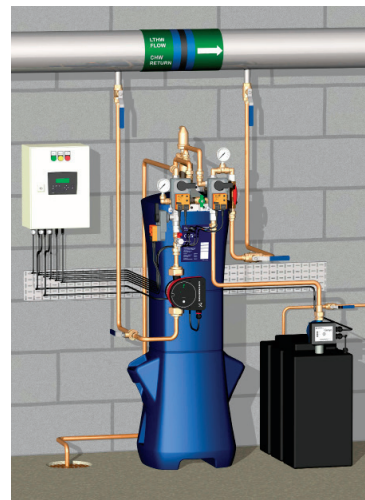
Several approaches to water treatment exist, but the side stream filtration approach, in combination with effective water treatment, is particularly useful for data centres. Filtering to less than ten microns and providing corrosion inhibition while also restricting bacterial growth (which can cause corrosion), are vital for maximising data centre system 'uptime' and minimising 'downtime'. Side stream filters are not 'in line', facilitating easy installation and maintenance.

Furthermore, it is advantageous for busy data centre management teams to have a water treatment approach that is self-regulating and adapts in real time. This ensures correct treatment is always in place and reduces the amount of hands-on time required by building operations teams and their managers.

As the energy efficiency challenge grows, more data centres are undertaking refurbishments, including around their cooling systems. Here, water treatment is even more important to consider as part of that process.

Newer systems often have narrower waterways to enhance efficiency. But this creates more potential for blockage. Ensuring that a system like side stream filtration is in place can help to reduce problems around retrofitting and ensure that the building energy performance benefits from investment in energy efficient equipment.

As the data centre sector looks to future growth while achieving energy efficiency, it's important to regard water quality as a critical component and approach it holistically. At Enwa, we believe that where water treatment is concerned, prevention is always better than cure and that an automated side stream approach provides a modern solution for cutting-edge clients. We also support engineers and clients with CIBSE approved CPD training on the principles of side stream filtration and self-regulating water treatment so that they can make the most of this technology. ■



The EnwaMatic provides side stream filtration and water treatment for closed heating and cooling systems