# AI demands spark urgent switch to advanced liquid cooling in data centres



As artificial intelligence continues to reshape industries from logistics to digital search, its unprecedented energy and cooling demands are introducing significant challenges to data centre infrastructure. This shift is forcing data centre operators to reconsider traditional cooling methods, particularly as the power required for AI processing escalates dramatically. During a recent discussion with cooling experts Daren Shumate and Stephen Spinazzola from Shumate Engineering, the urgency of adapting to these changes became starkly apparent.

The surge in AI workloads means that conventional air-cooling systems are increasingly inadequate. Spinazzola outlined the issue succinctly: "With high-density computing, like the data centres that run artificial intelligence, comes immense heat that cannot be cooled with a conventional air-cooling system." Where traditional cooling systems once sufficed, the power loads carried by today’s cabinets have doubled and tripled, resulting in catastrophic heat levels that exceed acceptable thresholds. Computational fluid dynamics (CFD) modelling shows temperatures surpassing 115 degrees Fahrenheit, leading to potential server shutdowns.

The growing water demands in parallel with rising energy requirements present an additional conundrum. According to a recent study, some hyper-scale facilities may need an astonishing 1.5 million litres of water daily for cooling and humidification. This is a particular concern in regions already facing water scarcity. Legislative efforts in states like Virginia are being introduced to ensure data centres submit water use estimates to better monitor this growing problem. With AI-driven demand set to escalate further, experts caution that reliance on technological improvements alone is insufficient; regulatory measures and thoughtful site selection are essential to mitigate the pressure on local water resources.

While water cooling offers a potential solution, incorporating such systems is not without its challenges. Daren Shumate discussed the complexity of efficiently delivering power to these high-density racks, explaining the intricacies of modern distribution systems. These systems must now accommodate larger quantities of feeder circuits to manage new power densities, illustrating the operational burdens data centres face in adapting to AI’s demands.

Amid these challenges, liquid cooling technologies are being heralded as more effective alternatives. They have emerged as a critical adaptive response to AI workloads, outperforming traditional air cooling in energy efficiency and performance. Reports indicate that 22% of data centres are now employing liquid cooling, a figure projected to rise significantly as the global market evolves, driven by an expected CAGR of 15% from 2023 to 2032. Despite this promising trend, obstacles to widespread adoption remain, such as varying standards, safety concerns, and a need for trained personnel to operate these advanced systems.

Two notable types of direct liquid cooling (DLC) are making headway. Emersion cooling involves fully submerging servers in non-conductive fluids, while cold plate cooling utilises a heat sink to transfer heat away from chips. Both methods present distinct advantages in space efficiency and cooling effectiveness but require careful design considerations to prevent leaks and ensure optimal performance.

A recent innovation, known as Hybrid-Dry/Adiabatic Cooling (HDAC), offers a promising alternative by combining two cooling temperatures within a single closed loop, significantly reducing water use while maintaining high energy efficiency. Spinazzola noted that HDAC can lower the Power Usage Effectiveness (PUE) ratio to as low as 1.1, a significant improvement over typical AI data centres where PUE often ranges between 1.2 and 1.4. However, the challenge remains that many operators appear hesitant to be the first to implement this new technology.

As data centre operators grapple with the escalating demands brought about by AI, the path forward is complex. Embracing innovative cooling solutions is not merely a matter of enhancing performance; it is becoming essential for survival in a landscape where power and water resources become scarcer. While air cooling systems have served their purpose over the years, the rapid evolution driven by AI workloads necessitates a fundamental rethinking of how we approach energy and cooling in data centres.

### Reference Map

1. Article on AI and data centre cooling challenges
2. Discussion on rising water demands due to AI
3. Insights into the Midwest data centre growth and energy usage
4. Overview of liquid cooling adoption in data centres
5. Analysis of challenges and solutions for AI cooling
6. Examination of evolving data centre cooling
7. Role of liquid cooling in the era of generative AI

Source: [Noah Wire Services](https://www.noahwire.com)

## Bibliography

* <https://www.techradar.com/pro/security/i-sat-down-with-two-cooling-experts-to-find-out-what-ais-biggest-problem-is-in-the-data-center> - Please view link - unable to able to access data
* <https://www.ft.com/content/65fff689-bd47-4c15-bdb8-083e5ccd84dc> - This article discusses the increasing strain on water resources due to the rising demand for AI tools, including generative AI, which has led to greater water consumption by data centers. It highlights legislative efforts in Virginia to require data centers to submit water use estimates and notes that AI processing is projected to heavily consume global water by 2027. The piece also mentions that companies like Equinix are adopting cooling techniques to reduce water use, though complete reliance on innovation might not suffice. Regulatory measures and thoughtful site selection are suggested to mitigate the strain on local water supplies.
* <https://www.axios.com/2025/04/16/midwest-data-center-growth-energy-usage> - This article reports on the surge in data center construction in the Midwest, driven by the AI boom, transforming the region into a major hub for digital infrastructure. It notes that major cities like Columbus and Chicago lead development, with secondary cities such as Minneapolis and Des Moines also attracting interest due to lower costs and more accessible energy. However, the rapid expansion raises concerns over environmental impact and economic return for communities, as data centers consume vast and often unmeasured amounts of electricity and water, with hyperscale facilities alone using around 365 million gallons of water annually.
* <https://www.networkworld.com/article/2076039/data-centers-warm-up-to-liquid-cooling.html> - This article discusses the growing adoption of liquid cooling in data centers, driven by the increasing power demands of AI and high-performance computing workloads. It highlights that 22% of data centers are using liquid cooling, with the global market expected to grow at a compound annual growth rate of 15% between 2023 and 2032. The piece also addresses obstacles to adoption, including the lack of standards, safety concerns, and the need for trained personnel to handle the technology.
* <https://www.datacenterdynamics.com/en/opinions/cooling-solutions-for-ai-workloads-in-evolving-data-centers/> - This article explores the challenges and solutions for cooling AI workloads in evolving data centers. It emphasizes that liquid cooling offers a more sustainable option compared to other thermal management technologies, reducing energy consumption. However, it also outlines challenges such as initial investment costs, complexity of integration, and scalability. The piece suggests that careful cost-benefit analysis and long-term planning are necessary for successful adoption of liquid cooling systems.
* <https://www.intelligentdatacentres.com/2024/09/06/the-evolution-of-data-centre-cooling-to-support-ai-workloads/> - This article examines the evolution of data center cooling to support AI workloads. It discusses the importance of effective cooling solutions in meeting the growing demands of AI workloads and highlights the role of liquid cooling technologies in enhancing performance, increasing energy efficiency, and improving reliability. The piece also notes that while air-cooling is likely to remain in data centers, liquid cooling is becoming increasingly important for AI-centric operations.
* <https://www.datacenterdynamics.com/en/analysis/liquid-cooling-in-the-generative-ai-era/> - This article analyzes the role of liquid cooling in the era of generative AI. It discusses how the adoption of liquid cooling within the data center space is driven by the workload itself, with facilities not offering AI or HPC services unlikely to see a need to upgrade their cooling infrastructure. The piece also addresses the lack of standardization across components of liquid cooling solutions and the regulatory pressures that influence the adoption of these technologies.