STRATEGIC PANEL & Committees

Market Improvement Fund

Water Efficient Data Centres

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February 2026

FINAL REPORT

Client: MOSL on behalf of the Strategic Panel's Market Improvement Fund

Report Ref: UC19447.03

Report Date: February 2026

This project is funded by the Market Improvement Fund. The Market Improvement Fund was set up to fund innovative projects that will benefit the non-household water market and its customers. The fund is overseen by the Strategic Panel (including project selection, funding allocation and progress of work) and is administered by MOSL.

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Report Reference: UC19447.03

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Document History

Version number	Purpose	Issued by	Quality Checks Approved by	Date
V1	Draft report for comment	Joe Cahill	Fiona Thompson	14/11/2025
V2	Final report for comment	Sally Tang	Hattie Dingle	26/01/2026
V3	Final report	Hattie Dingle	Joe Cahill	05/02/2026

This document has been produced by WRc.

Contents

Appendices

List of Tables

List of Figures

Acronyms

AI	Artificial Intelligence
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
AWS	Amazon Web Services
CDD	Cooling Degree Days
CER	Cooling Efficiency Ratio
CNDCP	Climate Neutral Data Centre Pact
COP	United Nations Global Compact's Communication on Progress
CRAH	Computer Room Air Handler
CSDDD	European Union Corporate Sustainability Due Diligence Directive (Directive 2024/1760)
CSRD	European Union Corporate Sustainability Reporting Directive (2022/2464)
CUE	Carbon Usage Effectiveness
EC	European Commission
EED	European Union Energy Efficiency Directive (EU/2023/1791)
EMS	Environmental Management System
ESG	Environmental, Social and Governance
EU	European Union
GW	Gigawatt
GGC	Greening Government Commitments
GRI	Global Reporting Initiative
IT	Information and Communication Technology
IIRC	International Integrated Reporting Council
ITE	Information and Technology Equipment
KPI	Key Performance Indicator
kWh	Kilowatt-hour
MW	Megawatt
NFRD	Non-Financial Reporting Directive
OECD	Organisation for Economic Cooperation and Development Guidelines
PUE	Power Usage Effectiveness
REF	Renewable Energy Factor
WEI	Water Exploitation Index
WEMS	Water Efficiency Management Systems

WRMP	Water Resource Management Plan
WUE	Water Use Efficiency
WUE_1	Type 1 Water Use Efficiency, as defined by BS EN 50600-4-9:2022
WUE_2	Type 2 Water Use Efficiency, as defined by BS EN 50600-4-9:2022
WUE_3	Type 3 Water Use Efficiency, as defined by BS EN 50600-4-9:2022
ZB	Zettabytes

Summary

This study explored potable (public water supply) water use by data centres in England. It aimed to provide informative and valuable insights, linked to tangible policy and industry recommendations. Aspects where the data centre and water industries could become more aligned through communication and collaboration have been identified, as well as through policy adjustments and aspects where further information and exploration would be beneficial, informing recommendations to support the sustainable development and growth of the English data centre sector.

The headline finding is that, while some English data centres consume not insignificant volumes of potable water, the landscape is significantly different to other jurisdictions, notably the USA where evaporative water cooling is commonplace[1]. Furthermore, while full coverage of metered consumption data is not available, our analysis, consistent with other sector research, has found that the majority of data centres do not consume significant quantities of potable water (67% use <1,000 m^3/year). Overall, our estimates in Section 3.3 suggested that English data centres may take 1,879,000 m^3/year from the public water supply (amounting to 0.2% of the NHH market), but this is increasing. This is highly skewed towards the large water users, with the top six data centres accounting for 65% of the sector's water consumption. When considering future trends, it should be noted that two of these data centres came online in 2024, and five of them have come online since 2020.

In accordance with the project scope and objectives, a number of recommendations have been produced in Sections 4.5 and 5 to promote water efficiency and support sustainable sector growth. These recommendations should be interpreted in the context of a growing sector and a prioritised area for economic growth which is classed both as Critical National Infrastructure and an emerging industry (meaning it is not factored into water resource planning). Furthermore, the overall amount of water required for data centres was not the primary concern of water companies. Rather they had concerns over demand on peak days, and that these would likely coincide with increased domestic demand as both have temperature as a significant driver. This was supported by the evidence review in Section 3 which identified that peak water requirements have the potential to be significant, and the data analysis showed a clear seasonality with increased demand in summer, when domestic demand is typically greater. However, the proportionality and equity of any regulation and policy changes should also be considered as many of these recommendations will apply equally to many other sectors, including some which could be found to use more water or to use water less efficiently.

Following a review of existing policy and benchmarking frameworks, we found that there would be benefits to England adopting a reporting framework and putting in place a series of policy

[1] However, it should also be noted that use of groundwater sources is far more common in the USA compared to the UK which primarily relies on public water supply.

interventions to allow for easier benchmarking of data centre water consumption. This can be found in Section 4.8. In particular, this would consist of mandatory, centralised reporting of (at least a subset of) the metrics required under the EED, possibly in addition to some other metrics which would allow for better comparison and interpretation of water consumption. The international policy review in Section 4.7 found that the EU is leading the way with regard to developing an internationally recognised efficiency label and that the proposed label has a number of strengths with respect to how it incorporates water and energy. It is recommended that England seek to emulate and adopt this system, and consider the applicability of proposed, but not yet established, minimum performance standards. However, in order to make best use of this framework, these interventions should be considered alongside a variety of additional policy options which may be required to address current issues. The interventions discussed in this report include concepts such as advancing the proposed registration of data centres in a Critical National Infrastructure register and making improvements to the planning process to improve the visibility of data centre applications and improving communication and proactive engagement between data centre designers and water companies.

Recommendations have been produced separately for policy planning, benchmarking water use and for further research, and can be found in Sections 4.5 and 5.

Regarding monitoring and benchmarking, in Section 4.8 we suggest that England could mandate centralised reporting of (at least a subset of) the metrics required under the EED. They may wish to consider expanding eligibility to data centres smaller than 500 kW. This data could be published in anonymised form, presenting for each data centre its area (e.g., county), PUE, REF, IT power, water use, potable water use, WUE_1, and WUE_2. Beyond what is required by the EED, there would be value in requiring reporting of water use by source (e.g., raw water, potable water, reused water and harvested water), water use split by purpose (e.g., domestic-like use versus other use), and annual average versus peak-month potable water consumption.

Policy options to incentivise efficiency include a minimum performance standard (implement regulation and monitoring of the progress towards such a commitment), considering whether to adopt any minimum performance standards that may be subsequently introduced by the EU, or mandated efficiency labelling, or commitment to the CNDCP. Other policy recommendations in Section 4.5 include planning system reform, registration of data centres and other Critical National Infrastructure, and improved communication between data centre operators, designers and water retailers and wholesalers, including more robust Service Level Agreements.

Regarding further research, headlines include:

- engagement and collaboration with the data centre industry, water industry, regulators, and leading experts is recommended regarding how to reduce and remove barriers to use of treated sewage effluent
- increased collaboration in water resource planning and develop a greater understanding of each of the industries, including the opportunities and limitations due to statutory requirements and regulatory pressures.

1. Introduction

Data centres are a globally significant sector and form the backbone of society. techUK describes a data centre as a "*building used to house computing equipment like servers and associated telecommunications, network and storage systems*" (techUK, 2025a). Various services are provided through this equipment including data storage (such as the cloud), transactions, social media, online media such as news, etc (BBC, 2025a).

The criticality of data centres in our lives has meant that in 2024 the UK Government designated them as Critical National Infrastructure, granting them government support during critical incidents and potentially preferential treatment for planning permission (Department for Science, Innovation & Technology & the Rt Hon Peter Kyle MP, 2024). In 2025 they were incorporated into the Network and Information Systems (NIS) Regulations 2018, designating them as essential services. They are also a key part of the government's growth ambitions, with £45 billion in private investment committed since July 2024 (Clark, 2025). Their presence attracts new organisations and enables the expansion of existing organisations. Despite this, data centres have been under increasing scrutiny in recent years due to the substantial resources they use, including land, power, and water.

Data centres require cooling as the equipment housed produces a significant amount of heat, which if left can cause the equipment to overheat and become damaged. Similarly, data centres require humidity control as high humidities damage metal components and low humidities cause a build-up of electrostatic charge and increase the potential of sparks (Yadav, 2025). There are a variety of cooling methods which can utilise water, chilled air, and liquids such as mineral oils.

In the Netherlands, Microsoft received heavy criticism for using 84,000 m^3 (84 million litres (Ml)) of water in 2021, when it had initially stated that it would use 12,000 to 20,000 m^3/year (12 to 20 Ml/year) (Judge, 2022a; 2022b). Microsoft stated that this figure included water used for construction of the next phase of the data centre. Similarly, in Chile Google faced backlash from the local population over its plan to use water-based cooling in a proposed data centre whilst the country was 15 years into a significant drought (Moss, 2024). The plan proposed to install cooling towers that would use 7,600 m^3/d (7.6 Ml/d or 2,774 Ml/year) (Moss, 2024). Ireland currently has recently ended a moratorium on data centre development in the Greater Dublin Area, which was initially instated due to them using ~21% of electricity (Government of Ireland, 2022; Butler, 2024; Duggan, 2025). Similarly, the Netherlands has banned hyperscale data centre developments due to concerns regarding energy use and capacity (Greenberg Traurig, 2024).

The UK water industry has turned its attention towards data centres. Thames Water have claimed that a large data centre may use between 4,000 to 19,000 m^3/d (4 to 19 Ml/d), which is equivalent to the daily demand of over 50,000 households (Thames Water, 2023). As such they have stated that they will install flow restrictors on sites that fail to adequately reduce demand. Similarly, Anglian Water have opposed plans to construct data centres within their region due to concerns regarding water sourcing and sewer flooding due to large discharges, questioning whether drinking water was an appropriate source (BBC, 2025b). With the Environmental Improvement Plan 2023 requirement for non-household water use to be reduced by 9% by 2038 and 15% by 2050, data centres using public water supplies, along with other non-households, will likely continue to face pressure from water retailers, wholesalers, regulators, and the public to reduce consumption (Defra, 2023).

This project aimed to explore what efficient water use looks like in data centres and how it can be driven in England. Whilst humidity control can be required in the UK, it uses a minimal amount of water, so the project focused upon water use for cooling. The research was initiated in response to the limited understanding of data centre water use within a UK water resources context and the potential implications of their rapid growth for water scarcity. The project was funded by the Market Improvement Fund and delivered by WRc during 2025.

The objectives were to:

- review and assess operational water usage in data centres across England (and comparable regions), considering the national water resource context, with particular attention to cooling technologies
- review and assess policy and standards relating to the management of water use in data centres
- review and assess international data centre water use benchmarking and reporting approaches, to recommend an appropriate benchmarking framework for England.

This report summarises our methods and the results of our data collection in relation to the project objectives. It then examines the data centre landscape in England and internationally, including how data centres use water and approaches to water efficiency. The report also considers the wider water resource context, reviews relevant policies, standards, and reporting frameworks, explores existing benchmarking approaches, and concludes with recommendations to support the sustainable development and growth of the English data centre sector.

1.1 Definitions

There are a variety of different categories of data centre:

- Enterprise data centre - a data centre operated by an enterprise (such as a bank, a hospital, a university), which solely delivers and manages the information technology needs of said enterprise (European Commission, 2024a; techUK, 2025a).

- Colocation data centre - a data centre which rents floor space to one or more customers to install and manage their own network(s), servers and storage equipment and services (European Commission, 2024a; techUK, 2025a).

- Co-hosting data centre - a data centre which rents floor space, network(s), servers, and storage equipment to one or more customers on which they operate their own services and applications (European Commission, 2024a; techUK, 2025a); this type of data centre can be described as 'managed infrastructure'.

- Edge data centre - a data centre located near network boundaries, close to the source and use of data streams e.g. an on-campus data centre at a university (European Commission, 2024a; techUK, 2025a).

- Hyperscale data centre - definitions vary, but generally a very large data centre that contains over 5,000 servers, is over 10,000 ft^2 (930 m^2), and offers over 40MW of capacity (Dawn-Hiscox, 2022).

However, Ptach, Andrews & Philbin (2023) and techUK (2025b) highlighted that the definition of a data centre is inconsistent, stating that depending on definitions a data centre can range from small cabinets in offices to large warehouse complexes (Ptach, Andrews & Philbin, 2023).

Due to the challenges with different types of data centre and agreement across industries on definitions, this project did not formally adopt a definition of a data centre, acknowledging the challenges associated with determining whether individual sites or operations are within scope or not. When considering policy interventions, it will be important to consider the impact of the definition adopted.

2. Methodology

To address the project objectives, a mixed-methods approach was developed to gather both quantitative and qualitative evidence from multiple sources. This mixed-methods design was implemented due to the fragmented nature of current knowledge on data centre water use. The methodology combined a rapid scoping review, stakeholder interviews, and analysis of water-use data from data centres. This approach enabled the study to develop a comprehensive understanding of data centre water use and its management, as well as enabled comparison between theoretical or policy-based perspectives and on-the-ground experiences and actual water use. This, in turn, supported the development of well-informed insights and targeted recommendations that reflect industry realities and broader water resource considerations.

2.1 Evidence review

This review aimed to establish a contextual understanding of water use in data centres, including cooling technologies, operational contexts, and relevant regulatory and policy considerations. It sought to address the following primary research question:

How is water used by data centres that have been, or may be, constructed in England?

To support this, the review also explored several secondary research questions, available in Appendix A.

The following topics were deemed out of scope and excluded from this review:

- Quantitative analysis of trade-offs (e.g., abstraction vs. consumptive use, energy use vs. water use, grey vs. blue water footprint)
- Design or feasibility assessment of water-efficient cooling systems
- Cost analysis (capital, operational, or maintenance)
- Cost-benefit analysis
- Impacts of potential future policy or strategy changes.

A global search strategy was adopted. No specific geographical restrictions were applied; however, findings were considered in their relevance to UK data centres. This approach supported an understanding of how water resource challenges intersect with data centre water supply, governance, regulation, and planning. Only English-language publications were included.

No publication date restriction was applied to literature relevant to policy, regulation, and guidance, but academic and industry publications must have been published after 2010 to ensure relevance.

A wide range of sources were reviewed, including:

- the BASE database[2]
- grey literature and industry reports identified through targeted web searches
- regulator and government websites at national, regional, and state levels
- data centre owners' and suppliers' reports and insights through targeted web searches.

Specific search terms used for the BASE search are listed in Appendix B.

Literature was screened by title and abstract/summary for relevance to the primary and secondary questions. The reliability and credibility of each source was also considered, with more weight given to peer-reviewed research and evidence from sources with related interests assessed for bias. Evidence was extracted from the literature that passed the screening process and categorised. A mix of predefined and developed categories were used, including regulation and technical standards, current and emerging technologies (including any information on water use), governance and policy context, future directions, and water efficiency opportunities. A full list of categories can be found in Section 3.1. Evidence was excluded when access was unduly restricted, content was not relevant to primary or secondary questions or related to topics excluded from this review.

2.2 Stakeholder engagement

A series of stakeholder interviews were conducted to gather insights into the practical realities of data centre water use. Participants were selected to represent a range of perspectives, including those from the data centre sector, regulators, third parties, and water wholesalers.

A combination of purposive and snowball sampling methods was used to identify and engage relevant stakeholders. This ensured participants had direct knowledge or experience related to the research aims, while also allowing flexibility to include additional stakeholders recommended during the data collection process.

[2] https://www.base-search.net/

In total, 14 stakeholders were approached, and nine interviews were completed, representing a 64% response rate. Five stakeholders either did not respond or declined to interview. This engagement is considered acceptable for the qualitative and targeted nature of this research and significantly exceeded the original expectation of five responses. Interviews were undertaken with individuals from the following organisations:

- Acton Consulting
- Anglian Water
- Ark Data Centres
- Digital Realty
- Environment Agency
- Global Switch
- NTT Data
- techUK
- University of York and University of Durham

Four of the nine interviews were with data centre operators (double the project target of engagement with two data centre operatives), and there was one interview each with a water wholesaler, regulator, consultant, industry body, and academics. Discussions with the data centres were particularly useful as they were able to contextualise information about cooling technology and difficulties faced in the sector, including in disclosing water usage. techUK showed a strong interest in the project, as they had recently undertaken a survey in collaboration with the Environment Agency of English data centres to infer the scale of water use. Following an initial discussion, techUK forwarded our request for stakeholder engagement to members of their Data Centre Council, as well as interested consultancies. Similarly, Ark Data Centres had forwarded our call for engagement to other data centres.

The stakeholders interviewed are likely to represent a highly engaged segment of the sector. However, some bias may exist within the final sample, for instance, a potential overrepresentation of the data centre sector and within this, those already engaged with water resource challenges and water efficiency. Efforts were made to minimise this bias through a sampling approach designed to engage a diverse range of stakeholders; nonetheless, potential biases were acknowledged during data analysis.

Several non-interviewed stakeholders also contributed by sharing additional materials such as written feedback, email insights, and industry reports which were assessed as part of the desktop evidence review.

Interviews were conducted online and followed a semi-structured format. A mix of core and additional questions were asked depending on relevance to the interviewee and direction of conversation. Core questions explored topics such as data centre water use, policy and regulatory frameworks, water reuse, and responsibilities in water resource management for data centres. Additional bespoke questions were developed to reflect the specific expertise and organisational context of each participant. A copy of the standard questions can be found in Appendix C.

Participation was based on informed consent, with verbal permission gained to record the discussion. Participants were provided a full verbal project briefing and debriefing, informing the participants how to withdraw from the project and explaining what would happen next with the information shared. Data was recorded through MS Teams transcription and manual note taking (synthesis of response).

Interview notes were analysed using content analysis, with key information highlighted in the note summaries and verified against the formal transcripts to minimise recording bias. In cases where consent was provided for the interview but not for audio recording, insights were documented through detailed note taking rather than formal transcription. This limitation reduced the ability to verify notes and may have introduced recording bias, which was acknowledged during data analysis.

2.3 Water-use data analysis

A variety of data sources were assessed to understand data centre water use in England and Europe, this included:

- EU Energy Efficiency Directive report (European Commission, 2025a)
- Dutch data centre submissions to the EU Energy Efficiency Directive[3]
- CMOS data from MOSL

[3] Available at https://www.rvo.nl/documenten-publicaties?publicationTypes=613&subsidies=3627&sectors=1259&page=0 (Accessed 23/09/2025)

- responses to a techUK survey (run with the Environment Agency) on data centre water use in England (techUK, 2025a)

- sustainability reports from various data centres operating in England[4].

The datasets were interrogated and compared in order to infer knowledge about the likely level of water use and water efficiency within data centres in England.

Each dataset had several limitations as no one dataset was complete. Overall, they are likely skewed to the subset of data centres that report water use metrics, while for the EU and Dutch data centres reporting under the EED this is further constrained to data centres that are >500kw. It should be considered whether the reporting bias may result in an overly favourable picture. It should also be considered how different the picture would look were it to more accurately represent water use in small data centres (for example, server rooms in multi-purpose buildings) which we understand to be less likely to consume water for cooling but, when they do, may be more likely to rely on evaporative cooling towers.

Similarly, the data centres which included water usage within their ESG reporting and the data centre companies interviewed are likely to be highly engaged in sustainability, creating a bias. It should also be noted that not all the water usage data was given as the same metric (e.g., water usage, water use effectiveness), preventing direct comparison between datasets. The limited information pertaining to data centre size and cooling technology also limited direct comparisons. Where common metrics and aggregation levels did exist, the datasets were compared. Qualitative analysis was also performed on findings from the datasets as a whole. These limitations were acknowledged when assessing the evidence and developing the project insights.

To advance the analysis, the following assumptions were made:

- MOSL water consumption data was provided from 2018 to 2024. Comparisons were based on 2024 consumption unless stated otherwise.

- MOSL water consumption data apparently covered 257 data centres using only 208 water connections (208 SPIDs). For the purpose of analysing water usage, there were considered to be 208 data centres. For example, that the duplicates were different business units/entities operating within the same physical data centre.

[4] Ark Data Centres, Equinix, Global Switch, Kao Data, Digital Realty, CyrusOne. In addition, the following operators published ESG reports which did not disclose water use/effectiveness: Stack Infrastructure, Pulsant, Vantage.

- The monthly MOSL consumption data contained some negative readings which were assumed to relate to billing adjustments following meter reading. Where possible, these adjustments were applied to the previous six months of readings. Where this was not possible, for example when the negative reading was greater than the sum of positive readings prior to that date, all readings up to that point were removed from the dataset.

- In order to minimise the impacts of adjustments and estimated readings, analysis was performed at an annual level by data centre, and trend and seasonality analysis was performed at a sector level.

- The Dutch data centres data included some zeros for water use. While this is improbable (as water would be required for domestic use), they were not excluded from the analysis.

- Where total water use was provided by some data centres but not potable water use, all usage was assumed to be potable.

- When water usage, power usage and water usage effectiveness (WUE) were reported in the ESG data, the reported WUE could be compared with a calculated value. These often did not align, and the reported values were used preferentially. This may be because companies are reporting (but not specifying) WUE_2 rather than WUE_1 in the categories of WUE defined in Section 3.1.2.

3. Results

3.1 Evidence review

During the evidence review, 391 sources were identified, of which 255 were deemed relevant under the criteria set out in Section 2.1 and reviewed. Sources were a mix of academic and grey literature, sustainability reporting, and news media[5]. Information was extracted and categorised into one of 12 different categories defined in Table 3.1. Following this, an assessment was conducted to determine information gaps. Additional searches were undertaken for categories with less than 50 pieces of evidence to find additional information.

The number of records in the evidence database against each of the project categories can be found in Table 3.1; note, one piece of evidence can belong to multiple categories. There was a significant amount of evidence relating to current and emerging cooling technology, data centre water consumption and WUE, energy and other considerations, and policy. Less information was available on water quality, and targets and minimum standards.

Table 3.1 Number of records against each of the information extraction categories from the evidence review

Category	Definition	No. pieces of evidence
Policy	Policy and regulation relating to data centres.	191
Current technology	What cooling technologies are being used in the UK?	219
New technology	What cooling technologies are being explored in the UK and elsewhere?	184
Energy, cost & other considerations	What energy use, cost, carbon etc. is associated with different cooling technologies? How does this scale with water use? How do direct lifecycle costs and societal costs compare? Is water a significant component,	227

[5] Care was taken to avoid bias introduced by use of news media by comparing articles from different outlets.

Category	Definition	No. pieces of evidence
	insignificant or not being considered?	
Water quality	What water quality do these cooling technologies require? How does water use/consumption change with water quality? What water sources are being used in the UK for cooling (e.g., abstraction vs. purified vs. potable vs. treated but non potable)?	36
Context	General overview of the data centre sector and the current situation, including criticism.	319
Water consumption	Relates to how much water is consumed as well as information relating to water consumption in general.	241
Water source	The water source used for cooling water, as well as any alternative sources that could be used.	78
WUE	Information on WUE, as well as the WUE of data centres.	127
Recommendations	Recommendations made by sources for the data centre sector and its governance.	97
Metrics	Metrics and standards (e.g., ISO) used by data centre operators.	89
Targets and minimum standards	Targets and minimum performance standards relating to data centre water consumption.	40

3.1.1 Data centres and resource demands

The primary driver for the cooling demand of a data centre is the power of the IT equipment it contains. Secondary drivers include the thermal efficiency and utilisation of those units, the temperature set points (often specified in the contractual service level agreements) and the ambient temperatures. The cooling demand itself will then impact upon the appropriate choice of cooling system. For example, a different solution will be suitable for computers pulling 10kW per cabinet to those pulling 100kW per cabinet. This will impact both the choice of heat transfer mechanism, the heat rejection system and choice of cooling medium (e.g., air, water, refrigerant or oil) (Ark Data Centres, 2025). The water used by the system will be a complex function of the choice of heat rejection system, heat transfer medium and heat transfer system.

Data centres house IT equipment like servers, networks and storage systems such as the Cloud. techUK defines the Cloud as an on-demand delivery of resources over the internet (techUK, 2025a). Examples include Google Drive and Microsoft SharePoint. Rone (2024) states that the Cloud is often seen as 'immaterial and ephemeral', when in fact it is in a data centre. They state that this draws "*attention away from the complex and often energy-intensive digital infrastructure needed to maintain data flows and storage*" (Rone, 2024).

Lehuedé (2022) and Rone (2024) note that the lack of transparency has been an issue in establishing the impacts of data centres, in particular those belonging to the large technology companies such as Google.

Similarly, Luccioni, Strubell & Crawford (2025) state that Artificial Intelligence (AI) has emerged as a contested force in the face of the current climate crisis. On the one hand it can help advance the reversal, mitigation and adaptation to a changing climate. On the other hand, it has significant resource demands, water and energy consumption, and a large carbon footprint (Luccioni, Strubell & Crawford, 2025). The Institution of Engineering and Technology (2025) notes that recent advances in AI means that the growth of AI systems and services has happened at an unparalleled rate and without much regard for resource efficiency, risking irreparable damage to the environment. They highlight that "*[t]o build systems and services that effectively use resource, we first need to effectively monitor their environmental cost. Once we have access to trustworthy data pertaining to their environmental impacts, and a sense for where these services and systems are needed, we can begin to effectively target efficiency in development, deployment, and use - and plan a sustainable AI future for the UK*" (Institution of Engineering and Technology, 2025).

3.1.2 Policy and standards

UK policy

The following UK policy relates to water:

The **National Framework for Water Resources 2025** applies to England and Wales (Environment Agency, 2025). Data centres are specifically mentioned for the first time in the new framework where it is asserted that *"[d]ata centres require significant amounts of water for cooling servers. Large centres can consume millions of litres daily, with water use rising in summer".* It also highlights the link between energy efficiency and water use, where *"[a] lack of water can force data centres to rely on less efficient cooling methods, increasing energy consumption and environmental impact"* (Environment Agency, 2025). It speculates that air cooling may become less common due to modern chips becoming hotter, noting that water availability needs to be considered during data centre planning. The Framework explicitly notes the challenges related to getting information about water consumption and future water needs from the sector, concluding *that "more transparency is needed"* and that they will work with government to *"develop policies around data centre sustainability"* (Environment Agency, 2025). The ongoing collaboration with MOSL to understand data centre water consumption was also noted.

The National Framework for Water Resources 2025 states that future data centres may be more geographically spread and not as focussed in South East England (Environment Agency, 2025). This is driven by the need for edge computing and storage, cheaper land, access to power, cooler climate, physical access to hardware by customers, opportunities to utilise waste heat, and technological changes. Additionally, many use cases don't require low latency, while those which do may benefit from proximity to services located outside of the South East.

The following UK policy relates to energy:

The **Minimum Energy Efficiency Standards** (MEES) apply to all properties with commercial leases (including data centres) (UK Government, 2015). It previously stipulated that commercial leases will only be granted to properties with an energy performance certificate (EPC) rating of at least E unless an exception applies. In 2023 the regulations on exceptions tightened requiring that landlords cannot continue leasing properties which fail the standard unless "all possible cost-effective" energy efficiency improvements have been made, or a specific exemption is registered. Water is not included in the MEES, which risks missing opportunities for water efficiency in an effort to drive energy efficiency.

Similarly, the **Energy Savings Opportunity Scheme** (ESOS) requires large organisations above 250 people or £44m turnover to report and audit energy use and to identify energy-savings opportunities at least once every four years (Department for Energy Security and Net Zero, 2025). Water considerations are notably absent from this scheme, with no requirements to consider water use, efficiency, wastewater, indirect energy use from water use, or water scarcity.

The **Energy Act** introduces statutory regulation for heat networks which are now regulated by Ofgem (UK Government, 2023). The Act requires the Secretary of State to take account of the UK's obligations in the 2008 Climate Change Act and increases powers for imposing future regulations on energy performance, emissions disclosures and decarbonisation standards. It has the power to require all wasted heat sources to supply a heat network, including waste heat from data centres. This could theoretically lead to secondary legislation mandating that data centres offer their waste heat to heat networks. It should be noted that the type of cooling technology deployed significantly impacts the amount of heat that can be reclaimed, the cost of reclamation, its efficiency, and the grade of the heat. In particular, water-based or other liquid cooling techniques are likely to be best suited.

The following UK policy relates to planning:

Data centres were previously absent from the **National Planning Policy Framework** (NPPF) and guidance, potentially resulting in inconsistent planning decisions being made (Ministry of Housing, Communities & Local Government, 2024). The government consulted on proposed changes in 2024, publishing a response in February 2025, which would include extra provisions for digital infrastructure such as local plans identifying suitable sites and allowing developers to opt into the Nationally Significant Infrastructure Project regime (Ministry of Housing, Communities & Local Government, 2025a). The response also acknowledges the trade-off between the sustainability of data centres and their importance to economic growth, as well as respondents' stance that data centres should be limited by scale.

Prior to the release of the government response to the consultation, the NPPF was revised in December 2024, making many of the proposed changes. In particular, new clauses now state that planning policies should *"pay particular regard to facilitating development to meet the needs of a modern economy, including by identifying suitable locations for uses such as laboratories, gigafactories, data centres, digital infrastructure, freight and logistics;"* and make *"provision for […] clusters or networks of knowledge and data-driven, creative or high technology industries; and for new, expanded or upgraded facilities and infrastructure that are needed to support the growth of these industries (including data centres and grid connections)"* (Ministry of Housing, Communities & Local Government, 2024). Around this time, data centres were also designated as Critical National Infrastructure.

The **Cyber Security and Resilience (Network and Information Systems) Bill** was published in December 2025, amending the **Network and Information Systems (NIS) Regulations 2018** and designating data centres as essential services, requiring data centres operating above defined capacity thresholds to have "*appropriate and proportionate measures in place to manage risks*" (Department for Science, Innovation & Technology, 2025a). As part of this, mandatory incident reporting is required, enabling "*regulators to better support affected organisations with rapid responses, identify systemic vulnerabilities, and implement targeted interventions to strengthen the resilience of the relevant sector*" (Department for Science, Innovation & Technology, 2025a). It is unclear whether the impacts of water availability will be included within this reporting.

The **Planning and Infrastructure Bill** grants authority to the Secretary of State and the Gas and Electricity Markets Authority to amend or modify electricity licenses and connection agreements for a period of three years (UK Government, 2025). Some have speculated that this may cause uncertainty to long-term agreements that data centres have in place. However, the Guide to the Bill states that the revisions will encourage investment in *"anything which requires electricity, from housing and hospitals to gigafactories and data centres"* and also adds additional provisions requiring grid and electricity distributors to *"have regard to the designated strategic plans",* suggesting that the purpose of the reforms may be to support data centre growth (Ministry of Housing, Communities & Local Government, 2025b).

The following UK policy relates to digital infrastructure:

The UK Government's consultation on **Protecting and enhancing the security and resilience of UK data infrastructure** was released in December 2023, but as of November 2025 no response has yet been issued (Department for Science, Innovation & Technology, 2023). The consultation proposed a statutory framework under which *"relevant data centre providers would be required to register with the designated regulator and provide relevant information regarding their UK operations."* It was not specified whether such information would include water usage.

In 2024, the UK Government launched the **AI Growth Zones initiative** to encourage large data centre developments and support strategic goals of growing the UK's prominence in the AI sector (Department for Science, Innovation & Technology, 2025b). In order to qualify for the initiative, developments >500 MW had to undertake *"proactive engagement with statutory water providers and environmental regulators from project inception. Applicants must provide written confirmation from the relevant local water utility, detailing specific volumes of water required and available; any infrastructure improvements or limitations; and anticipated delivery timelines. Applicants must also present comprehensive wastewater discharge management plans, evidencing substantive engagement with appropriate regulatory bodies (such as the Environment Agency or devolved equivalents)"* (Department for Science, Innovation & Technology, 2025b). It is also noteworthy that AI growth zones will be a pilot area for the use of small modular nuclear reactors. The future deployment of such technology could have a significant impact on the water use of the sector (may increase the demand for water but reduce the water quality requirements of that water, opening up more opportunity for open-loop pass through cooling techniques frequently adopted by energy generation).

The UK Government (2024) noted that the recently published **Digital Strategy** marked a missed opportunity for government to embed specific water consumption targets and requirements for government IT infrastructure and procurement.

The **UK Climate Change Agreement for Data Centres** is a voluntary scheme, managed by the Environment Agency and administered by SLR Consulting Ltd on behalf of techUK, that offers discounts on the Climate Change Levy in return for energy efficiency savings calculated via targeted Power Usage Effectiveness (PUE) reductions (techUK, 2023). There is no direct link to water use in the scheme which was created in response to the Climate Change Levy on large energy users. The scheme was originally planned to run from 2013 to 2023. Following consultation, this was extended to 31 March 2025 and then to 31 March 2027 (UK Government, 2020). The agreement requires purchase of carbon offsets if PUE targets are not reached. Up-to-date adoption information was not available. However, between January 2020 and December 2021 50% of organisations voluntarily enrolled in the scheme had to buy carbon offsets, according to CCA data (Booth, 2023), and it was reported in 2023 that about 170 data centre sites are part of the scheme (techUK, 2023).

International policy

The European Union's **Energy Efficiency Directive** (EED) requires all data centres with IT power over 500 kW located in the EU (with a few exceptions, like for those related to military operations) to annually report metrics, including energy use and potable and total water use (European Commission, 2025b). It also requires local planning authority reports to be produced for major data centres applications.

Reporting is ultimately to a central EU database, although Member States can choose whether data centres should report directly into the database or report to their national database which then reports into the EU database. The European Commission have produced a report based on the data submitted during the first reporting period (up to 15 September 2024) and have committed to making public summaries of the data available annually (European Commission, 2025b).

Reporting includes the following metrics relating to water:

- Total water input
- Total potable water input
- WUE (calculated by European Commission based on the reported data).

The key performance indicators (KPIs) to be reported are defined in Commission Delegated Regulation (EU) 2024/1364 of 14 March 2024 on the first phase of the establishment of a common Union rating scheme for data centres (European Commission, 2024a).

The first round of reporting was due by May 2024, with a report covering the reporting published in July 2025. Reporting compliance was poor and many Member States missed the reporting deadline. As a result, the data from this first round of EED reporting is incomplete (Climate Neutral Data Centre Pact, 2025a). In October 2025, the European Commission published a follow-on report, '*Assessment of next steps to promote the energy performance and sustainability of data centres in EU, including the establishment of an EU-wide rating scheme'* which provides a benchmark, based on expert judgment combined with data reported under the EED, for percentage reduction in WUE (and change to PUE and Renewable Energy Factor (REF)) which would be expected from adoption of the following measures (European Commission, 2025c):

- Free cooling with filtration
- Hybrid adiabatic cooling systems
- Cold-/Hot-aisle containment

- Immersion cooling & waste heat reuse with a heat pump.

The report proposes:

- a WUE <0.4 m^3/MWh for existing data centres by 2030
- a WUE <0.4 m^3/MWh for new data centres commissioned from 2027
- WUE Category 2[6] reporting only by 2030.

They note that 72% of reported entries already achieve a WUE of ≤0.4.

The **EU Taxonomy Regulation, part of the EU Code of Conduct for data centre energy efficiency published by European Commission JRC,** is a classification system which assesses activities against the EU's climate and environmental objectives for investment purposes (European Commission, 2025d). A number of these criteria are relevant to water use of data centres:

- 5.2.7 Effective regular maintenance of cooling plant (Expected) – regular maintenance to ensure it operates as intended
- 5.2.8 Review and optimise chilled water temperature (Expected) – to optimise use of free cooling and reduce energy consumption
- 5.4.1.3 Indirect water free cooling with Computer Room Air Handler (CRAH) and dry cooler or cooling tower (Optional) – cool water through free cooling
- 5.4.1.6 Indirect water free cooling with condenser water cooling chilled water (Optional) – cool water through plate heat exchanger
- 5.4.1.7 Alternative cooling sources (Optional) – evaluate alternative forms of cooling e.g. ground source cooling
- 5.4.1.8 Free Cooling Installation (New build or retrofit) – evaluate use of free cooling in new builds and retrofits

[6] As defined in Section 4.6.1

- 5.4.2.6 Do not share data centre chilled water system with comfort cooling (New build or retrofit[7]) – this compromises efficiency of cooling system

- 8.1.3 Facilitate the use of "Free Cooling" (New build or retrofit) – building layout should not obstruct use of free cooling

- 8.3.1 Capture rainwater (Optional)

- 8.3.2 Other water sources (Optional)

- 8.3.3 Metering of water consumption (Optional) – to help manage and reduce water consumption, where reporting is based on ISO/IEC 30134-9 (WUE)

- 9.3.1.2 WUE Reporting (Optional) – reporting based on ISO/IEC 30134-9

In the European Union, sustainability reporting is mandatory for specific companies and outlined by the **Non-Financial Reporting Directive** (NFRD) and the **Corporate Sustainability Reporting Directive** (CSRD), whereas in the UK, it is not required but encouraged. Organisations such as the National Engineering Policy Centre have strongly urged the UK Government to require tech companies to submit mandatory reports on their energy consumption, water consumption, and carbon emissions for data centres (National Engineering Policy Centre, 2025). This recommendation stems from the observation that AI systems are expanding rapidly without sufficient regard for resource efficiency, and crucially, there is currently "*no reliable data on the quantity of resources used by data centres*". The report '*Water use in AI and Data Centres*' specifically recommends "*legislation requiring all data centres operating in the UK, particularly those above a certain power threshold (e.g. 1 MW), to submit mandatory, granular reports on their energy, water consumption (distinguishing between potable and non-potable sources), and carbon emissions. This reporting should be location-specific to identify and manage localised water stress*" (UK Government, 2024).

New policies are likely to incentivise companies to report data by imposing penalties or similar forms of reprimand. In the EU, firms need to disclose specific environmental and social information; however, there is no standard format. Companies can use European, international, or national guidance, depending on their requirements. There are various initiatives including the **Organisation for Economic Cooperation and Development Guidelines** (OECD), **United Nations Global Compact's Communication on Progress** (COP), the **International**

[7] Expected for any data centre built or undergoing a significant refit of the M&E equipment from 2011 onwards

Integrated Reporting Council (IIRC) and leading guidelines from the **Global Reporting Initiative** (GRI) (Ptach, Andrews & Philbin, 2023).

The **European Union Corporate Sustainability Due Diligence Directive** (CSDDD), adopted in modified form in March 2024, obliges companies exceeding 1,000 employees and €450 million in net turnover to "*establish and implement a due-diligence process*" that covers adverse environmental impacts across their entire *"chain of activities*" (European Commission, 2025e). Although *recital 35* lists greenhouse gas emissions expressly, the operative provisions do not specify water use, nor do they clarify whether emissions from third-country data centre operations fall within the chain of activities if it is a separate legal entity (Usman & Zakir, 2025). The **European Union Artificial Intelligence Act** (European Commission, 2024b), requires providers of general-purpose AI models to publish *"sufficiently detailed"* data on energy use during AI model training phases but not during model use (Usman & Zakir, 2025). Despite this, Usman & Zakir (2025) state that 71% of impacts from carbon emissions and freshwater depletion relating to AI are traceable to companies covered by the EU's Corporate Sustainability Due Diligence Directive, yet less than 20% disclose project-level emissions and only 7% report water use.

The **German Energy Efficiency Act** extends the reporting requirements of the EU EED to smaller data centres using more than 300kW (Federal Ministry of Justice and Consumer Protection, (2023). It also introduces specific limits on temperature set points: data centres commissioned from 1 January 2024 onwards must maintain a minimum air inlet temperature of 27°C for IT equipment cooling unless a lower temperature is achieved passively (without mechanical refrigeration). For data centres commissioned before 2024, the minimum is 24°C, rising to 27°C after 1 January 2028.

Blauer Engel (Blue Angel) (DE-UZ-228) is a voluntary ecolabel for energy efficient data centres in Germany, developed by the German Ministry of Environment and the German Federal Environment Agency (consisting of DE-UZ-161 and DE-UZ-214). While the standard focusses on energy efficiency, it also requires monitoring of water use, including regular publication of, Cooling Efficiency Ratio (CER) and WUE (Blauer Engel, 2023).

The **California Green Building Action Plan** (data centres) required state agencies to reduce water use in their data centres by 10% by 2015 and 20% by 2020 relative to a 2010 baseline (Californian State Government, 2012). In addition, the Department of Water Resources was tasked to develop water use guidelines, reporting, benchmarking with 2010 baseline data, and the use of alternative water sources in new and renovated State buildings to help achieve these goals.

The French **Finance Law 2020** and **REEN 2021** do not impose specific requirements on data centres. REEN 2021 encourages limiting the impact of cooling including reducing water use (Legifrance, 2021). Finance Law 2020 covers energy efficiency in heating, cooling, and hot water systems, including the installation of sub-metering to measure consumption (Legifrance, 2025). The '*Ordonnance taken on 15 July 2020 and a decree on 20 July 2020*' introduces requirements for transparent and cost-effective measurement of energy and water use related to cooling (Legifrance, 2020a; 2020b).

Since 2022 building owners or operators of commercial properties >25,000 square feet in New Jersey must annually benchmark and report energy and water use under the **New Jersey Clean Energy Act** (Blau, 2023). This requirement also applies to Honolulu, Boston and Washington DC. A similar requirement exists in Philadelphia, San Francisco, Berkeley, Los Angeles, San Jose, Denver, Evanston and New York City for commercial buildings >50,000 square feet and Federal Buildings under the **Energy Independence and Security Act** (and all commercial buildings in New York City where the city pays the utility bill) (Walsh, 2025).

A number of guidelines and policies are in place regionally in China, starting with a PUE limit of 1.5 at State level for large data centres in 2015. Such policies focus on PUE and utilisation, with none seemingly placing any limits on water consumption or efficiency (Huang *et al.*, 2023).

Standards

The American Society of Heating, Refrigerating and Air-Conditioning Engineers **(ASHRAE) Technical Committee 9.9 –** ***Mission Critical Facilities, Data Centers, Technology Spaces, & Electronic Equipment*** is widely regarded as the industry standard for environmental design conditions for IT. We have not identified any alternative standards being followed or approaches used. The technical committee has membership from IT equipment manufacturers, environmental equipment manufacturers, data centre designers and end users. Operating 'envelopes' released by ASHRAE are developed collaboratively by the committee. High-density products that use high-powered high density computer systems now have their own H1 class. For H1 systems, the maximum allowable cooling air temperature is 25°C and the recommended maximum is only 22°C (range 18 to 22°C) (Bizo, 2021).

For standard equipment, ASHRAE has a Recommended range of 18°C to 27°C and allowable temperature ranges of:

- **Class A1**: 15°C to 32°C (59°F to 89.6°F)
- **Class A2**: 10°C to 35°C (50°F to 95°F)
- **Class A3**: 5°C to 40°C (41°F to 104°F)
- **Class A4**: 5°C to 45°C (41°F to 113°F)

The fifth edition (2021) states that most IT equipment (servers) comply to class A2, resulting in a maximum recommended cooling air temperature of 27°C, and an allowable maximum of 35°C.

These envelopes tend to be linked to warranties and reliability guarantees and explicitly define the amount of free air cooling that it is possible to achieve. For example, the standard states that *"[t]he allowable envelope is where the IT manufacturers test their equipment in order to verify that the equipment will function within those environmental boundaries. Peak performance at upper extreme may not be guaranteed"*.

ISO 30314 is a series of best practice guidelines. It covers data centre KPIs including PUE, renewable energy, equipment usage and energy efficiency for servers, cooling efficiency, energy reuse, WUE and Carbon Usage Effectiveness (CUE).

BS EN 50600-4-9:2022 Water Usage Effectiveness provides a standardised calculation method for WUE, defined as the ratio of the data centre water consumption divided by the energy consumed by IT equipment.

$$WUE = \frac{W_{IN} - W_{OUT}}{E_{IT}}$$

Where:

- W_{IN} is the total annual water input from outside the data centre's boundaries measured by total volume in m^3

- W_{OUT} is the total annual water output/discharge from inside the data centre's boundaries measured by total volume in m^3

- E_{IT} is IT equipment energy consumption (annual) in MWh.

The standard notes that the "*calculation of WUE requires the measurement and documentation of water values and E_{IT} over a coincident period of 12 months. This document does not specify the frequency of measurements of water values and E_{IT}, since WUE is calculated on an annual timeframe […] The frequency of measurements or assessments can be useful for the improvement of sub-systems, but is not required for WUE disclosures.*"

There are three different categories of WUE, reflecting exclusion of different types of (indirect) water usage which influence how it is calculated:

- **Category 1**: W_{IN} is the total annual water input from outside the data centre's boundaries (e.g., potable water, abstracted water) measured by total volume in m^3, E_{IT} is IT equipment energy consumption (annual) in MWh, and W_{OUT} is the total annual water returned out of the data centre's boundaries in m^3. Water reuse and indirect use is not considered in this category, therefore W_{OUT} is 0.

- **Category 2**: W_{IN} is the total annual water input from outside the data centre's boundaries measured by total volume in m^3, E_{IT} is IT equipment energy consumption (annual) in MWh, and W_{OUT} is non-industrial reuse (e.g., reusing water for toilet flushing, irrigation, etc).

- **Category 3**: W_{IN} is the total annual water input from outside the data centre's boundaries plus indirect water consumption for energy use measured by total volume in m^3, E_{IT} is IT equipment energy consumption (annual) in MWh, and W_{OUT} includes all water reuse. Water significance (amount of renewable freshwater that is available for each person each year) is considered by additional reporting of regional water stress and land use.

The standard also suggests that the following data is of value for interpreting trends in WUE:

- Data centre size (facility square meters)
- Total data centre design load for the facility (e.g., 10 MW)
- Name of the possible auditor and method used for auditing
- Data centre contact information
- Data centre environmental conditions
- Data centre location and region
- Data centre's mission
- Data centre archetype percentages (e.g., 20% web hosting, 80% email)
- Data centre commissioned date
- Numbers of servers, routers, and storage devices
- Average and peak server CPU utilisation
- Percentage of servers using virtualisation
- Average age of IT equipment by type
- Average age of facility equipment by type (cooling and power distribution equipment)
- Data centre availability objectives (see EN 50600-4-1:2016, Annex A)

- Cooling and air-handling details.

In addition to WUE, the standard also defines the Water Reuse Factor (WRF) which is the ratio of the water reuse (annual) of the data centre measured by total volume in m^3; to the water input (annual) of the data centre measured by total volume in m^3.

CLC/TS 50600-5-1:2023[8] covers the environmental sustainability of a data centre. It focusses on energy use, embodied carbon and energy sources. The specification superseded Part 2 of BS EN 50600-99, which did make reference to water: *"[e]nvironmental impacts consider not just those associated with electricity but also water usage and other pollutants."* It also included a method for conducting a life-cycle assessment (LCA) but does not require an LCA to be undertaken. Instead, it presents a set of recommendations for being environmentally sustainable. With respect to water, this includes the following:

For new facilities, rainwater harvesting is encouraged but only for *"evaporative cooling or other non- potable purposes in order to reduce overall energy consumption".* Other recommendations include use of non-public water supply, again only for *"evaporative cooling or other non- potable purposes in order to reduce overall energy consumption"*, and metering from *"all sources in all data centre spaces"* and managing and tracking overall water consumption.

For existing facilities, they recommend *"increasing the number of cycles before discharging to drain in evaporative cooling systems where conditions allow; this could be based on measured water quality rather than a prescribed number of cycles"* and to *"[r]eview water treatment requirements and consider alternatives to reduce environmental impact".* In addition, they suggest that the volume of discharge to sewer is minimised through reuse and that this is tracked through discharge per kWh of IT. WUE is recommended for measuring water consumption (even though, strictly speaking, this is an efficiency metric not a consumption metric).

ISO 46001 Water Efficiency Management Systems is an international standard designed to help organisations develop water efficiency management systems and integrate them into their company. ISO 46001 was first published in 2019 and has had one amendment in 2024. It provides a structured framework to achieve efficient and sustainable water use and integrate water efficiency into a company's overall strategy and daily operations. Its development was led by Singapore and was originally based on their Water Efficiency Management System (WEMS) standard SS 577:2012. Currently no UK certifying bodies are accredited to ISO 46001, meaning no UK businesses can gain certification.

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[8] formally CLC/TR 50600-99-2

The standard is applicable across industries and sectors, offering flexibility for organisations to tailor their water efficiency management systems to their unique needs and circumstances. ISO 46001 aims to foster a culture of sustainable water management within organisations. The standard requires a clear understanding of the organisation's purpose and strategy, ensuring that water efficiency goals align with broader business objectives. It also places emphasis on conducting detailed reviews of water usage to identify opportunities for improvement and encourages organisations to incorporate best practices into their policies and procurement processes.

ISO 14001 Environmental management systems is an internationally recognised standard that provides a framework for organisations to establish, implement, and maintain an effective Environmental Management System (EMS). First introduced in 1996 and regularly updated to reflect evolving best practices, ISO 14001 is designed to help organisations enhance their environmental performance while meeting regulatory and stakeholder expectations. It promotes a systematic approach to managing environmental responsibilities, encouraging organisations to adopt a "plan-do-check-act" cycle, integrating environmental considerations into business operations and decision-making processes. This involves identifying and assessing environmental aspects, setting objectives, monitoring performance, and implementing actions for continual improvement.

ISO 14001 provides a structured approach to managing environmental risks and opportunities, ensuring that organisations remain adaptable to changing environmental conditions and regulations. By focusing on proactive strategies, the standard enables organisations to not only reduce negative environmental impacts but also identify opportunities for innovation and value creation. Water should be considered as one such environmental risk, but ISO 14001 doesn't explicitly drive/require water efficiency, so water saving efforts through ISO 14001 could be restricted to companies/sites that use a lot of water or who have the knowledge/impetus to reduce water demand.

There appears to be good adoption of ISO 14001 amongst large UK data centre operators (at least those who are required by investors to produce ESG reports); of the ten operators for whom ESG reports were found, nine claimed to have ISO 14001 with Vantage being the exception.

BREEAM is a construction certification that consists of five benchmark levels based on points scored across a range of criteria, including water. BREEAM data centres cover new builds, extensions and major refurbishment and building fit-out. Water criteria are:

- Water consumption:
  - water efficiency of fittings relating to household-like use (taps, toilets, showers)

  - technology or strategy which reduced potable water consumption of cooling by 20% (1 point) or 40% (2 points).

- Water metering: meter meets specification and has pulse output allowing for connection to building management system

- Leak detection: leak detection system installed and meets requirements

- Sanitary supply shut off: water supply to toilets is linked to sensors and only on when in use to minimise leakage

- Water recycling: rainwater harvesting present.

The **Green Building Index** is a construction certification that includes water as one of its six criteria, including the following categories (Green Building Index, 2012):

- Rainwater harvesting resulting in potable water consumption reduction ≥15% (1 point) or ≥30% (2 points)

- Wastewater recycling resulting in potable water consumption reduction ≥10% (1 point) or ≥30% (2 points)

- Reduce potable water consumption for landscape irrigation ≥50% (1 point) or no potable water consumption for landscape irrigation (2 points)

- Reduce annual potable water consumption ≥30% (1 point) or ≥50% (2 points)

- Sub-metering

- Linking sub-meters to EMS for leakage detection.

There are four classifications: certified, silver, gold and platinum.

The BCA-IMDA **Green Mark for Data Centres** (Singapore) is a building certification with four levels (certified, gold, gold plus and platinum) (Chow *et al.*, 2024). In order to achieve certified status, the data centre must achieve 35 points (out of 88) for energy efficiency and 10 points (out of 37) across water, sustainable operations and management, indoor environmental quality and other green features and innovations. Of the 37 points, 12 are available for water efficiency and 10 for "other green features and innovations". As such, it is possible to achieve certification without being water efficient, but it would become challenging to achieve platinum status (requiring 90 out of 125 points). The Green Mark sits amongst other regulations (such as the Green Data Centre Standard and the Green Data Centre Roadmap) which, together, seek to define a basic level of sustainability in Singapore. However, the Green Mark standard has been challenged by some scholars for not including a broader range of environmental metrics and best practices for water sources and usage (UK Government, 2024).

Water efficiency points are detailed in Table 3.2.

Table 3.2 Water efficiency points in the Singapore Green Mark

Requirement	Points
Private metering, e.g. submetering large water uses like cooling towers AND Potable water leak detection	1
PUB Water-Efficient Building Certificate OR Water efficient fittings under Water Efficiency Labelling Scheme	1
Establish baseline water consumption and have targets for improvement with implementation strategies and improvement plans covering the next three years quantifying savings from the proposed measures.	1
Utilisation of non-potable water for non-potable uses like cooling towers, irrigation, washing, water features and toilet flushing.	>50% reduction in potable use across applicable uses = 3 >10% reduction in potable use across applicable uses = 2 >0% reduction in potable use across applicable uses = 1
For data centres with cooling towers, the "cycles of concentration" (relative ratio of sediment concentration in discharge water to inlet water).	≥10 = 6 ≥7 = 4 <7 = 0

Developed by the U.S. Green Building Council, **LEED16** is a framework for identifying, implementing, and measuring green building design, construction, operations, and maintenance. A building or neighbourhood can achieve four levels of certification: certified, silver, gold, and platinum.

New data centres can be rated against LEED BD+C (Building Design and Construction) criteria and existing data centres against O+M (Operation and Maintenance) criteria (data centre specific in LEED v4/v4.1 with LEED v5 using a flexible, general framework). A review of the BD+C criteria shortly after its introduction found that relatively few of the criteria had been made specific to data centres (only energy performance and thermal comfort) (Moud *et al.,* 2018; Global Switch, 2023).

The following have been identified as relevant to water use in data centres.

LEED Building Design + Construction (BD+C) - Design Phase:

- **Indoor Water Use Reduction (Prerequisite):** Mandates a minimum 20% reduction in aggregate fixture water consumption from established baselines
- **Cooling Tower Water Use (WEc3):** 1 or 2 points available for optimising cooling tower cycles of concentration (COC) and achieving maximum cycles without exceeding water quality parameters
- **Water Metering (WEc4):** Requires permanent submetering for at least two water subsystems.

LEED Existing Buildings: Operations + Maintenance (EBOM) - Operational Phase:

- **Indoor Water Use Reduction (WEc2):** Up to 4 points for data centres (compared to 5 for other building types) based on either calculated or metered water use reductions
- **Cooling Tower and Process Water Use:** Requirements for cycles of concentration and use of alternative water sources
- **Building-Level Water Metering:** Requires performance data collection over a minimum one-year baseline period.

A study by Islam *et al.* (2017) suggested that LEED is being actively pursued by 77% of large data centres, incentivised by tax/zoning benefits.

Minimum performance standards

Article 12(5) of the EED Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast) (2023) states:

"By 15 May 2025, the Commission shall assess the available data on the energy efficiency of data centres submitted to it pursuant to paragraphs 1 and 3 and shall submit a report to the European Parliament and to the Council, accompanied, where appropriate, by legislative proposals containing further measures to improve energy efficiency, including establishing minimum performance standards and an assessment on the feasibility of transition towards a net-zero emission data centres sector."

Based on this, there has seemingly been an intention that Phase 2 (from 2030) of the recast of the EED will develop a rating/labelling scheme (Kontinakis, 2023), minimum performance standards for data centre facilities and a "comparative framework": a *"rating system [which] will establish performance bands per metric that reflect these categorical distinctions, ensuring that all data centres are evaluated against appropriate peer groups. Whilst the detailed performance data will continue to guide internal improvements, public comparisons will be based on consolidated scores within these well-defined categories"* (DigitalEurope, 2025a).

The **Climate Neutral Data Centre Pact** (CNDCP) was established in 2021 and has over 100 signatories, at least 74 of which are data centre operators, representing 85% of data centre operational capacity in Europe (Climate Neutral Data Centre Pact, 2022; 2025b). The Pact focusses on five areas, one of which is water conservation, and aims to work closely with the European Commission as they seek to develop efficiency metrics for EU data centres.

This pact was formed in response to data centre operators and trade associations committing to the European Green Deal with ambitions to become climate neutral by 2050. The pact's commitments cover energy efficiency and conservation, clean (renewable) energy procurement, water conservation, circular economy, and governance (Ptach, Andrews & Philbin, 2023).

It set a requirement that by 1 January 2025 new data centres operating at full capacity should meet minimum performance standards. The headline minimum performance standard is a WUE of 0.4l/kWh, however, in practice very few data centres would be subject to this limit as:

1. the minimum performance standard is a design efficiency which assumes the data centre is operating at 100% capacity

2. this limit applies only to water stressed (high Water Exploitation Index (WEI+), cold climates using potable or fresh water; for other situations the cumulative effect of multipliers shown in Table 3.3 is applied.

Notably, the minimum performance standards were last updated June 2025, after the January deadline.

Table 3.3 WUE minimum performance standard from climate neutral data centres pact (Climate Neutral Data Centre Pact, 2024)

Climate	Multiplier
Cooling degree days[9] < 50	1.0
Cooling degree days[10] ≥ 50	1.1
Water stress	**Multiplier**
WEI+ ≤ 10	5.0
10 < WEI+ ≤ 20	4.0
20 < WEI+ ≤ 40	2.5
WEI+ > 40	1.0
Water source type	**Multiplier**
Potable water or fresh water	1.0
Grey water	3.0
Black/brackish/sea water	6.0

The CNDCP have proposed that the WUE values will apply when revamping the cooling systems of signatory data centres from January 2025 and that all must comply by 2040.

The key energy efficiency performance indicators required by the **Austrian Ecolabel** (Österreichischen Umweltzeichen) for data centres are PUE, CER, energy reuse factor (ERF), and WUE which must be documented in an energy efficiency report (Brocklehurst, 2024). This report is part of the criteria for certification under the Austrian Ecolabel guideline UZ80 for data centres (CIS, no date).

The municipality of Amsterdam, Haarlemmermeer and Hollands Kroon (Noord Holland) has implemented minimum conditions for new data centres and any expansions of existing data centres which have at least a gross floor area of more than 2,000 m^2 and an electrical connected load of more than 5 MW (Provincie Noord-Holland, 2022). Conditions relating to water use are presented in Figure 3.1.

[9] Calculated according to method used by Eurostat/JRC; the number of days in a year where temperature is above 21°C.

[10] Calculated according to method used by Eurostat/JRC; the number of days in a year where temperature is above 21°C.

Figure 3.1 Criteria relating to water use for large data centre developments in Noord Holland (Netherlands) (Provincie Noord-Holland, 2022)

2. Water Use

A. Datacenters reduce water use and primarily utilize low-grade sources. In case a water-cooled cooling technique is chosen, the following preference order applies:

1. Maximize water conservation by maximizing energy savings (for example, as the temperature of free cooling - cold aisles - rises, the number of hours/days requiring water cooling decreases).
2. If the temperature of the waste heat is suitable, establish an open ground energy system that allows the data center to use cold for cooling.
3. Optimal use of rainwater (individually or collectively), purified effluent, or demineralized brackish/salt water.
4. If not feasible or insufficient, optimal use of surface water (not guaranteed).
5. If not feasible or insufficient, optimal use of industrial water (industrial water sourced from surface water).
6. If not feasible or insufficient, optimal use of groundwater (except for storing rainwater or an open ground energy system).
7. If not feasible or insufficient, optimal use of drinking water.

B. Promote self-sufficiency.

- To bridge emergencies and dry periods, it is advisable to establish a water buffer for cooling water.
- In the case of surface water, the minimum desired size of the storage facility is coordinated with water authorities.
- In the case of drinking or industrial water, the minimum desired size of the storage facility is coordinated with the water supplier

C. Maintain a logbook for Water Usage Efficiency (WUE)[2] and m^3 water use, record m^3 water type per month, keep it for a minimum of 5 years, and make it accessible to the competent authority.

DigitalEurope (2025b) states that minimum standards do not account for intricacies of location and the interdependence of water and energy, stating that by implementing minimum standards you are removing the ability for data centres to achieve the optimum efficiency for their location (DigitalEurope, 2025b).

3.1.3 Cooling technology and water use

As temperatures increase, the rate of failure of IT equipment also increases so, within a data centre, cooling is provided over a large scale. Typically, cold air is drawn over the hot IT equipment, absorbing the heat. This hot air is then extracted from the room, cooled, and then recirculated (Mytton, 2021). The following sections present findings of current and emerging cooling technologies implemented by data centres and the water requirements.

Current technology and water use

A data centre cooling system is composed of a heat transfer system and a heat rejection system (techUK, 2025a). techUK (2025a) stated that data centres can use water within a heat transfer system, which absorbs heat from the Data Hall and transfers it away. They also state that water can be used in evaporative cooling, a heat rejection system which expels heat from the data centre through evaporation (techUK, 2025a). In water-based cooling, air temperature is reduced by using chillers to cool water (techUK, 2025a).

There are two different types of water-based cooling: evaporative and adiabatic. Often, they are treated as the same for simplicity. Evaporative cooling utilises latent heat through spraying the air stream with water, causing any heat to be evaporated. The hot, wet air is expelled from the data centre through fans, and the cool air is recirculated through the building. Adiabatic cooling utilises sensible heat, where water is sprayed at a surface which air passes over, cooling it before it enters the Data Hall (Mytton, 2021; Herrera *et al.,* 2025). Mytton (2021) states that a 1 MW data centre using water-based cooling can use ~25,500 m^3 (~25.5 Ml/year), 30 to 80% of which is lost to evaporation (UK Government, 2024). techUK (2025a) states that some data centre operators in the UK adopted evaporative cooling in the 2010's following the introduction of the Climate Change Levy, which incentivised energy efficiency. To reduce energy usage, some operators turned to water-based cooling, which uses less energy (techUK, 2025a).

Dietrich (2025) states that data centre water use is influenced by local climatic conditions, the availability of free cooling, and the characteristics of its heat rejection system. They note that in water rich areas, water-based cooling is an energy efficient option, but that dry or mechanical cooling should be prioritised in water scarce locations (Dietrich, 2025). Similarly, techUK (2025a) highlighted that water does not need to be used for cooling, and that data centres can also use refrigerant or air cooling. The choice of which cooling system is used depends on local climate, the cost and availability of power, localised water stress, etc. There are trade-offs between each method, with techUK (2025a) stating that when you reduce water consumption you increase energy consumption. Jerléus, Ibrahim & Augustsson (2024) stated that strategically siting data centres will be crucial for minimising their environmental impacts, particularly in the face of climate change. techUK (2025a) recommended the Environment Agency maintain and publish a WEI for each major river basin to aid developers in siting and choosing cooling technology for new data centres, as it indicates water stressed areas (techUK, 2025a).

Water-based cooling is not the only available method. Mechanical/air cooling uses refrigerants in mechanical chillers to cool the air, similar to an air conditioning system (Huang *et al*., 2023). Free cooling can also be used and involves the circulating of ambient air or water to remove heat without evaporation or chillers (CyrusOne, 2023; Gnibga *et al*., 2024). This can be used in a closed- or open-loop, which is circulated around the building before being discharged. Data centres that utilise free cooling are situated within regions with naturally low temperatures, such as northern Europe (Magnusson & Sjokvist, 2022). Papadopoulos & Wurm (2012) stated that in countries like the UK, free cooling can be used for up to 250 days a year. Free cooling is highly water and energy efficient (Huang *et al.,* 2023). Hybrid cooling utilises a mix of different cooling methods and can offer a more targeted approach, as it reaps the benefits of multiple cooling methods (Pan *et al*., 2018; Ott, Wenzel & Radgen, 2024; UK Government, 2024).

Dr Arman Shehabi, who published the first reliable estimates for data centre energy use in the US stated with respect to water consumption/use "*I never thought it could be worse* *transparency than on the energy side, but we actually know less*" (Judge, 2022b). Similarly, in their report '*Water use in AI and Data Centres',* the UK Government stated that there is a lack of reliable and comprehensive data on data centre water consumption, noting that this forms a "*significant barrier to effective policy*". They claim that only two fifths of data centre operators track water usage metrics (UK Government, 2024). Conversely, a techUK (2025b) survey of English data centres found that 69% measure water use.

The reporting of actual and estimates of water consumption figures were generally at the country level, with some data centre operators reporting data centre level water consumption. Jerléus, Ibrahim & Augustsson (2024) estimated data centre water consumption in Sweden to be between 6,100 m^3/year to 11 million m^3/year (11 Mm^3/year) per data centre, with the sector using a total of 42 Mm^3/year in Sweden. Mytton (2021) stated that in the US, data centre sector water consumption was 620.5 billion m^3/year (620,500 Mm^3/year). Copley (2022) states that the average data centre uses 414,503 m^3/year. The EUDCA (2025a) states that in 2020, French data centres collectively consumed 482,000 m^3. Microsoft was exposed by local Dutch media for using 84,000 m^3 in one of its Dutch data centres in 2021, when it had initially stated that it would use 12,000 to 20,000 m^3 (Judge, 2022a). Microsoft stated that this figure included water used for construction of the next phase of the data centre. In its 2025 Environmental Report, Google reported the water use and consumption of 36 of its data centres, with consumption ranging from 38 ml to 3.8 m^3/year (Google, 2025a). Foxglove (2025) stated that a 2020 planning application for a data centre in Slough had requested 1,728 m^3/d, equivalent to 630,720 m^3/year, whilst a 2022 application requested 7,949 m^3/d, equivalent to 2.9 Mm^3/year.

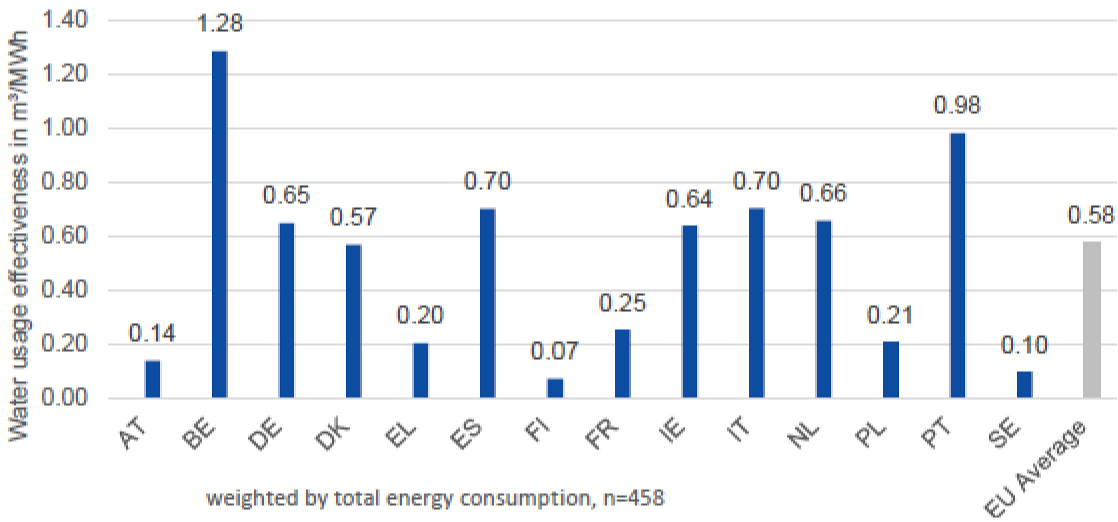
The environmental reports of the largest data centre operators (Google, Microsoft, Amazon Web Services (AWS), and Meta) shows that annual water consumption is increasing (Luccioni Strubell & Crawford, 2025). Li *et al.* (2025) stated that AI is playing a significant role in the rapid increase in data centre water consumption, stating that "*according to the recent U.S. data center energy report, the total annual on-site water consumption by U.S. data centers in 2028 could double or even quadruple the 2023 level, reaching approximately 150 – 280 billion liters* [150 to 280 Mm^3]*"*.

AI data centres run AI chips, which are specialised computer processors that perform significant computing. This drives up power consumption and subsequently heat generation (Andreichik, 2025). High temperatures can affect chip performance, therefore greater cooling is required. Aishwarya (2025) stated that water-based cooling's effectiveness at removing heat makes it "irreplaceable" for AI cooling, as air-based cooling removes heat at too slow a rate (UK Government, 2024; Aishwarya, 2025; Andreichik, 2025).

The techUK (2025a) report surveyed 80 data centres in England and found that 64% use less than 10,000 m^3/year, with 51% using waterless cooling systems (excluding closed-loop heat transfer systems). They state that as the data centre sector grows, its water use could increase proportionally if the current mix of cooling systems remains constant, noting that efficiency gains will likely reduce water withdrawal needs (techUK, 2025a). The Commons Library Research Briefing on 8 July 2025 noted *"current plans indicate that the measures proposed by water* *companies will be sufficient to meet the projected deficit in 2050. However, these calculations do not take account of the water needs of novel infrastructure or data centres, and future demand may mean that water resources are more difficult to plan for*" (Burnett, 2025)[11].

The European Union's EED report on data centre energy and sustainability performance states that 36% (770) of data centres in the EU responded, with the majority from Germany and France (European Commission, 2025a). Figure 3.2 shows that average WUE of each Member State fluctuates significantly, which could be a symptom of the low response rate.

Figure 3.2 Average WUE of data centres by Member State (European Commission, 2025a)



Germany is likely to be the most comparable EU country to the UK. It has 529 data centres of which 335 are in scope of the EED (>300 kW in Germany). The in-scope data centres were reported to use 2.1 Mm^3/year and the average WUE was found to be 0.65 compared to an EU average of 0.58. Across the EU, WUE was highest in large data centres (>10 MW) and lowest in small data centres (<500 kW) (Figure 3.3). WUE also varied between data centre type (Figure 3.4), with enterprise data centres exhibiting the highest WUE (0.83), followed by colocation (0.56) and co-hosting (0.17) (European Commission, 2025a). However, it should be considered whether or not the low response rate (36%) skews the results.

[11] techUK noted that the authors have alerted them that they "plan to correct this" having reviewed techUK's report on UK data centre water use.

Figure 3.3 Average WUE by data centre size (European Commission, 2025a)

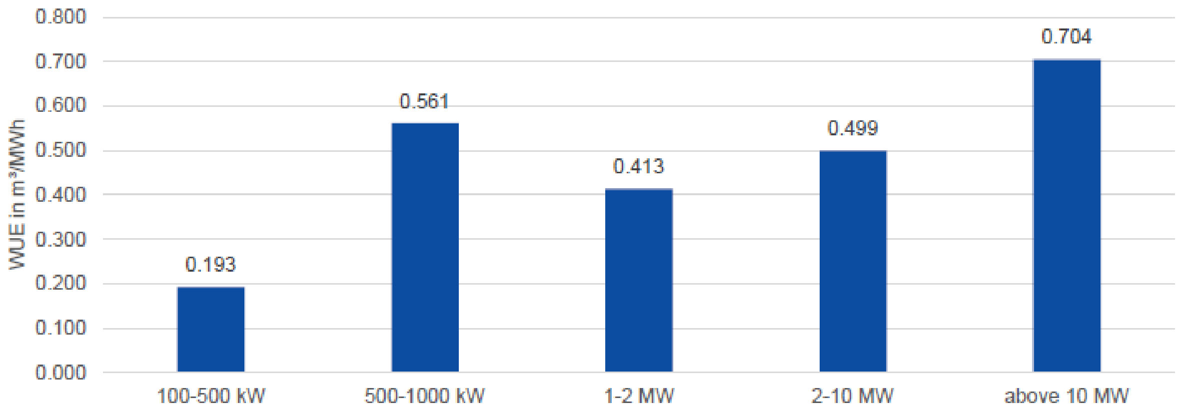
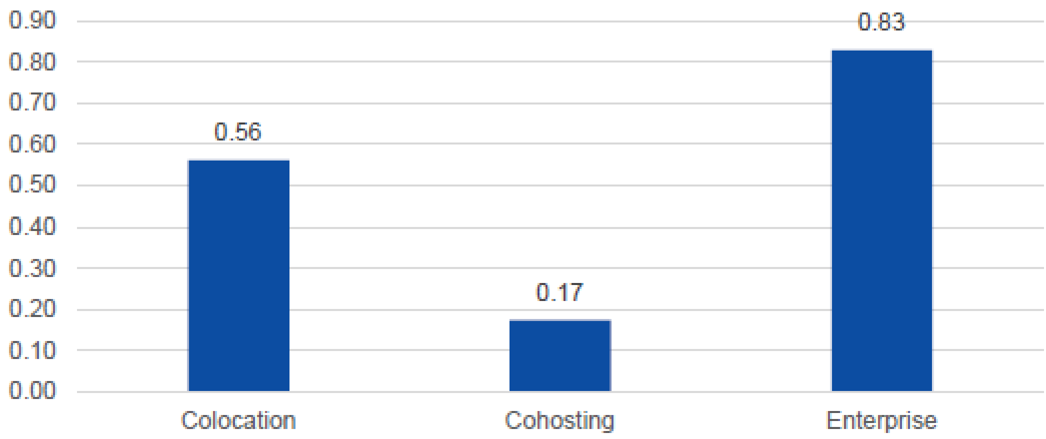


Figure 3.4 Average WUE by data centre type (European Commission, 2025a)



The '*State of European Data Centres*' report noted "*[a]lthough the data centre industry as a whole is a relatively small consumer of water, high concentrations of facilities, particularly large hyperscale campuses, can have a significant local impact*" (EUDCA, 2025b).

Emerging technology

Liquid cooling is a new type of cooling method which directly removes heat from IT equipment, as opposed to using air to remove and transport the heat to the heat transfer unit (Dietrich, 2025; Microsoft, 2021; Verne, 2024).

Direct-to-chip cooling is a type of liquid cooling where a miniature closed loop system containing dielectric fluid (non-conductive mineral oil) is situated directly over a computer chip to absorb heat (Vertiv, no date; Chowdhury, 2021; AQ COMPUTE, 2024; CyrusOne, 2024a; Herrera *et al.*, 2025). The heat is then transferred away from the IT equipment via a heat transfer unit, which transfers the heat from the fluid into either another liquid (refrigerant or treated water) or air (Vertiv, no date). The liquid/air then transfers the heat to the heat rejection unit.

Immersion cooling immerses the motherboard in a ‘bath’ of dielectric fluid (non-conductive mineral oil) (CyrusOne, 2024b; Herrera *et al*., 2025). The fluid absorbs and removes the heat from the equipment, transferring it to a heat transfer unit. Immersion cooling is another type of liquid cooling which enables the equipment to be safely operated at higher temperatures (AQ COMPUTE, 2024; NTT Data, 2025; Castrol 2025).

Liquid cooling is effective for high power density equipment such as AI processors and can use 31 to 52% less water (Ott, Wenzel & Radgen, 2024; UK Government, 2024; Herrera *et al*., 2025). Microsoft stated that the deployment of liquid cooling saves 125,000 m^3/year at each of their data centres employing the technology (Microsoft, 2021).

Beyond liquid cooling, other emerging and novel methods of cooling include submerging data centres in the sea. Microsoft submerged a data centre off the coast of Orkney with the assumption that the heat generated would be dissipated quickly by currents (Ptach, Andrews & Philbin, 2023). They reported “*no negative results on marine life”*, but concerns were raised about the impacts of thermal pollution on marine life (Ptach, Andrews & Philbin, 2023).

Spray cooling is also being explored. Spray cooling is a type of liquid cooling which sprays fine particles of dielectric liquid at the hot parts of a server (AQ COMPUTE, 2024). The coolant is then collected, re-cooled and then resprayed at the server.

3.1.4 Water sources and quality

Food & Water Watch (2025) and Li *et al*. (2025) stated that data centres need clean water for cooling to prevent bacterial growth and blockages due to the build-up of minerals and salts. This water can be used for a few cycles before being discharged, as bacteria and salts build up and conductivity increases (Zhang, 2024; Food & Water Watch, 2025; Li *et al*., 2025). Veolia (2025) states that poor-quality water can cause the formation of biofilms, which can create insulating layers and reduce heat transfer, as well as cause the build-up of salts around components such as valves, which can accelerate corrosion and reduce the lifespan of equipment. They also stated that common treatments used in data centres include water softening, reverse osmosis and direct nanofiltration (Veolia, 2025). It is important to note that no definition was provided for what constitutes clean or poor-quality water within the context of data centre requirements. Further exploration of this distinction could help clarify water source specifications.

The EUDCA ‘*State of European Data Centres 2025*’ report found that most (86.5%) colocation data centres use drinking water for cooling, with 13.4% using industrial water sources from a water utility, and 0.1% using rainwater (EUDCA, 2025b). Despite this, ~28% of colocation data centres claimed they were investing in rainwater harvesting, with another 47% considering it in the next two years. Mytton (2021) stated that data centres typically use drinking water for cooling as rainwater, greywater and surface water can be seen as unreliable. They did note several case studies which used sea water, recycled water, as well as placing a data centre under water off the coast of Orkney (as discussed in Section 3.1.3). techUK (2025a) noted that some operators are exploring alternative water sources, including rainwater harvesting, treated effluent reuse, and on-site storage of blowdown water for reuse. Despite this, they also stated that infrastructure constraints make it difficult to diversify the water sources used. The UK Government highlighted that "*[t]he explicit recognition that water for cooling systems "does not need to be drinking water quality" is a crucial technical detail that can inform policy on promoting non-potable water sources*" (UK Government, 2024).

Anglian Water (2025) identified rainwater, urban drainage systems, domestic grey water, and internal drainage board water as highly suitable water sources for data centre cooling which require either no or minimal treatment. They noted that desalinised sea water, sewage effluent, industrial effluent, mine water, and polluted groundwater could also be used when treated (Anglian Water, 2025). Similarly, Georgino (2025) stated that sea water can be used for cooling following desalination but did concede that it was an energy intensive process.

AWS highlighted in their 2024 Sustainability Report that 24 of their data centres used recycled water for cooling, with the aim to quadruple this by 2030 (AWS, 2024). Similarly, CoreSite's Santa Clara data centre used ~159,000 m^3 of recycled water in 2021, with the aim of expanding this to other facilities (CoreSite, 2024). Microsoft stated in their 2025 Sustainability Report that it was difficult to use recycled water as there is limited availability (Microsoft, 2025). Pan *et al*. (2018) noted that whilst switching to a wastewater source does not reduce a data centre's overall water consumption, it does shift it away from taking water from the environment. They also noted that when using wastewater, additional treatment steps will be required to ensure it meets quality standards (Pan *et al.,* 2018).

Ark Data Centres have rainwater harvesting systems at most sites, which they use for cooling (Ark Data Centres, 2024). At a site visit, they noted that as much as 90% of their water requirements can be met, but is dependent on space to capture and store the water. Similarly, AWS highlighted in their 2024 Sustainability Report that they had operational rainwater harvesting systems in place at five of their data centres globally (AWS. 2024).

Mine water has also been used to cool Interxion's data centre in Marseille, France. Water from an adjacent coal mine is pumped through the data centre and rejected into the mine drainage system (Smolaks, Simon & Donnellan, 2022). No insights were presented on the treatment required or the wider impacts of using mine water, presenting a gap in evidence.

Latif *et al.* (2025) highlighted that "*there are various underutilized free-cooling sources such as sea water, river water, lake water, aquifers and boreholes* […] *These cooling sources if correctly maintained are neither depleted or damaged by being used for cooling*". Nautilus' data centre in Stockton, California, is situated on a barge in the San Joaquin River. It draws cold water from the river and circulates it through the data centre before discharging it back into the river (Smolaks, Simon & Donnellan, 2022). Similarly, Google's data centre in Hamina, Finland, uses sea water from the Baltic for cooling. Sea water is circulated around the data centre, absorbing heat from the IT equipment. It is then mixed with cool sea water and discharged back into the Baltic (Ptach, Andrews & Philbin, 2023).

Setmajer (2024) stated that geothermal cooling methods such as aquifer thermal energy storage and deep lake water cooling can be used as they utilise the natural cooling of Earth's thermal mass. Cold water is drawn from large water bodies and circulated through the data centre, absorbing the heat. The water is then returned to its source (Planet Tracker, 2024; Setmajer, 2024). This operates on an open-loop, constantly drawing water in and discharging it. Smolaks, Simon & Donnellan (2022) noted that four sites in Germany were using aquifer thermal energy storage and highlighted that compared to traditional cooling towers, it can reduce water consumption by 75%. Similarly, Green Mountain's Stavanger, Norway, data centre uses an adjacent fjord for cooling, taking cool water from 100 m depth (Smolaks, Simon & Donnellan, 2022).

3.1.5 Trade-offs and impacts

Global Switch (2023), the Climate Neutral Data Centre Pact (2025b) and Gnibga *et al*. (2024) warned that actions to reduce one environmental impact can cause increased environmental impacts in another area. This was demonstrated by Aishwarya (2025), who assessed the impacts of the common cooling methods. Table 3.4 shows the trade-offs between each cooling method, highlighting that whilst air cooling has no water consumption, it has high energy use. Conversely, evaporative cooling has very high water use, but moderate energy consumption. Gnibga *et al*. (2024) stated that trade-offs need to be assessed on a location basis to determine which cooling method is most appropriate.

Table 3.4 Cooling technologies and their resource requirements (adapted from (Aishwarya, 2025))

Cooling method	Water consumption	Energy consumption	Cooling efficiency	Environmental impact
Evaporative cooling	Very high	Moderate	High	Permanent water loss
Air cooling	None	Very high	Low	High energy use
Hybrid systems	Variable	Variable	Variable	Mixed impact

Aishwarya (2025) stated that many data centres are being situated near to urban centres to reduce latency, but that these locations are also struggling to meet residential and agricultural water needs. They note that digital infrastructure is rigid in its water demands and that water allocation frameworks struggle to accommodate this (Aishwarya, 2025). Furthermore, water laws and policy do not take digital infrastructure into account, making it difficult to determine whether they should take priority over other users, and if so, who (Aishwarya, 2025).

Jerléus, Ibrahim & Augustsson (2024) stated that strategically siting a data centre could reduce its water scarcity footprint by 90%. This includes siting the data centre in a cooler climate where free cooling can take place, as well as in an area that is not water stressed (Jerléus, Ibrahim & Augustsson, 2024). That being said, Aishwarya (2025) highlighted that a data centre in The Dalles, USA, was situated to take advantage of the region's moderate climate and close position to a hydroelectric dam, but received criticism from locals when it abstracted significant amounts of water from the local river at a time when local farmers were having to limit irrigation (Aishwarya, 2025). The International Energy Agency (2025) stated that the number of people exposed to water stress will increase by at least 50% by 2050, noting that both strategic siting and technological innovations were required to mitigate the risks of water stress. Despite this, Papadopoulos & Wurm (2012) found that data centres that were pressured by investors and their customers gave more prominence to sustainability initiatives.

Many studies argued that the indirect water use of dry and mechanical cooling is significantly greater than the direct water use of water-based cooling, due to the significant amount of water associated with energy generation (Pan *et al*., 2018; Siddik, Shehabi & Marston, 2021; Mortensen, 2022; Global Switch, 2023; Gnibga *et al*., 2024; Jerléus, Ibrahim & Augustsson, 2024; Herrera *et al*., 2025). For example, fossil fuels and nuclear require water for cooling, whilst hydropower uses water for energy generation (Ristic, Madani & Makuch, 2015; Gnibga *et al*., 2024). Siddik, Shehabi & Marston (2021) stated that around three quarters of US data centre operational water footprint was from indirect water use, including for energy generation. As noted in Section 3.1.2, WUE_3 includes indirect water use and can be used to determine a holistic view of data centre water use.

Aishwarya (2025) stated that the training of AI models can cause significant peaks in data centre water use, noting that the shift from traditional computing workloads to AI has fundamentally changed data centre design requirements as they now must handle sustained peaks rather than the traditional variable workloads (Aishwarya, 2025). Furthermore, techUK (2025a) stated that there is no standardisation of AI cooling chip requirements, highlighting that "*an operating environment of ~32°C vs. ~25°C can enable energy and cooling efficiencies to be made*". Ark Data Centres (2024) stated that AI could reverse the efficiency gains within the sector and emphasised the need to balance performance and sustainability, stating that "*[p]eople who manufacture the servers that run the AI equipment need to understand the implications of the performance requirements they need*".

The UK Government stated that AI's water demand, particularly during hot periods which coincide with drought, intensifies the UK's vulnerability to climate change (UK Government, 2024). They noted the Environment Agency's concerns regarding water company resilience during the 2022 drought, which was England's hottest and driest summer since 1995 (UK Government, 2024). This intersects with environmental protection targets, including maintaining sufficient river flows to support ecosystems, as well as economic development, as housing and industry developments have been stopped in some places. The UK Government states that the availability and source of water needs to be considered early on during data centre planning and site selection to ensure cooling does not negatively impact the environment and local population (UK Government, 2024).

3.2 Stakeholder engagement

WRc spoke with 13 individuals across the ten companies listed in Section 2.2, within nine separate interview sessions.

3.2.1 Cooling technology and water use

Several interviewees highlighted the difference between water use and water consumption with respect to data centres. Data centre water use indicates water that remains within the system and is not discharged to sewer or evaporated. Conversely, water consumption describes water that does not remain within the system and is discharged to sewer or evaporated.

The data centres highlighted that the cooling equipment used and whether they use water varies depending on location and cooling requirements, with Global Switch highlighting that data centres with limited space (e.g., central London) use water-based cooling as this takes up less space.

The general consensus amongst data centre operators was that they felt that they did not use a significant amount of water, with the sector in recent years trending towards low water using cooling technology. The data centres and techUK highlighted that prior to the 2010’s, UK data centres were typically waterless, however a mix of the UK Government’s Climate Change Agreement, customer expectations for improved PUE, and the introduction of higher operating temperatures under ASHRAE incentivised energy efficiency, leading to some data centres adopting water-based cooling systems. In recent years, this trend has changed due to the increasing prevalence of water insecurity, with NTT stating that their policy on cooling technology had shifted from allowing sites to choose what technology they used to using waterless heat rejection systems unless they can prove that there is a sustainable water source available. Acton Consulting, Digital Realty, and Global Switch stated that closed-loop systems are typically filled up once, with any significant emptying rare. Interestingly, Global Switch noted that the indirect water footprint of air-based cooling is greater than the direct water footprint of water-based cooling, as energy production can use a lot of water.

Acton Consulting noted that large data centres do not necessarily use large amounts of water, with water use largely depending on the heat rejection system. Furthermore, they stated that open-loop evaporative cooling towers are rarely used in UK data centres.

One of the concerns flagged by Anglian Water and the Environment Agency was the potential for data centres to use a lot of water, in particular on hot days which often coincide with peak domestic demand. When significant water use by data centres is isolated to certain days, water companies need to plan for it to ensure sufficient water is available for all water users. Anglian Water highlighted that the water industry is very risk averse and will hold the water in its balance just in case, whether or not it actually ends up being used. They noted that whilst a data centre may not require a certain volume of water every day, they will not be pleased if they cannot access said water when they need it. As such, it needs to be constantly available just in case it is drawn upon. When asked what would happen if a data centre were to require more water than they'd requested, Anglian Water stated that they only have to supply water for domestic use and firefighting. Despite this, they noted that they would likely restrict flow over cutting them off.

The Environment Agency stated that they were getting a lot of mixed messages. On the one hand their survey with techUK on data centre water use indicated that most data centres are not using much water, but certain water companies like Thames Water were saying that they had received water connection applications for very large amounts of water. They also expressed concerns around how big and sustained these peaks in water use could be and that such massive ranges in water requirements could cause problems at a catchment level, particularly when combined with the projected growth of the sector.

Anglian Water and the Environment Agency also stated that it was difficult to get a clear picture of data centre water use due to the lack of data available for analysis. When asked about this, the data centre operators stated that they are being billed for the water they use, so the water wholesalers/retailers have the data. In discussions with MOSL it was highlighted that data centres are not a use category, so have fallen through the gaps.

AI

Anglian Water also questioned whether the government had taken data centre cooling into account when it announced its plans for AI Growth Zones. The Environment Agency stated that they are dealing with a lot of unknowns with respect to AI and new technologies, stating that they felt that more dialogue was needed regarding AI Growth Zones and water resource planning. The Environment Agency also noted that this issue wasn't exclusive to data centres, but to hydrogen production and industrial clusters as well. They stated as part of the planning process for new industry consideration needs to be given to the sourcing of water, highlighting that it can take several years to build a reservoir from planning to completion and there are potential trade-offs for other water users and abstractors.

Many interviewees expressed concerns that, when high density IT equipment is installed in data centres, this will require the data centre to cool to 22°C or below instead of the more common 27°C. They further stated that these control points are set by manufacturers and not sufficiently challenged. Some interviewees did however note that some customers were willing to operate the chips above the recommended maximum, allowing for significant energy (and potentially water) savings.

Acton Consulting stated that AI data centres are very different to traditional and cloud data centres in that they have much higher energy densities, fluctuating workloads (e.g., batch processing), and do not have the same redundancy requirements, so can be operated differently.

3.2.2 Water sources and quality

Anglian Water noted that there is often an assumption amongst non-household applicants that drinking water will be available and applicants are often shocked when they realise that "*water isn't literally on tap*". They stated that they currently have a 20 m^3/d limit on new non-domestic water connection requests and have objected to data centre planning proposals. Anglian Water stated that they are encouraging data centres to explore alternatives to drinking water, as it has undergone an expensive treatment process and to use it for cooling seems somewhat remiss when the public supply network is struggling to keep up with other demands. Whilst the use of final effluent for data centre cooling isn't a policy that Anglian Water has, it is something they strongly encourage. They referenced their report '*Re-using water for non-potable purposes*', which details the opportunities for water reuse with no or minimum treatment, indicating that water reuse did not need to meet all of a data centre's cooling needs, but should be considered.

Similarly, the data centre operators expressed interest in using final effluent from wastewater treatment works, with Global Switch stating that they already treat the water they use through reverse osmosis so little additional effort would be required to treat final effluent for use in cooling. Global Switch also stated that they use NEWater in their Singapore data centre, which is industrial water supplied by the water utility which is not of potable standard. Similarly, Digital Realty stated that in their North American data centres they connect to industrial water supply networks where available. These typically contain raw water that has not been treated to potable standards or final effluent. Currently only a few of their sites have such connections due to a lack of such supplies. Anglian Water stated that they currently have a non-potable supply network on the South Humber Bank which supplies 50 million litres per day (50,000 m^3/d).

NTT expressed interest in regional water resource groups when informed about them, and the Environment Agency felt that data centres would be welcomed.

When asked about wastewater, the data centre operators stated that they have trade effluent consents and that water from the cooling process is discharged to sewer. They highlighted that any water that has not been evaporated is cycled back through the cooling system several times before being discharged. This is because salts become more concentrated with each cycle and risk corroding equipment. Ark Data Centres stated that they wait for the salinity in their water to build up to 100 ppm dissolved solids before discharging to sewer, noting that the bulk of what they discharge is clean. For one of their sewerage providers this is welcomed as it dilutes the rest of the sewage arriving at their wastewater treatment plants, however their other sewerage provider has raised concerns over the quantity, as their network is constrained downstream. NTT noted that additional chemicals are added to cooling water such as corrosion inhibitors and biocides, and Global switch stated that sometimes glycol is added to water, which acts as an antifreeze.

3.2.3 Resilience

With respect to data centre resilience during supply outages, Anglian Water stated that they would expect data centres to be self-sufficient to a degree and that they typically suggest a certain amount of onsite storage in the event of a supply outage. They highlighted that they have a limited number of tankers and that in a serious event their focus would be on supplying hospitals and those on the priority services register. NTT stated that they have 24-hour water storage tanks and typically two mains connections at their sites. Global Switch stated that most data centres have 24-hours of onsite water storage, with this based on cooling demand of the hottest day.

When asked about what Critical National Infrastructure designation meant to them, Ark Data Centres stated that they expected it meant that they were guaranteed a water supply. Conversely, NTT and Global Switch both stated that they had no significant expectations as a result of being classified as Critical National Infrastructure, with Global Switch stating that they had been told by their wholesaler that there is no requirement to supply water from the public supply network for non-domestic uses.

Ark Data Centres highlighted that when applying for a new energy connection, the electricity grid states how much energy is available and how much upgrades would cost if they wanted more. They suggested that the water industry could offer something similar, with a menu stating the quantity of water and level of resilience they can have at what price. Ark Data Centres stated that they are paying millions for energy connections, so have a willingness to pay for similar water connections. Despite this, Global Switch noted that their water company had been unwilling to discuss re-enforcing the network to handle demand.

The Digital Realty representative noted that hyperscale data centres are no longer building operational redundancy into their sites, and are instead building IT redundancy, whereby if a site goes down, a different site can take on its functions. This is typically in enterprise data centres but could potentially be incorporated into other data centres.

3.2.4 Water efficiency and trade-offs

When asked who the onus should be on to drive data centre water efficiency, Anglian Water stated that everyone has a part to play. Whilst it is in a data centre’s best interest to be efficient, the government also has a role in setting the policy framework. They highlighted that part of the problem was that historically the cost of water has been very cheap, so there was no drive to conserve it. The data centre operators also highlighted that water is significantly cheaper than energy, making it difficult to justify the business case for water efficiency when it will lead to an increase in energy use. There are also currently no incentives to be more water efficient.

The Environment Agency also felt that both water companies and the government were needed to support the drive to greater water efficiency by data centres, highlighting that water companies produce a lot of final effluent which could be used as a water source. When asked about trade-offs, the data centre operators highlighted that water is significantly more effective at removing heat than air, noting that in areas where power availability is more constrained than water, using water-based cooling can make more sense.

3.2.5 Policy

Acton Consulting and the data centres highlighted that there is no specific planning class for data centres. The Environment Agency also highlighted this, as often data centres get categorised as warehouses or similar, so it’s difficult to track applications and their water usage.

Ark Data Centres stated that the most important issue was the temperature control point, citing that if a data centre had a control point of 32°C water-based cooling would not be required until outside temperatures exceed 29°C. They suggested that policy could focus on control points rather than location or efficiency, citing that control points are currently dictated by manufacturers and are not sufficiently challenged. Ark Data Centres also stated that colocation data centres often have their hands tied by Customer Service Level Agreements, which are contracts which dictate (amongst other things) the temperature and humidity that equipment must be stored at. These agreements can last for significant periods of time, with Ark Data Centres quoting 25 years. Acton Consulting stated that most of these Service Level Agreements apply ASHRAE’s Recommended temperature envelope of 18°C to 27°C, which can inhibit cooling options. They also note that very few Information Technology Equipment (ITE) manufacturers offer warranty on their equipment to A2 which we understand to mean that operators are generally forced to operate within the narrower A1 temperature envelope. Furthermore, Acton Consulting stated that the ASHRAE temperature envelopes are dictated by IT manufacturers rather than data centre designers and operators.

Ark Data Centres stated that data centres in Europe created the CNDCP initially as a means to influence reporting that was to be required under the European Union’s EED. The Environment Agency stated that they think that data centres signing up to the CNDCP would support the progression of the sector to more sustainable water consumption.

Ark Data Centres stated that they did not foresee much resistance to England aligning with the EED and mandating reporting, but did envision pushback if England were to require different metrics to those required by the EED. They also noted that compliance with reporting may be poor due to confidentiality claims, citing confidentiality agreements with customers, as well as business sensitive information such as what cooling technology is used. Cooling technology was cited as business sensitive as customers may move to competitors who are more efficient or advanced. Global Switch highlighted that some of the data the EED requested was not sensitive, but some of it was. The Environment Agency stated that it would be useful to have a similar form of legislation to the EED, as the information provided would be invaluable.

Ark Data Centres also stated that the UK no longer reports under the Water Exploitation Index, which they believe is a serious issue as it is used by data centres to infer water availability.

The interviewees from the University of York and Durham University stated that their research had focussed predominantly on data centres in Singapore. They noted that they considered the Green Mark to have been beneficial, creating a common language and set of parameters to measure and compare and brings the issue of the sustainability of data centres into public awareness. They also noted the benefits of standards in forcing disclosure of key information, but warned of contextual differences to the UK, highlighting that in Singapore all listed companies must report scope 1/2/3 carbon emissions and data centres generally operate on a refinancing model where they need loans from commercial banks. The interviewees stated that the Green Mark is generally sufficient for them to secure green loans or sustainability linked loans, which provides an incentive to become certified or to seek higher levels of certification. They also warned how too much regulation can cause firms to leave and relocate to places where regulation is freer, resulting in poorer outcomes for society (e.g., Singapore previously implemented a ban on new data centres which led to significant growth in Indonesia and Malaysia where environmental safeguards are lesser). Global Switch noted a similar phenomenon due to Germany's strict implementation of the EED.

NTT and techUK both highlighted that minimum performance standards can stifle innovation and remove some of the most efficient cooling technologies from the market. They also questioned whether other sectors such as chemical manufacturing, pharmaceutical manufacturing, and food and drink would also be targeted, as they also use water-based cooling. Similarly, Acton Consulting and Ark Data Centres questioned whether other sectors would be targeted for water reductions, highlighting that golf courses and beverage manufacturers use more water than data centres. Ark Data Centres stated that efforts to manage and reduce water consumption would be more accurate and balanced if all industrial and commercial water users were targeted, highlighting that standards (such as ISO, BS, etc.) and sub-metering can be used to provide transparent and consistent data.

3.3 Data analysis

MOSL provided anonymised water use (meter) data which included 257 of the 453 English data centres identified on Data Center Map[12,13,14]. It is important to note that systematic biases may exist regarding which data centres were able to be matched. We recommend that MOSL consider reasons for being able/unable to match different data centres and the biases which this introduces into the data. For example, it is not known whether small/large, urban/rural or

[12] Available at: https://www.datacentermap.com/united-kingdom/ (Accessed: 29 September 2025)

[13] 257 data centres using 208 water connections. For the purpose of analysing water usage, there were considered to be 208 data centres.

[14] Where a SPID was matched to >1 data centre this was treated as one data centre for the purposes of comparing water usage.

new/old are more/less likely to be included within the 257. Without information to the contrary, no systematic biases were assumed to exist, and the sample was assumed to be representative of the English data centre sector (as defined by Data Center Map) as a whole.

The data shows very significant variability across data centres with the majority (67%) using less than 1,000 m^3/year (mean 217 m^3/year)[15]. This is comparable with the annual use of a 600 m^2 office (Artesia, 2024). For reference, the average computer room floor area in German data centres is 2,652 m^2 (European Commission, 2025a). In contrast, the top six (3%) of data centres used >50,000 m^3/year (average 115,800 m^3/year, comparable to a hospital with a floor area of 37,000 m^2) and accounted for 65% of the sector's water use. Moreover, the top 15 (7%) accounted for >80% of the sector's water use. Total annual water use for the sample was 1,066,000 m^3/year. Assuming scalability to the whole of England this would correspond to an annual sector usage of **1,879,000 m^3/year, representing 0.2% of NHH potable water use**. For comparison, this is the same as the postal and courier sector (MOSL, 2025), while a small water resource zone like Henley in Thames Water supplies around 5,000,000 m^3/year (Thames Water, 2024).

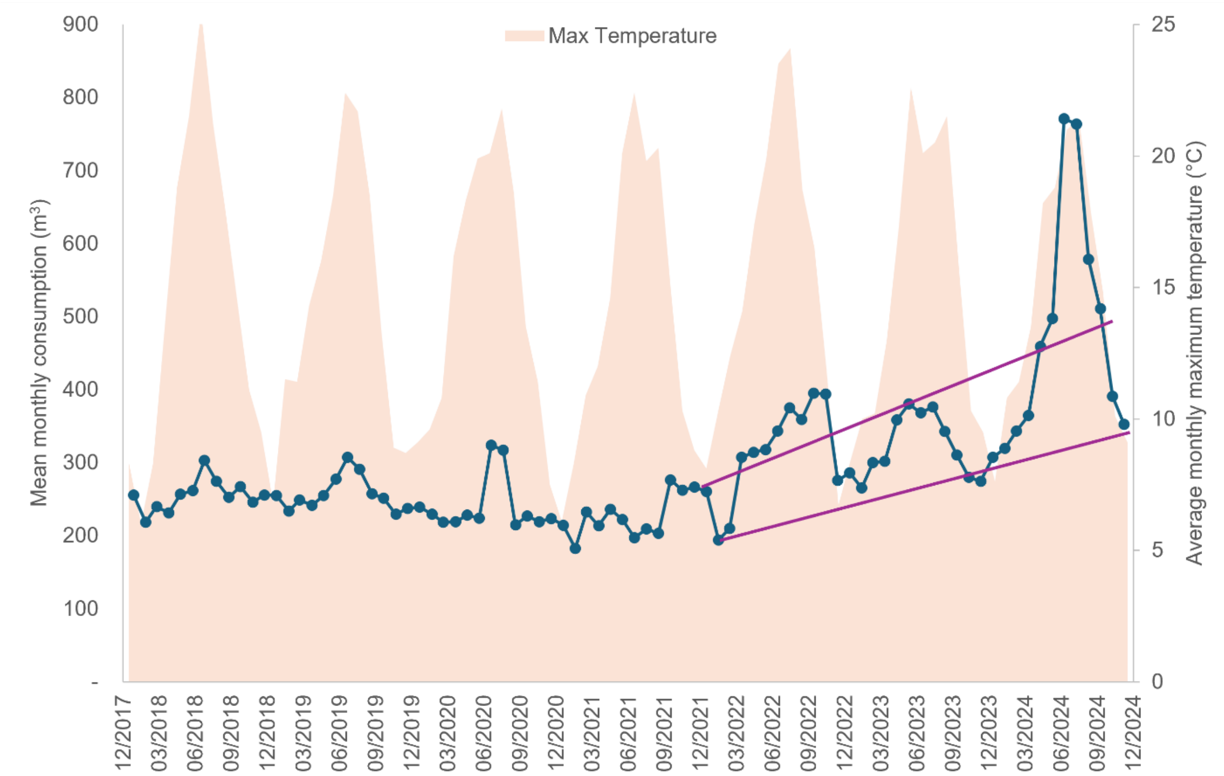
Overall, sector water usage shows a slight seasonal variation (Figure 3.5). The sharpness of the peaks is indicative of some data centres using hybrid cooling. An apparently alarming increase is observed in summer 2024. However, in 2024 two data centres, identified in the anonymised data from MOSL with IDs 207 and 208, appear to have come online which have highly significant water use (annual usages of around 90,000 m^3 and 273,000 m^3 respectively). It would appear that these data centres use hybrid cooling with water increasing several-fold during summer months (as seen in Figure D.1 in Appendix D). The massive impact of these two data centres alone can be clearly seen in Figure 3.5 where there is a noticeable increase in average usage, but a significant increase in summer use. **The size of the 2024 summer peak is caused predominantly by these two data centres so care should be taken when extrapolating any trends.** It should also be considered whether this high-water consumption is due to construction and commission of the data centres as opposed to cooling.

Ignoring seasonality, an upward trend in average water consumption (suggesting lower efficiency or a movement towards larger sites) have been observed since the end of 2021. In particular, Figure 3.5 shows an increase in average winter consumption and mean annual consumption of nearly two-fold (purple lines). This coincides with growth in the number of data centres and suggests that, **on average, new data centres are using more water than existing data centres and those being decommissioned, driving up average consumption.** However, it should be reiterated that this does not necessarily mean that new

[15] In 2023 the percentage in the lowest group is unchanged at 67% but the 13 data centres with usage over 50,000 m^3 only account for 72% of the total.

data centres **universally** consume large amounts of water; they may operate efficiently with a lower WUE but be larger in size.

Figure 3.5 Monthly average data centre water usage against monthly average maximum ambient temperature



However, not all data centres show seasonal use with more than **75% of data centres using less than 10% more water in summer months (July and August)** than their annual average (median 1%). This seasonal variation is therefore being driven by a relatively small number of data centres (only ten data centres using more than 50% extra during summer months, up to a maximum of 361%). This suggests that around 5% of data centres may use hybrid cooling but that these are (as expected) some of the largest water users, so significantly skew the overall sector profile.

4. Discussion

4.1 Understanding the data centre landscape

In the UK, the data centre market is already substantial, though estimates of its size vary, largely due to differing definitions of what constitutes a data centre. Current government estimates indicate that approximately 250 to 400 colocated data centres are operating, with a combined ITE capacity of 1.5 GW, with approximately 90% of these facilities located in London and the Southeast (Department for Science, Innovation & Technology, 2025c). Similarly, techUK (2021) estimates that there are approximately 500 facilities that qualify as data centres, of which around 200 are recognised colocation centres (techUK, 2021). Foxglove and The Times have claimed that water companies are supplying almost 10 billion litres (10 Mm^3) of water annually to 231 of these data centres, with Thames Water identified as one of the largest suppliers (Vaughan, 2025).

In the global context, the data centre sector has expanded rapidly over the past decade, with an estimated 7.2 million continuously operating facilities (of various definitions), representing a 550% growth in data centre computing operations (Ptach, Andrews & Philbin, 2023), with other estimates indicating this figure is more likely 10,000 to 11,000 (Alaamer, 2025). Organisations are increasingly able to import cloud services, leading to substantial growth in markets like the US, UK and China (Federal Ministry for Economic Affairs and Climate Action, 2025).

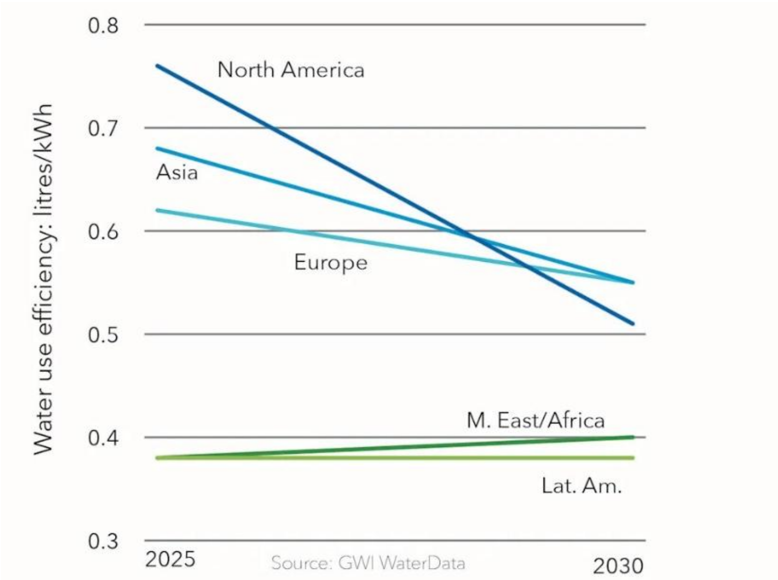
At this point in time, the primary method for cooling electronic equipment is still forcing cooled air through the systems. As heat density increases so does the volume and ultimately the temperature of the air needed to provide this cooling.

4.1.1 The future landscape of the data centre sector

In the evidence review, attempts to forecast future global growth in data centres were limited, with some arguments stating that current estimates are unreliable indicators due to technological shifts away from routine internet services towards rapidly growing, intensive, on-demand AI applications (Department for Science, Innovation & Technology, 2025c). Despite this, the evidence did reveal some insights into the potential global resource demands (energy and water) associated with data centre growth.

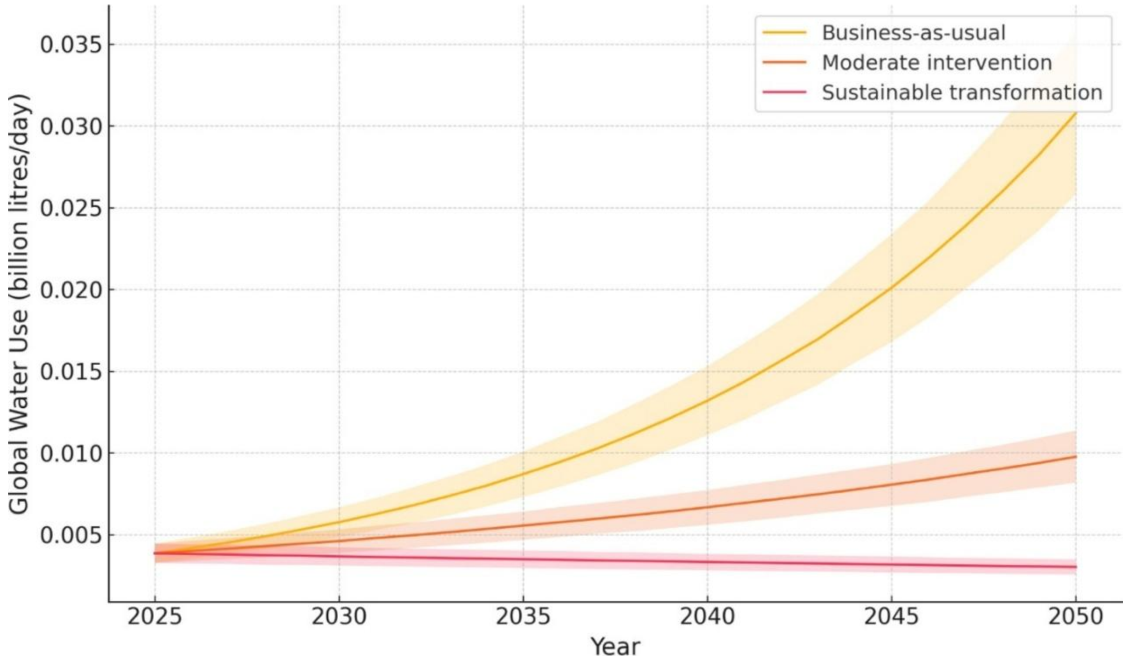
Global Water Intelligence estimates average WUE to be highest in North America (~0.77 l/kWh), as shown in Figure 4.1, followed by Asia (~0.68 l/kWh) and Europe (~0.63 l/kWh) (Global Water Intelligence, 2025). By 2030 they project Europe WUE to drop to 0.55 l/kWh. The most drastic change can be seen in North America, which decreases to 0.51 l/kWh following their uptake of air-based cooling (Figure 4.1).

Figure 4.1 Predicted trends in global WUE (Global Water Intelligence, 2025).



Despite the predicted decreases in WUE, research by Global Water Intelligence also forecasts that onsite water consumption will increase by 50% by 2030 (Global Water Intelligence, 2025). Similarly, forecasts of water withdrawals associated with AI technologies indicate an increase from 4.2 billion to 6.6 billion m^3 by 2027 (UK Government, 2024). This could be a conservative estimate, as data centres serve a wide range of digital functions beyond AI, meaning that actual water use could exceed these projections. Longer-term modelling by Herrera *et al.* (2025) further suggests that global water consumption related to data centres could increase sevenfold between 2030 and 2050 (Figure 4.2). Global energy demand from data centres could also double by 2030, rising from around 1% to 2% of total energy consumption, with some projections even higher, anticipating an increase to 8% by 2030 (Amiri *et al.,* 2025). Therefore, while concrete projections of global data centre growth remain limited, current resource estimates point to a rapidly expanding sector that will demand significant resources worldwide.

Figure 4.2 Simulated estimates of global data centre water use under three different scenarios (Herrera *et al.*, 2025)



Within this global landscape, the UK is positioning itself as a major hub for data centre development, with the UK Government keen to establish the UK as an AI centre and intending to develop AI Growth Zones (Department for Science, Innovation & Technology, 2025b). Some forecasts indicate that the number of UK data centres could rise by almost 20% (BBC, 2025a). Similarly, planning assessments suggest nearly 100 new facilities may be constructed over the next five years, about half of which are expected to be in London and neighbouring counties. Evidence also points to increasing development beyond the traditional Southeast concentration (Environment Agency, 2025), notably, the UK's largest planned facility is the DC01UK development in Hertfordshire (Department for Science, Innovation & Technology & The Rt Hon Peter Kyle MP, 2024), with an even larger site proposed for construction after 2030 in Blyth, near Newcastle (BBC, 2025a).

The use of AI and development of AI data centres requires greater cooling due to the increased amount of heat they produce. Water and liquid-based cooling systems are currently the preferred method for cooling AI chips due to their greater efficiency in removing heat (Aishwarya, 2025). Interviewees from Ark Data Centres, NTT and Global Switch noted that NVIDIA, the market leader in AI chip manufacturing, recommends data halls containing their AI chips to be kept at 20°C (likely linked to the ASHRAE guidelines), forcing data centres to use water or liquid-based cooling. That being said, NTT noted that there has been some pushback on this and that this temperature could rise, but it is unknown by how much.

The representative from Acton Consulting highlighted that AI data centres are very different to traditional data centres not only due to their higher energy density (up to five times greater than standard racks), but also due to their fluctuating workloads and differing uptime/resilience requirements. This may result in different water demand profiles and impact peak demands should they be supplied from public water supplies. It should also be noted that AI within typical data centres may not be that prevalent and may continue to just be present within a subset of data centres.

A rise in high-density computing and high-power chips, for example those designed for use with generative AI and graphics, may result in a decrease in temperature set points in data centres. Interviewees were split regarding the impact this would have on water use. On one hand a decrease of temperature set points would vastly increase the number of days that hybrid systems rely on water-based cooling, and this would be particularly impactful if requests from single customers in colocation data centres required whole data centres to increase their cooling. On the other hand, interviewees noted that high-density computing is not generally suitable for air cooling and that it would result in a move towards direct-to-chip or immersion cooling. Such systems could still consume water for heat rejection (e.g. evaporative – adiabatic – or hybrid) but some interviewees indicated that they expected this transition to reduce water use. Further in the future, quantum computing may yet become commonplace. Such computers operate at extremely low temperatures, requiring cooling with liquid helium to around -270°C. This would result in a complete overhaul of data centre cooling, and it cannot be predicted whether such a system would require water consumption.

The continuing expansion of the sector, coupled with growing demand for advanced cooling technologies, will inevitably increase water use. However, there remains a considerable degree of uncertainty regarding the scale and pace of this trend, both in the UK and globally. The Environment Agency has acknowledged these challenges, emphasising the need to explore data centre water supply sources (including alternatives to mains supply) and future demand, to strengthen forecasting and support long-term water resource planning (UK Government, 2024).

4.1.2 Drivers of data centre growth

Globally, the acceleration in demand for data centres is driven by the expansion of the digital economy (Chow *et al.*, 2024). The evidence and stakeholder engagement indicated that this growth is driven by the ongoing introduction of emerging technologies, including big data, AI, cloud computing, edge computing, and the Internet of Things, alongside increasingly powerful hardware, such as high-performance graphics processing units (Mytton, 2021; Ott, Wenzel & Radgen, 2024; UK Government, 2024; Amiri *et al.*, 2025). Hyperscale warehouse-style data centres represent a significant part of current and projected growth, including a shift from smaller 'traditional' enterprises to colocation and hyperscale (Mytton, 2021; Federal Ministry for Economic Affairs and Climate Action, 2025; International Energy Agency, 2022). In terms of numbers, projections indicate that by 2030, 29.3 billion devices will be connected online, representing a 59.2% increase relative to 2018 (Mytton, 2021). Concurrently, global data storage demand was expected to rise from 22 zettabytes (ZB) in 2018 to 175 ZB by 2025 (Jerléus, Ibrahim & Augustsson, 2024).

These developments present substantial challenges in terms of energy consumption and cooling requirements, both in terms of the overall water resources required to support cooling but also the increase in total thermal design power of data centres necessitating more sophisticated cooling technologies, adding complexity to the water resources required (Latif *et al.,* 2025).

This rapid growth is not driven solely by market forces but is also underpinned by formal governmental support and strategic policy. The UK Government, along with international partners, recognises AI and the digital economy as key drivers of economic growth. Ministers have implemented active policy measures to accelerate data centre expansion, including reforms to planning regulations, initiatives to secure investment, and the development of AI Growth Zones (UK Government, 2024; BBC, 2025c; Foxglove, 2025; techUK, 2025a).

In September 2024, policy measures advanced further with the designation of data centres as Critical National Infrastructure, placing them alongside essential systems such as water, energy, and emergency services (UK Government, 2024). However, discussions with data centres identified that they were unclear of the meaning of this designation, with some understanding it was in relation to planning policy and others understanding it meant they were among the highest priority for utilities. Global Switch stated that they had been told by Thames Water that it did not guarantee access to water. Furthermore, the UK Government's '*Water use in AI and Data Centres'* report in 2024 identified that this designation could carry significant consequences for water resource planning, potentially obliging water wholesalers to supply data centres and limiting their capacity to refuse connections (UK Government, 2024). Currently water companies are not obliged to provide water to energy companies unless an agreement is in place. A similar point was raised within environmental capacity assessments for upcoming hydrogen clusters where United Utilities noted that they agreed to supply water that was available according to their water resources planning (WRc, 2024). However, should a company want more, they were required to either: choose a designated source; support United Utilities with network upgrades; or offset demand (resulting in demand reduction) which may include finding alternative sources such as water recycling. A similar approach may be expected for data centres.

4.2 How data centres use water

Data centres use water for cooling, humidity control, and domestic use, with cooling accounting for the majority of water consumption. Interviewees from Ark Data Centres and Global Switch stated that they felt that they did not consume much water, with much of the bad press derived from US data centres operating open-loop evaporative cooling systems. This view was supported by survey data from techUK's report '*Understanding data centre water use in England*' (techUK, 2025a). The data provided by MOSL indicated data centres in England consume 1,879,000 m^3/year and account for 0.2% of non-domestic water consumption.

Several interviewees highlighted that data centres consumed less water than other sectors such as energy, golf courses, pharmaceuticals, and food and drink. Per MOSL's CMOS database, in 2024 food and beverage services (restaurant, catering, etc.) consumed 64,675,481 m^3/year (6.8% of non-domestic water consumption); the manufacture of food consumed 45,162,865 m^3/year (4.8%); the manufacture of beverages consumed 12,970,694 m^3/year (1.4%); sports, amusement and recreation consumed 35,644,586 m^3/year (3.7%); and the manufacture of pharmaceuticals consumed 1,305,531 m^3/year (0.1%) (adapted from MOSL, 2025). It should be noted that these figures relate to non-households that partake in the business retail market and does not include those that abstract/extract water from the environment (which is common in agriculture and energy production).

Interviewees highlighted that the type of data centre plays a crucial role in understanding and contextualising water use. For instance, achieving water efficiency is more challenging in colocation facilities, where multiple clients share the same infrastructure and all server rooms typically operate at a uniform temperature set point, limiting flexibility in cooling strategies. This was echoed in the evidence review presented in Section 3.1.

techUK (2025a) found that 64% of data centres use less than 10,000 m^3/year, although 18% of respondents did not declare their water use. Considering only those that reported, 78% use less than 10,000 m^3/year. This compares to MOSL's data, which found that 67% use less than 1,000 m^3/year, with 93% using less than 10,000 m^3/year. techUK found that 4% of those surveyed (5% of those who reported their water use) used >100,000 m^3/year, comparable to MOSL's data which put 3% in this category (techUK, 2025a). Given the variation in definition of what classes as a data centre between the datasets and the limited coverage of each, this provides good corroboration of the results of the two studies. The techUK study further indicates that 44% of data centres use hybrid cooling systems with 5% using water-based cooling (alone). This is compared to the publicly disclosed data centre reporting of >500kW facilities in the Netherlands (a subset of the EED dataset) in Table 4.1[16].

As the Dutch data also includes power, WUE can be calculated and compared to the numbers reported by select UK data centre operators who published WUE in their ESG reports (Table 4.2). As ESG reports are published by operators and presented as an average across sites (in some cases split by liquid-cooled and non-liquid cooled), no statistics other than a weighted mean can be calculated.

[16] Available at https://www.rvo.nl/documenten-publicaties?publicationTypes=613&subsidies=3627&sectors=1259&page=0 (Accessed 08/01/2026)

Table 4.1 Comparison of banded water use in European data centres

Potable water usage band (m^3/year)	Source	Proportion of sample	Number of data points	Average in-band usage (m^3/year)
<1000	Dutch data centres[1]	70.7%	41	221
	techUK report	38.6%	22	N/A
	MOSL data	66.7%	138	217
1000-10,000	Dutch data centres[1]	12.1%	7	3017
	techUK report	40.4%	23	N/A
	MOSL data	26.1%	54	3076
10,000-100,000	Dutch data centres[1]	13.8%	8	27,044
	techUK report	15.8%	9	N/A
	MOSL data	4.3%	9	19,448
>100,000	Dutch data centres[1]	3.4%	2	148,014
	techUK report	5.3%	3	N/A
	MOSL data	2.9%	6	115,806

1: 40 out of 106 data centres did not report water or potable water usage. When total water usage was reported but not potable use, exclusive potable use assumed.

Table 4.2 WUE comparison between Dutch data centre EED reporting and data from publicly available ESG reports of UK data centre operators

Source	ESG report	EED	Dutch data centres
Number of data points	Six operators covering 50 data centres	458	54
Average	0.78	0.58 (all) 0.193 (100-500kW) 0.561 (500-1000kW) 0.413 (1-2MW) 0.499 (2-10MW) 0.704 (>10MW) 0.56 (colocation)	0.74

Source	ESG report	EED	Dutch data centres
		0.17 (co-hosting) 0.83 (enterprise)	
Median	N/A	N/A	0.08
25th percentile	N/A	N/A	0.02
75th percentile	N/A	N/A	0.32
90th percentile	N/A	N/A	2.28
Percentage WUE <0.4l/kWh	N/A	N/A	75.9%

The data reinforces two important messages:

- Data centre water use is very low in the majority of data centres
- Water use is significant in some (the minority of) data centres.

Together, these conclusions have important implications for planning: data centre growth should not necessarily be constrained due to concerns about water availability, but, equally, the potential water footprint of data centre growth shouldn't be underestimated. For example, **were IDs 207 and 208** referenced in Section 3.3[17] **to be representative of all new English data centres** then an additional 100 data centres in the next five years could hypothetically require 9,000,000 m^3/year; increasing non-household demand by 2% and the sector usage by 10-fold. In addition, these numbers do not present what the impact to peak demand may be, which can be a significant aspect to water resources planning.

It is challenging to forecast how much water a data centre uses due to their differences in size, workload, siting, and cooling system. The evidence review, stakeholder engagement and data analysis has clearly identified that there is a vast range of water demand and demand profiles for data centres, and that they cannot be lumped into one simple category for water resources planning. Generally, the water consumption figures provided by the literature were country-scale estimates. Some data centre sustainability reports included water use and consumption per data centre, but most did not.

As indicated by interviewees from Anglian Water and the Environment Agency, concerns arise from the potential for data centres to use a lot of water on hot days, the unpredictability of when

[17] These data centres showed significantly higher water usage, skewing the results. As shown in Section 3.3.

this will occur and for how long, as well as how this could change with the projected growth of the sector and technological changes. The impact of this is that water resource planners are unable to estimate future data centre demand due to uncertainties in how much water data centres use, the effects of climate change, and data centre growth. It can take a significant amount of time for new water resources to be designed and come online. At the same time technology is moving quickly, therefore any new water resources that account for data centre growth could be insufficient by the time they come online. This project has identified that liaison between regional water resource planning groups, water companies and data centres is vital for planning. In addition, the findings suggest that it is beneficial for data centres themselves to take ownership of forecasting their water demand given the commercial sensitivities surrounding certain information essential for accurate demand projections. Following this there is potential for data centres and water companies to enter into agreements similar to those used by the energy sector (including the hydrogen sector), for a water company to provide up to an agreed amount, and potentially allowing regional groups and the public water sector to develop water resources plans with contribution from data centres, increasing the financial feasibility of certain water resources options.

A recent letter from the Climate Change Commission to Emma Hardy MP, Parliamentary Under-Secretary of State (Department for Environment, Food, and Rural Affairs) stated that the UK should at a minimum prepare for 2°C of warming above pre-industrial levels by 2050 (Climate Change Committee, 2025). Under this scenario heatwaves are set to become twice as likely and drought risk will double. This means that data centres will experience more days where peak cooling is required, and that the resilience of water supplies will likely be reduced due to increased drought conditions.

Concerns have also been expressed over the potential impact of data centres on domestic utility bills, as their resource consumption strains local supplies, necessitating investment to increase supply (Saul *et al.*, 2025). In Ohio, monthly utility bills have increased by $20 (£15) due to data centres (BBC, 2025a), whilst Saul *et al.* (2025) found that in the US electricity costs in areas near data centres rose by 267% compared to five years prior. This suggests a requirement for data centres with significant water demand (including a significant daily peak water demand) to contribute towards the improvement and maintenance of the network to ensure they are paying for the full cost of water, and their costs are not unintentionally passed on to domestic utility bills. As stated in Section 3.2.3, there was willingness from at least some of the interviewed data centres to foot the additional network costs incurred by their demand.

Similarly, there are concerns regarding the environmental impact of data centres. These generally relate to the environment from which the water was sourced, although they can impact the environment in which they operate if discharging cooling water to the environment, largely due to the temperature of the discharge. This includes water from the public supply network, which is largely abstracted from rivers, groundwater, or reservoirs. Removing too much water from the environment damages ecosystems and their associated services. Lower river flows, aquifer levels and reservoir levels mean that there is less water available to dilute pollutants/toxins that enter the water body. It also means that there is less space for species, fragmenting habitats. This reduces species diversity and can lead to the loss of keystone species (UK Government, 2024). This will be exacerbated by dry weather and drought, which are likely to increase in England under climate change (Climate Change Committee, 2025).

When discharged into the environment, cooling water can cause thermal pollution, which causes biochemical changes in water bodies. This includes reduced dissolved oxygen, which can cause aquatic life to die as there is not enough oxygen to breath and can facilitate algal blooms, which are also harmful for aquatic life (Arcadia, 2017). Increased temperatures can also increase metabolism, causing some fish and amphibians to need more food. Over time this can put pressure on an ecosystem, as its inhabitants are eating more than it can produce (Arcadia, 2017). Reproductive issues and birth defects can also occur. All of this can lead to a loss of biodiversity (Arcadia, 2017). Concerns have also been raised about chemicals that may be in the cooling water, with some farmers concerned about soil pollution (Rone, 2024). The data centre operators stated that they discharge to sewer.

4.2.1 Cooling technology

ASHRAE recommend a Data Hall (the room in which servers are stored) temperature of between 18°C to 27°C (18°C to 22°C for high density systems such as AI) (Bizo, 2021). To keep within the recommended operating envelope of the housed technologies, data centres employ cooling systems.

As described in Section 3.1.3, the cooling system can be split into two parts: the heat transfer system and the heat rejection system (techUK, 2025a). Heat transfer within a data centre can be done using either a closed- or open-loop system. In a closed-loop the cooling medium within the loop is continuously reused, like in a central heating system. Conversely, in open-loop systems the cooling medium is not continuously cycled through the system and is instead pumped around the building and then discharged.

The closed-loop system is filled with water during construction and is periodically topped up when needed. Interviewees from Global Switch, Digital Realty and Acton Consulting stated that top-up was very minimal, that no periodic flushing or refilling was conducted and that the systems should be thought of as 'single fill' (Veolia, no date). The amount of water within a closed-loop system would scale with its size, e.g. a 100 MW data centre would require about ten times more water than a 10 MW data centre. Global Switch estimated that a closed-loop system at a 1MW site would contain ~24 m^3, but that this would vary depending on volume of pipework and equipment connected.

The interviewees from Ark Data Centres and Acton Consulting stated that open-loop systems with cooling towers were very rare in England, due to how water intensive they are and concerns around legionella. Furthermore, interviewees stated that open-loop systems are very uncommon in English data centres, but are commonly employed by the energy industry (although this aspect was not included within the scope of this project's evidence review and so no evidence from literature was identified to substantiate these observations), which typically uses raw water from rivers and estuaries. It was also noted by Acton Consulting that those that do exist are older sites nearing end of life and that this technology would not be considered for new sites.

Data centre cooling systems vary globally depending on climate and resource availability. The NTT representative stated that of their 120 sites globally, about 20 of them use water-based cooling. Similarly, the Acton Consulting representative stated that the new cooling technology used within Europe was exclusively low water, with much of the water intensive cooling towers nearing the end of operational life. Interviewees noted that the cooling technologies employed can be complicated and vary depending on location, equipment housed, and any Service Level Agreements, and that often a variety of different cooling technologies will be used through the year. This includes operating some cooling technologies concurrently.

There are a variety of different cooling technologies that can be employed for heat rejection, including free cooling, air cooling, evaporative cooling, and adiabatic cooling. Further details on these individual methods can be found in Section 3.1.3. In England, and the wider UK, free cooling is generally used where possible. When free air cooling is insufficient for high temperatures, this might be supplemented with water or forced air cooling on days above a certain temperature. This is referred to as hybrid cooling. This temperature will vary depending on the agreed internal temperature for a Data Hall. However, water-based cooling is an attractive method as water is 3,200 times more effective at removing heat than air (Nautilus Data Technologies, 2024). Furthermore, water cooled data centres use, on average, 10% less energy than air cooled data centres (Google, 2022). The interviewees from Ark Data Centres, NTT, and Global Switch stated that the lower cost of water compared to energy also means that it is a significantly cheaper cooling option (Carriero, 2025).

The Global Switch interviewee noted that often evaporative cooling is used in space constrained locations such as inner-city London. This is because an air-cooled chiller takes up 82 m^2 of space, compared to 44 to 48 m^2 for a draught cooling tower which uses water (ASHRAE UK, 2025). Similarly, the Global Switch interviewee stated that if the building is constrained on how much electricity it can use, it will use evaporative cooling to free up more space for IT equipment.

techUK (2025a) suggested that 51% of data centres in England had a waterless heat rejection system, 44% were hybrid, and 5% used water for heat rejection (e.g., evaporative cooling) (techUK, 2025a). It should be noted that water could still be used at sites with a waterless heat rejection system in the form of a closed-loop heat transfer system.

Cooling technology trends

The evidence review and interviews suggested that in England and the wider UK, the use of water within a closed loop heat transfer system will likely continue due to its effectiveness at absorbing heat. Similarly, the use of air cooling will likely continue, but is dependent on the technology within the data centre (e.g., AI chips), the space available for chillers/cooling towers, grid capacity (how much electricity they can use), and level of cooling required. Where a data centre contains equipment that either produces a lot of heat or needs to be kept at cool temperatures (e.g., <20°C), lacks space, and/or is located in an area with limited grid capacity, evaporative cooling with a closed-loop system will likely be used. The use of liquid cooling methods such as direct-to-chip and immersion cooling can also be used to cool equipment which produces a lot of heat or needs to be kept at cool temperatures. These can be used with a closed loop heat transfer system with either air-based or evaporative heat rejection systems. It should however be noted that there are a variety of upcoming PFAS bans and restrictions, with the UK considering bans. This could lead to many refrigerant gases being banned or restricted, making it difficult to operate mechanical chillers (Red Engineering, 2025). This loss of mechanical chillers could lead to an increased uptake in water-based cooling.

4.2.2 Water sources

Water used for data centre cooling is generally required to be of high quality to prevent scaling, clogging, bacterial growth, and damage of the cooling system (Li *et al.,* 2025). Currently in Europe, 86.5% of cooling water is derived from drinking water, 13.4% from industrial water (non-potable) supplied by water companies, and 0.1% is from rainwater harvesting (EUDCA, 2025b).

The English and wider UK data centre industry currently, almost exclusively, relies on public water supply. Apparent barriers to the use of alternative water sources include:

- A lack of precedent, incentive and interest from water companies to provide non-potable supplies, or possibly fears about regulatory pushback and the challenges relating to getting such a scheme approved
- A view that surface water flows are unreliable and the abstraction licenses are hard to obtain
- A, possibly outdated, view that data centres need to be located in urban centres, close to customers and close to business headquarters
- A lack of precedent and fears of regulatory pushback to novel ideas like submerged ocean-cooled data centres or aquifers as heat storage for district heating
- An unfortunate narrative that water *use* is bad rather than water *consumption*, leading to open-loop systems being discounted as water inefficient and reputationally damaging, despite their widespread use in the energy sector
- The treatment by most metrics of all sources of water as equivalent
- A view of connection to public water supply as a right.

Whilst cooling water does need to be of high quality to prevent corrosion and bacterial growth, suitable quality can be obtained from minimally treated alternative sources. Anglian Water's report '*Re-using water for non-potable purposes*' identified opportunities for using non-potable water for a variety of different activities, differentiating them based on level of treatment (no/minimal treatment and minimum treatment) (Anglian Water, 2025). For data centres, the report identifies rainwater, urban drainage systems, domestic grey water, and internal drainage board water as highly suitable sources which require either no or minimal treatment. When sources are treated, this extends to desalinised sea water, sewage effluent, industrial effluent, mine water, and polluted groundwater. It should be noted that some of these sources are not reliable throughout the year e.g. rainfall is not temporally consistent (Anglian Water, 2025). Table 4.3 describes the main water sources and their suitability for use in data centres.

Sites may need to be close to certain sources e.g. wastewater treatment works (WWTW), the coast, mines, and internal drainage board infrastructure, as it may not be practicable or cost effective to transport the non-potable water over significant distances. That being said, industrial supply networks which provide non-potable water exist and could be expanded upon.

Table 4.3 Advantages and disadvantages of water types for data centre cooling

Water source	Pros	Cons
Potable water	Good quality and requires limited treatment by the data centre before use. Cheap to buy (compared to energy).	Constrained resource under pressure from increasing demand. Intended for domestic use.
Treated effluent from WWTW	Reduces burden on potable supplies. Sustainable (unless required for river flows). Of a quality that can be treated on-site by data centres at minimal additional cost. May be cheaper than potable water.	Could impact rivers that rely on effluent for base flows. Requires siting close to a WWTW. Requires additional treatment.
Rainwater/stormwater	Reduces burden on potable supplies. If there is sufficient storage onsite, then rainwater could meet the majority of a site's needs. Best suited to large sites with significant roof space. Not reliant on utility for supply, reducing cost and increasing resilience.	Limited resilience (not a consistent and reliable source due to the seasonal nature of rainfall) and can carry Legionella risk. Would require additional filtration, treatment and onsite storage. Difficult to retrofit rainwater harvesting collection systems due to the large storage tanks required. Limited water collection potential at smaller sites.

Water source	Pros	Cons
Seawater and brackish water	Reduces burden on potable supplies. Significant and reliable resource. Suitable for open-loop systems where quality is less important. Not reliant on utility for supply, reducing cost and increasing resilience.	Water quality and salt content can cause scaling and corrosion. Requires siting close to the coast, which could make the site vulnerable to flooding and erosion. If pumping to a site inland, pumping could be energy intensive. Could require desalination or treatment prior to use and environmental impacts of discharge need to be managed e.g. temperature, brine.
Groundwater	Reduces burden on potable supplies. Not reliant on utility for supply, reducing cost and increasing resilience. Opportunities both for open-loop 'take and return' and closed-loop operation.	Available water can vary depending on season and rainfall. Significant abstraction could lead to subsidence, as well as increased competition with other abstractors. Would require additional treatment. Requires abstraction license. Environment Agency looking to implement sustainable abstraction licence reductions, so sufficient supply may not be guaranteed.
River water	Reduces burden on potable supplies. Opportunities both for open-loop 'take and return' and closed-loop operation. Not reliant on utility for supply, reducing cost and increasing resilience.	Would require additional treatment for use in closed-loop system. Requires abstraction license. Flow availability dependent on location, weather and environmental permit. Furthermore, river quality can vary depending on season and rainfall, as well as any pollution incidents. As such treatment may need to be dynamic. Available water varies depending on season and rainfall.

Anglian Water, the Environment Agency and the data centres expressed interest in using treated sewage effluent. The Global Switch interviewee noted that their data centre in Singapore utilises the Country's NEWater, a lower quality supply of water aimed at industrial use. Similarly, the Digital Realty representative noted that they use industrial water sources where available. Currently this is in California and North Virginia.

4.2.3 Wastewater

The salt content and presence of chemicals such as glycol and biocides means that data centres typically have trade effluent consents to discharge spent cooling water to foul sewer. The data centre operators stated that cooling water is often cycled several times before being discharged, and that it is only discharged due to its salt content, which poses a risk of corrosion to the cooling system. With each cycle, the concentration of salts increases, with the water discharged once salts reach a certain concentration. Ark Data Centres stated that they discharge when salt concentration reaches 100 ppm.

The impact of discharged cooling water on sewerage infrastructure can vary. When the sewerage network is not constrained downstream and/or a non-substantial amount of spent cooling water is discharged, negative impacts are likely to be limited and can in some instances dilute the existing wastewater within the sewer. Conversely, if a significant amount of spent cooling water is discharged and/or the sewer is constricted downstream, discharge can overwhelm the network and potentially cause or contribute to sewer flooding. Risks are higher when the downstream network is a combined sewer system with all additional flow increasing the risk of combined sewer overflow spills during periods of heavy rain. Other possible risks include the presence of biocides in the discharged cooling water potentially impacting microbial processes used in wastewater treatment. However, the sewerage undertaker should mitigate this risk through stipulations in its trade effluent consent.

It was unclear from our research what proportion of cooling water is discharged to sewer. A crude calculation could infer that whatever water is not evaporated during heat rejection gets discharged to sewer e.g. if 80% is evaporated, 20% is discharged to sewer. However, this does not account for any cycling (reuse) of this unevaporated water. Such cycling results in a smaller proportion of cooling water being discharged.

4.3 Water resources context

The agenda for developing water-efficient data centres, and the drivers to support this, are deeply embedded within the broader context and approach to water resource management in England. The current context of water resource management is outlined in the Environment Agency's '*National Framework for Water Resources*' (Environment Agency, 2025). This report projects a potential water deficit in England of approximately 5 billion l/d (5 Mm^3/d) for public water supplies and 1 billion l/d (1 Mm^3/d) for the non-public supply by 2055. This shortfall arises from a complex combination of factors, including population growth, the need to protect environmental sustainability, and reduced water availability driven by climate change.

Water Resource Management Plans (WRMPs) set out how this deficit will be addressed. Collectively, the planned measures anticipate that around 60% of the shortfall will be met through demand management and leakage reduction by 2050. This includes the mandated reductions in non-household water consumption outlined in the Environmental Improvement Plan (2021) (a 9% reduction from businesses by 2038 and 15% by 2050) which has implications for sectors such as data centres (Tempest, 2025). The remaining share of this deficit is expected to be met through supply-side initiatives, primarily involving new water resource developments such as ten new reservoirs, nine water transfer schemes, and options including desalination and mine water treatment. However, the bulk of the additional supply from these supply side schemes takes a significant amount of time before the benefit is seen by the network and so planning timelines should be considered by the data centre industry when planning water requirements.

Within this high-level overview of water resources in England, there are several complexities with the water resource planning system and data centres that complicate their water supply.

4.3.1 Water resource planning cycles

WRMPs in England operate on a five-year cycle and must forecast and plan for water demand, covering both current and future household and business needs over a minimum 25-year period, although many companies, particularly in water stressed areas will plan for a longer time horizon. For the most recent planning round (WRMP24), draft plans were published in 2022, with final company plans released from summer 2023 onwards. These plans are underpinned by extensive demand forecasting, scenario modelling, and broad stakeholder engagement.

However, the WRMP planning cycles can be misaligned with the rapid (current and projected) growth in data centres across the UK and globally. While data centres currently account for a relatively small share of total potable water use, projected expansion (particularly linked to AI and cloud computing) could significantly increase future demand (see Section 4.1.1). As water companies begin work on the next planning cycle (WRMP29), this misalignment poses several challenges, with similar challenges applying to the regional water resource planning cycle, which has the same planning cycle as WRMPs.

The sector’s growth trajectory and ever evolving growth forecast, combined with limited and potentially biased data on actual and peak water use across different data centre types (Donnellan *et al.*, 2025), currently makes it difficult to accurately forecast demand or develop robust supply and demand management strategies. The pace of innovation and investment in data centres is substantially faster than the current water planning cycle, which risks creating gaps between anticipated and actual water requirements.

This issue is further complicated by the timelines for addressing projected water deficits. Under the Environment Agency’s ‘*National Framework for Water Resources*’ (Environment Agency, 2025), demand management and leakage reduction are expected to deliver around 80% of the necessary deficit reduction until new supply schemes become operational after 2030. Yet, a significant number of new data centres are expected to be developed before these new water sources are available (Vaughan, 2025). Without a clearer understanding of data centre water use and improved efficiency standards, this timing mismatch could exacerbate competition for current water resources placing additional pressure on other sectors and household supply. Effective water resource planning requires a clear understanding of projected demand profiles, including annual averages, seasonal variations, and potential daily peak usage.

4.3.2 Drought and water scarcity

An additional and growing complexity in data centre water management arises from the pressures of drought and water scarcity, both locally and nationally. Data centres are typically sited in urban areas to minimise latency (Aishwarya, 2025), which often coincide with water-stressed regions (UK Government, 2024). For example, Cambridgeshire, which is already facing significant water scarcity, has been identified as a key area for data centre expansion. While forecasted growth is expected nationwide, the South East of England remains the dominant region for development, reflecting strong economic and connectivity advantages. However, these benefits are complicated by acute water stress, meaning that meeting data centre water requirements in such areas may become increasingly difficult.

Water scarcity is not limited to long-term stress but is also intensified by short-term events, from high-temperature days to formal drought declarations. During such periods, cooling demands in data centres may rise sharply (see Section 4.2), thereby increasing their water demand at a time when overall societal demand is also high and water resources may be constrained. Data centres' recent designation as Critical National Infrastructure further complicates this, as it potentially implies a need for uninterrupted water supply, hypothetically obliging wholesalers to maintain service even during restrictions such as non-essential use bans (UK Government, 2024). However, as discussed in Section 4.1.2, stakeholder engagement revealed uncertainty within the data centre sector regarding what Critical National Infrastructure classification means in practice, for example, whether it guarantees preferential treatment during supply interruptions or influences access to water and wastewater services. Evidence on how water supply policies apply to Critical National Infrastructure users was limited, adding to this confusion among stakeholders.

Water company drought plans, such as Thames Water's Drought Plan (2022) did not reveal further clarity. Most restriction levels would likely not apply to data centres, however, Level 4 restrictions (such as standpipe use or rota cuts) could potentially affect them. The implications of such scenarios remain unclear, as little public evidence exists to define how Critical National Infrastructure water users, including data centres, should be prioritised (however this might appear in Emergency Plans for Drought, which are not publicly available). This uncertainty raises important policy questions, including how drought restrictions could impact data centres and how data centres may be managed or prioritised in times of severe water stress.

The proposed data centre development at Culham, Oxfordshire, highlights these potential uncertainties. Identified as the UK's first AI Growth Zone, it will be located close to the planned Abingdon reservoir (BBC, 2025c). While this proximity might suggest secure future water access, the reservoir's primary purpose is to support London and the wider Southeast during drought conditions (Thames Water, 2024b). In normal years, water may be available for local use, but in drought periods, resources may be redirected to maintain regional resilience. How this would interact with local data centres' Critical National Infrastructure priority status remains unclear, particularly if their demand peaks (due to heightened cooling requirements) when water availability is most constrained. The Culham example illustrates how misalignment between water resource planning and data centre growth could create long-term and short-term conflicts, particularly in the context of drought and water scarcity planning.

Overall, the growing misalignment between water resource planning and data centre expansion, combined with ongoing policy uncertainties around data centre water supply and their Critical National Infrastructure status, presents significant challenges for wholesalers and water resource planners. This is particularly evident in both long-term water supply planning and short-term peak demand resilience. Balancing potable water supply between data centres, other non-domestic users, communities, and the environment during periods of scarcity is increasingly complex and may create regulatory and operational tensions. These challenges can lead to more cautious approaches to approving new connections or, in some cases, outright refusals.

For instance, Anglian Water's (2024) '*Non-Domestic Water Requests Policy*' now rejects all new non-domestic connection requests exceeding 20 m^3/day from the public supply, with each request reviewed on a case-by-case basis to see whether water efficiency and alternative water supplies can be encouraged. Other wholesalers are now considering similar policies, exercising their right to refuse non-household potable supply connections, where such connections might compromise their ability to meet existing or future supply obligations. The implications of this for the data centre sector are already emerging, with Anglian Water's recent objection to a proposed hyperscale data centre on environmental and supply capacity grounds (Foxglove, 2024).

These emerging conflicts underscore the need to enhance understanding of both current and projected data centre normal and peak water use and to integrate this knowledge more effectively into water resource planning mechanisms. Building resilience will depend on advancing water-efficient operational practices, including the adoption of cooling technologies that minimise water consumption and the integration of alternatives to mains supply, such as water reuse. Furthermore, clearer policy and planning mechanisms (particularly regarding the designation of data centres as Critical National Infrastructure) are required to support coherent and sustainable decision-making.

4.3.3 Alternatives to potable water

The evidence indicates that the landscape around alternatives to potable water use in data centres remains unclear in England. The data centre sector had a mixed response to their use, with an apparent general reluctancy or nervousness around using alternative water sources due to their reliability in access and purpose (with potentially unintended consequences). This highlights the importance of a reliant supply, which is becoming more challenging to supply with the changing climate and weather patterns.

Data centre stakeholders expressed interest in using treated sewage effluent, with Global Switch expressing frustration at the barriers they faced exploring its use for cooling, citing disinterest from their water company, although the reasons for such pushback could not be identified within this project. Additionally, many operators were unaware of opportunities to use coastal or marine waters, or lacked confidence that open-loop groundwater abstraction or submerged data centre models would be permitted.

In contrast, water company representatives presented a different perspective, highlighting ongoing encouragement for data centres to explore alternatives to potable water supply. For example, an Anglian Water representative referenced early collaborations to enable the use of recycled water in their region. While the evidence contained mixed accounts of the barriers to non-potable water use, several key obstacles were consistently identified (see Table 4.3).

Overall, a clear disconnect remains between data centres and the water industry regarding the use of alternative water sources. While some progress has been made, collaboration needs to be significantly strengthened and supported by clearer policy direction to enable large-scale adoption of water reuse, rainwater harvesting, and wider water sources. One such platform to promote communication and collaboration could be the water resources regional groups. Achieving collaboration could help mitigate the pressure data centres place on potable water supplies and, when combined with broader water efficiency measures, contribute to genuine long-term resilience across the sector.

4.3.4 Local planning system context

Challenges around data centre water supply are closely linked with both local and national planning systems. Evidence from the study highlighted the potential value of creating a distinct planning category for data centres, with applications required to declare whether proposals include a data centre (whether for internal business use or commercial operation) above a defined size threshold. Such a category would help ensure that water use associated with data centres is accurately identified and not misrepresented as another type of business activity. However, implementing this approach may be challenging due to varying definitions of data centres and the inherent complexities in distinguishing them from other building types.

4.4 Water efficiency

Ark Data Centres, Global Switch, NTT, and techUK interviewees suggested that the current focus on inefficient resource use has been misfocussed by targeting larger commoditised data centres. They have instead suggested that inefficiency is much greater in the public sector, small-scale data centres and legacy data centres, particularly where provision of data services is not the primary business purpose. The interviewees noted that the reasons for this include the overwhelming financial incentives to be energy efficient for large data centres where energy costs dwarf other operating costs (such as the Climate Change Levy), public pressure, investor pressure and pressure from clients at colocation sites (Papadopoulos & Wurm, 2012).

A key finding of this project is that there is very minimal financial incentive to be water efficient. Water bills are inconsequentially small in comparison to fibre optic and power bills, energy savings from using water would dwarf the cost of the water, and operating costs are themselves dwarfed by the consequences of failure. As such, there is a need for data centres to be incentivised to be water efficient as the current drivers of environmental conscience (public opinion and green finance) are insufficient and do not cover all parts of the sector. Examples might include grants, tax breaks, or streamlined permitting processes, for data centres that adopt water-saving technologies and practices or, conversely, taxes for data centres that rely heavily on the public water supply (UK Government, 2024). One example that is already being used to incentivise behaviour is the government's AI Growth Zones initiative, which requires applicants to prove that there is sufficient water availability, a move that has been criticised by techUK. Other approaches might include employing similar approaches to carbon and having a standardised accounting framework or water footprint method, or mandating compliance with a standard like ISO 46001.

While a number of relevant standards exist, including series such as EN 50600 and ISO 22237 focussed specifically on data centres, the impact and uptake appear to be low. To our knowledge, it is not currently possible to be "certified" by a UKAS approved body to the EN 50600 Series or the ISO 22237 series, nor to ISO 46001: Water Efficiency Management Systems, although there are organisations that provide "certification" such as the Data Centre Alliance Certification programme which uses the EN 50600 series as well as ISO27001. For the uptake and impact of these standards to improve, UKAS-approved certification would need to be made available, and certification mandated or encouraged through policy, regulation or, e.g., a rating scheme.

Establishing what water efficient looks like in data centres can be complicated due to the variety of different cooling technologies that can be employed. For example, a data centre may exclusively use free cooling on days where ambient temperatures are less than 10°C, use a mix of free cooling and air cooling up to 18°C, air cooling up to 24°C, and use a mix of air cooling and adiabatic cooling when ambient temperatures are above 24°C (or 27°C if temperatures up to 32°C are allowed in the data hall). Furthermore, cooling technology can vary depending on a variety of factors.

On face value, free cooling and air/mechanical cooling systems are the most water efficient cooling options, as they do not consume water. This is followed by adiabatic cooling, which uses a mix of water and air, and evaporative, which uses exclusively water. Therefore, an obvious option for water efficient cooling would be to not use water-based cooling. However, the literature and the Global Switch representative highlighted that the indirect water footprint of air-based cooling is greater than the direct water footprint of water-based cooling, indicating that when considered holistically water-based cooling methods are more water efficient (Shehabi *et al.,* 2016; 2024; Mortensen, 2022). It should be noted that this varies depending on energy source, with fossil fuels and nuclear using/consuming more water than wind or solar. In the UK, negligible drinking water is consumed in the production of electricity (Byers, Hall & Amezaga, 2014), but significant volumes of sea water, freshwater and tidal water are abstracted; an average of 0.5 l/kWh (Moores, 2021). Much of this is immediately returned to the environment through open-loop cooling, with around 5% consumed. Water from the public supply is often valued more highly than raw water, as it has undergone treatment and is required primarily for domestic use. Increased demand on public supplies can also necessitate network upgrades. This means that whilst energy production may consume more water, the data centre's use of water from the public supply network may be viewed as the unacceptable option.

Consideration should also be given to the impacts of cooling technologies that do not use water. When water use is reduced, energy use increases. The environmental impacts of this increased energy use vary depending on how the energy is generated. Energy generated with fossil fuels releases carbon dioxide, a greenhouse gas which causes the atmosphere to heat up, impacting water demand, as well as causing air pollution. The use of nuclear energy generates nuclear waste, which is radioactive. This radioactive waste needs to be disposed of or stored (depending on how radioactive it is) (US Nuclear Regulatory Commission, 2024), which requires a significant amount of concrete and water to contain the waste and associated radiation. Spent nuclear fuel can be reused, although whether this happens varies between countries (World Nuclear Association, 2024). The use of nuclear fuel does not directly produce air pollution or release carbon, but the mining and making of the nuclear fuel requires significant energy and water, and may not use renewable energy sources. Similarly, solar and wind generation do not directly cause air pollution or release greenhouse gases; however, their manufacture is energy intensive (US Energy Information Administration, 2024a). Hydrogen energy production is also gaining traction, with the UK Government looking to develop a hydrogen sector in the UK (Department for Energy Security and Net Zero, 2021). Hydrogen requires clean water to store the hydrogen in, as well as a significant amount of water for cooling.

To balance these issues, a combination of cooling approaches can be employed. Alternative water sources can also be used where water-based cooling is a necessity. It may also aid in balancing the trade-offs between water and energy consumption. Alternative sources are detailed in Section 4.2.2.

The essential dependency of water (and energy) use for cooling and temperature control points does not appear to have an appropriate level of focus. This is particularly important given the uncertainty that surrounds the sector regarding the future direction of temperature set points and the significant impact on cooling system design (e.g., necessitating a move to direct-to-chip or immersion cooling) that lower set points may necessitate. The Ark Data Centres representative suggested that, rather than focussing policy on efficiency, policy should focus on control points. This can be particularly problematic for colocation operators for whom control points are determined by their customers. This project also identified that often only a single control point can be applied to a data centre, meaning that the whole building needs to be cooled to the temperature required by the most conservative customer.

The Ark Data Centres representative noted the legacy of previous guidance which recommended cooler temperatures, stating that advances in technology meant that equipment can now be stored at higher temperatures. Despite this, some customers are hesitant to operate at these higher temperatures due to concerns it could damage equipment. Similarly, pre-existing Service Level Agreements can still stipulate the use of these colder temperatures. The Ark Data Centres representative stated that these Service Level Agreements can last for up to 25 years, meaning that some colocation and co-hosting data centres have no choice but to operate at cold temperatures. Possible policies could include imposing limits relative to ASHRAE standards or imposing global limits on control points (which may incentivise chip manufacturers and ASHRAE to accept lower control points to avoid losing market share). Interviewees from Ark Data Centres and Global Switch suggested that chip manufacturers are currently not sufficiently challenged with regard to control points, resulting in standards being overly conservative. As working outside of recommended limits can void warranties, data centres have little power over control points.

A water efficiency ‘quick win’ for both data centres and water retailers/wholesalers is smart metering and submetering within a data centre. This enables water consumption to be understood and facilitates the detection of abnormalities such as leaks. AI can also be utilised to optimise performance and save money (UK Government, 2024).

Digital Realty collaborated with their chemical provider Nalco to use AI to detect changes in the chemical concentrations within their water-based cooling systems to infer leakage at all North American sites, with one site found to have 20% leakage. This leakage is often not obvious and can occur due to aging assets such as valves. This scheme is currently not expanding outside of North America due to differences in chemical providers.

4.5 General policy recommendations

The domestic and international policy review (see Section 3.1.2) brought to light a series of current gaps, limitations and opportunities for improvement to the UK/English policy landscape in order to promote water efficiency and best-value societal outcomes with respect to water use in data centres. Following a review of these gaps and limitations, and a benchmarking of the current UK/English policy landscape to international practices, the following potential opportunities for improvement were identified.

- A clear recommendation from this project is that data centres should have their own category in the planning process and that planning applications should have to declare whether the plans include a data centre (including internally to the business) over a threshold size.

- Water companies should be a statutory consultee on planning applications which require water connections for non-domestic purposes.

- There should be increased transparency regarding how and where water will be used by data centres within planning applications.

- A voluntary or compulsory register of data centres could act as eligibility for certain protections as critical national infrastructure and proactive communications from water and energy companies regarding issues of resilience.

- Mandated/encouraged accreditation to EN 50600, ISO 22237 and/or ISO 46001 could be considered.

- Encouraging/facilitating the use of alternative water sources, such as final effluent and rainwater, to improve resilience and reduce pressure on potable supplies. This could include mandating all new data centres to include rainwater harvesting on site.

- Unlike energy, there are no financial incentives to be water efficient. Incentives for water efficiency could include grants, tax breaks, streamlined permitting processes, variable price tariffs, or taxes on potable water use. Of course, this applies to all water users, particularly for-profit users.

- Rapid growth economic sectors such as data centres should be included in WRMP demand modelling so that their future growth and water needs can be adequately planned for.

- Water wholesalers and retailers should enter into agreements with data centres to ensure communication of needs.

- Nomenclature and descriptions used for data centre cooling systems across the industry and world are inconsistent. The sector should create a consistent set of definitions and descriptions such that meaningful data and comparisons can be made. Required definitions include what is classified as a data centre, confusion between heat rejection systems and heat transfer mechanisms and their definition and water use, confusion about whether closed water loops are classified as using water, inclusion of non-cooling water uses in assessments, inclusion of alternative water sources in calculations, WUE definitions and utilisation assumptions.

Further to these opportunities, there are currently four hot topics: creation of a data centre register, the value of introducing minimum performance standards, the possible need to augment the planning system, and the possibility for improved service level agreements between data centres and water companies. These are discussed in greater detail below.

4.5.1 Data centre registration and minimum performance standards

For the data centre sector, discussions emerged around registration, minimum performance standards, and reporting. For example, in December 2023, the UK Government issued a consultation on protecting and enhancing the security and resilience of UK data infrastructure. The consultation proposed a statutory framework under which relevant data centre providers would be required to register with the designated regulator and provide information regarding their UK operations. Although it was not specified whether this information would include water usage, such a framework could help address challenges in understanding data centre water demand, supporting effective water supply management and water efficiency at scale, and streamlining proactive communication on resilience issues, potentially linked to their Critical National Infrastructure status. Limited discussion of registration and its potential opportunities and barriers in the evidence highlights an area for future exploration, particularly regarding its design to support water resource planning and efficiency objectives.

Minimum performance standards were identified as another potential mechanism to support water efficiency. While there were limited calls for global minimum performance standards, such as universal limits on WUE, the evidence did suggest regulation or minimum performance standards requirements for new data centres (UK Government, 2024). Given the water resource challenges outlined and potential negative outcomes minimum performance standards focused on, WUE limits could provide a viable approach. For instance, WUE limits could be applied initially to new data centres, with potential extension to existing facilities over time. Other suggestions included mandatory water availability assessments during planning and government-backed initiatives like AI-growth zones to require locations to have access to plentiful supplies of non-potable water for cooling, or forbidding the use of water >20 m^3/d for non-domestic uses in areas which are classified as seriously water stressed.

However, care must be taken to ensure that minimum performance standards do not produce unintended negative consequences. For example, interviewees from the University of York, Durham University, NTT, techUK and Global Switch highlighted that overly restrictive measures could stifle data centre growth, limit innovation, prevent the use of certain technologies or inadvertently create geographical inequalities by incentivising location in cooler climates outside the UK (DigitalEurope, 2025b). Any policy supporting minimum performance standards and water efficiency must therefore carefully balance potential trade-offs, especially those with energy and carbon.

In conclusion, any minimum performance standards or registration mechanism should seek to reconcile sectoral growth and innovation with broader public interest objectives, ensuring sustainable water consumption while mitigating adverse environmental or operational effects.

4.5.2 Mandatory reporting

There was agreement amongst data centre interviewees that, should mandatory reporting be introduced in England they would have a strong preference for alignment to EED reporting in order to minimise administrative effort, maximise compliance and align to existing reporting they already undertake in Europe and internally. This view is shared by DigitalEurope, who stated that *"[t]o reduce fragmentation, we advocate for existing regulatory and voluntary frameworks to align with the EED and the forthcoming rating scheme for data centres. This ensures consistent recognition of data centre performance across the single market and avoids duplicative or contradictive regional and local schemes. Additionally, it is important to align the rating scheme with upcoming AI, cloud and quantum initiatives to ensure coherence with Commission initiatives aimed at fostering innovation and sustainability across the digital sector"* (DigitalEurope, 2025a).

Mandatory water use, water reuse, water source reporting and water efficiency reporting is a clear recommendation to come out of this project, addressing current key barriers to understanding and managing water use in data centres (DigitalEurope, 2025b), such as:

- it not being known how much water is being abstracted and used by English data centres due to the lack of a specific building use category for data centres and it not being known whether or not buildings include their own data centres
- there being no standard way by which WUE is reported when the information is voluntarily published
- there being no data by which to benchmark and compare data centres to challenge inefficiency or appropriateness of new proposals
- use of alternative water sources is not sufficiently visible or encouraged.

Mandatory reporting is also supported by the National Engineering Policy Centre (2025), Laville (2025), and Herrera *et al.* (2025). However, Ark Data Centres and Global Switch expressed concerns about data sharing for colocation data centres if customer data is submitted by the operator on their behalf (like it is under EED) when service agreements may not permit sharing of this data (of which they are not the owner).

When asked why data centres do not publicly report WUE, even if it's reported internally and to investors, the Ark Data Centre representative replied "*because nobody asked us to*" before explaining that customers consider it to be sensitive due to an unwillingness to give hints as to what technology is used and fears that customers could go elsewhere to someone more efficient or advanced.

The report '*Water use in AI and Data Centres'* suggests that change should start with government, leveraging its procurement power and setting rules on its own activities (UK Government, 2024). For example, Greening Government Commitments (GGCs) and the Greening Government IT Strategy *"provide a robust framework and established policy levers for addressing sustainability within government's own digital operations. The challenge lies in* *explicitly integrating water efficiency and AI-specific considerations into these existing commitments*." The report notes that the GGCs' emphasises that *"engaging suppliers and purchasing sustainable, efficient products represents a powerful tool to drive water efficiency standards throughout the digital supply chain".* It also suggests that the opportunities were missed by the recently published '*Defra digital sustainability strategy*' to set minimum performance standards on data centres for government services and suggests strengthening the Government Digital Sustainability Strategy *"to include explicit, quantifiable water efficiency targets for government-owned and procured data centres and AI services. Require government suppliers to demonstrate adherence to these water efficiency standards, including reporting on their water usage and commitment to using non-potable sources"* (UK Government, 2024).

It has also been suggested that, to aid benchmarking and support continuous improvement, companies that report data should receive an annual anonymised summary of reported KPIs per data centre size and per every business category (enterprise, colocation and co-hosting data centres) (DigitalEurope, 2025a).

It was also mentioned during interviews how some data centre operators, such as Ark Data Centres, as well as the CNDCP, rely on the WEI+ to quantify water stress in an area and that this has not been published for the UK since leaving EU. Ark Data Centres are now looking at propensity of Temporary Use Bans in an area as an alternative method, but it should be considered whether there is value in publishing WEI+ for the UK. Global Switch stated that they use WRI Aqueduct as their measure of water stress within the CNDCP framework[18].

There should be additional dialogue with data centres to understand confidentiality and competitive advantage concerns regarding data sharing. Data should be collected in such a way so that the data can be made publicly available, for example in anonymised or redacted form, so that it can be analysed and used by other stakeholders rather than reported only in aggregate as is currently the case under the EED.

4.5.3 Local planning system reform

Discussions with data centre operators, Anglian Water and the Environment Agency have repeatedly given the impression that water companies should be a statutory consultee on planning applications which require water connections for non-domestic purposes, and engagement with water companies should occur early to ensure effective decision-making and allow risks to be identified early enough for mitigations to be incorporated and to avoid wasted effort. For example, Anglian Water have recently opposed plans for a large data centre site, Elsham Tech Park, over concerns about flood risk and water sourcing. However, the developer describes the design as *"closed-loop"* with no water being *"evaporated or released"* (BBC, 2025b). The Acton Consulting interviewee claimed to have seen the designs and verified that it

[18] According to this too the UK is low/not water stressed.

will result in no water use aside from the initial filling of the system. Should these designs only require initial water for filling during operation, concerns about water sourcing may not be realised. Should water companies not be a statutory consultee, data centre applications should be identified early through a specific building type category which triggers early communication with water companies. It should also be considered whether data centres, specifically those using above a certain threshold of water, should be incorporated into regional planning and water resource groups.

A water company representative on the project steering group indicated that they believe there to be a disconnect between how much water is being asked for at the planning application and how much is being used. They considered design engineers to be too conservative (requesting too much), making it hard for water companies to plan. There were also concerns raised regarding the fact that data centres are requesting what they require on a ‘peak day’, when temperatures are extremely high. This peak day use could be significantly higher than required on a typical day and mean that water wholesalers are supplying a significant amount of water just in case it is required. In contrast, both Global Switch and Ark Data Centres highlighted that this is not an issue with their energy providers.

4.5.4 Service Level Agreements

Commercial data centres are very significant capital investments, with energy connections costing tens of millions and servers and cooling systems designed for short asset cycles to maximise resilience. These facilities face substantial financial penalties for downtime, being certified to an uptime resilience level by the Uptime Institute and often contractually liable for every minute of downtime. This drives a strong willingness to invest in redundancy and reliability. Data centre stakeholders noted that the water sector lags behind energy and digital services in its engagement with operators, particularly regarding service expectations and resilience, where formal Service Level Agreements are commonplace e.g. for energy and internet. No clear evidence of formal agreements between water wholesalers, retailers, and data centres was found in the evidence, although such arrangements may exist, representing a potential limitation of the evidence base. Nevertheless, establishing such agreements could present a valuable opportunity to improve water efficiency and resource management, enabling proactive risk management and enhanced operational resilience.

Such agreements could facilitate the following:

Agreements with retailers

- Many data centres indicated a desire to have a smart meter/smart meters. We recommend submetering of, at least, any filling of closed-loop cooling systems, any water-based heat rejection systems, and domestic-like use. Service Level Agreements could include a commitment to installing/retrofitting smart meters by a particular date.

- Consideration should be given to introducing dynamic tariffs for data centres, where water costs vary according to demand and scarcity. This would incentivise efficient water use during periods of high demand or limited availability.

- Retailers could establish agreements that specify typical, peak, and contingency supply volumes, particularly relevant where hybrid cooling or backup water-cooling systems are employed. This would improve planning, transparency, and resilience.

- Each data centre should have an established, direct line of communication with its water retailer to ensure timely information exchange, coordination during supply challenges, and proactive management of water risks.

Water wholesaler

- Operational policies that data centres will use to meet design curves for chillers could be part of Service Level Agreements with local utilities (power and water) so that the wholesaler can anticipate water demand (Sharma *et al*., 2008).

- Water companies could provide a 'menu' of options so that data centres can choose to pay for an increased quantity of water and level of resilience. They should be willing to enter into discussions about novel solutions and possible options to achieve the level of service that is desired (e.g., if it requires new pipelines to be built at the data centre's cost then this should be presented as an option rather than requests being declined outright).

- Data centres should be provided with clear targets, limits and constraints, for example peak flows, peak time restrictions and periods of higher availability to allow them to operate most efficiently, sustainably and with least impact on other users.

- Water companies should clearly communicate what will occur during drought conditions, specifying the level of service guaranteed and the circumstances under which supply may be reduced or interrupted.

- Data centre operations should be aligned with broader public water supply needs. For example, Service Level Agreements could include rules around when storage tanks should be filled, when/what notice should be provided before surges of discharge to sewer, and any situations under which data centres can rely on their storage instead of public supply.

- Data centres should be provided with timely warnings regarding upcoming service issues to allow proactive planning and minimise operational disruption.

4.6 Measuring data centre water use

This section explains the most commonly used metrics in the data centre industry which impact on understanding and driving water use and water efficiency. The pros and cons of each metric are discussed. Current performance of European data centres against these metrics is then presented as a means of providing a benchmark.

4.6.1 Metrics

The most commonly used water use related metrics are detailed below.

Water usage effectiveness (WUE), which is the ratio of data centre water consumption divided by the energy consumed by IT equipment:

$$WUE = \frac{W_{IN} - W_{OUT}}{E_{IT}}$$

As discussed in Section 3.1.2, there are three different categories of WUE, with a recent report for the European Commission recommending the use of Category 2 (European Commission, 2025c).

Water consumption, water withdrawal and water returned to the environment (volumes) are often reported by data centres within their ESG reports. Data centres can consume and/or use water, with water consumption indicating that water is removed from the system either through discharge to sewer or evaporation, whilst water use includes all consumptive and non-consumptive forms of usage. For example, water may remain in the system (like a radiator), be consumed, or the full volume may be discharged without consumption. Water withdrawal and water returned to the environment can be a proxy for inferring water used.

Some data centres have started to report **water replenishment** (Meta, no date; Microsoft, 2023; Google, 2025b), including that which doesn't relate to water use (Water Action Hub, no date). This can be done through directly refilling water bodies (e.g., aquifer recharge) or through creating/remediating land and water bodies to facilitate water retention and infiltration. Water replenishment helps mitigate water stress, supports the environment and ecosystem services (similar to environmental destination), and looks good in a sustainability report. Meta has a target to be water positive by 2030. As of 2024, they had consumed 3.1 million m^3 (3.1 billion litres) and restored 6.0 million m^3 (6 billion litres) (Meta, 2025). Google also aims to be water positive by 2030. As of 2024 they had consumed 30.8 million m^3 (30.8 billion litres) and had replenished 17.4 million m^3 (17.4 billion litres) (Google, 2025a).

In addition to metrics relating directly to water use, the following commonly used metrics are indirectly relevant.

Cooling degree days are used to determine what cooling technology should be used. The US Energy Information Administration describes **cooling degree days** (CCD) as "*a measure of how hot the temperature was on a given day or during a period of days. A day with a mean temperature of 80°F has 15 CDDs. If the next day has a mean temperature of 83°F, it has 18 CDDs. The total CDDs for the two days is 33 CDDs*" (US Energy Information Administration, 2024b). These are summed for a calendar year. CDD allows water use for cooling to be contextualised; higher CDD represents an increased need for cooling and can explain one data centre using more energy/water or appearing more inefficient than another. For example, data centres located in Scandinavia are known for having low cooling degree days allowing them to operate predominantly using free cooling without the need for water use for cooling and with a low PUE.

Cooling efficiency ratio quantifies the efficient use of energy to control the temperature within data centres. That is, the cooling output normalised on the power input. The specific focus on energy of cooling efficiency ratio could act to drive the use of water-based cooling, which will have lower ratios than more energy-intensive methods, rather than incentivising the most efficient use of all resources in cooling operations.

It was noted that WUE is not unanimously measured across the industry. Indeed, techUK reported that 69% of data centres in England measure their water use (techUK 2025a), whilst Uptime Institute reported that globally 47% of data centres tracked their water consumption (Donnellan *et al.*, 2025). It should be noted that techUK's report was focused specifically on water use and therefore may be skewed by highly engaged data centres. Similarly, data centres that do not use water for cooling likely do not measure water use.

WUE is normalised to IT consumption, therefore a data centre inefficiently using energy results in a low (apparently efficient) WUE. Similarly, for some data centres, if they lose a customer their energy usage can go down as they're housing less IT equipment, however they still require similar amounts of water for cooling, causing their WUE to drastically increase. This dependency between output/utilisation and water efficiency is common across many industrial sectors. Furthermore, the different categories of WUE can be confusing and are not consistently used across the sector. The use of water reuse for cooling is only considered in category 3, which also incorporates indirect water use. This incorporation of indirect water use can hide water efficiency gains owing to water reuse. Similarly, annualised WUE and water consumption/use obscures peak day water consumption/use, as average operations (e.g., 10°C) likely consume/use significantly less water than on a very hot (peak) day (30°C).

A conclusion from the above is that metrics should not be used in isolation and should instead be used in combination to get a holistic view of resource efficiency within the data centre. Solely focusing on WUE leads to increased power usage, whilst solely focusing on power usage effectiveness (PUE) leads to increased water use. This creates a catch-22 for data centre operators, who need to carefully balance their resource use to ensure they are operating within their means.

Schneider Electric's Energy Management Research Center, in their '*Guide to Environmental Sustainability Metrics for Data Centers*', suggested three levels of maturity regarding reporting metrics (Lin, Bunger & Avelar, 2023). Relating to water, those in the 'Beginning' class should report total site water usage, 'Advanced' sites should also report WUE_1, while 'Leading' sites should further report total source energy water usage, water replenishment and total use by the supply chain. Based on benchmarking against major data centre operators, they have set a target value of 0.3 to 0.45 l/kWh.

Schneider Electric's guide proposed a sustainability index which is a function of:

- IT equipment power consumption (kW)
- Data centre traffic (Mb)
- WUE (l/kWh)
- Water discharged (l/kWh)
- Embodied carbon of IT equipment averaged over life and utilisation.

The sustainability index included a number of factors which allowed the metric to be customised to different data centres and locations (Lin, Bunger & Avelar, 2023).

Some UK operators publicly report WUE and water use within their ESG reporting (e.g., Ark Data Centres, Equinix, Global Switch, Digital Realty, CyrusOne), with some also splitting this by water cooled and 'dry' data centres (e.g., Equinix). However, these are only reported at company level and only one ESG report clarified how they calculated their WUE. Best practice would see clear definitions of the metrics being calculated and reporting for each data centre, or at least an anonymised distribution of WUEs.

The Uptime Institute '*Global Data Center Survey 2024*' found that *"[f]ewer than half of data center owners and operators are tracking the metrics needed to assess their sustainability and, in some cases, to meet pending regulatory requirements"* (Donnellan *et al.*, 2024). Best practice would see internal and external reporting, in accordance with a standardised methodology, of a standardised set of metrics, plus any additional metrics relevant for internal use.

Conversations with data centre representatives highlighted the need for submetering and smart metering, which has been previously discussed in additional detail in Section 4.5. A data centre site can contain several data centres and several customers, as well as several water uses (for example, water use for cooling should be tracked separately to domestic uses). Submetering would enable a greater understanding of water use on site, and can also be used to infer leaks. Several weaknesses have also been identified regarding the collection, storage, sharing and access to water use in data centres. Widescale measurement of water in the data centre sector would facilitate benchmarking, support short-term operational planning, long-term water resource planning and allow for better targeting of efficiency schemes. Currently it appears that data centres are often measured by single dumb meters which are read infrequently by water retailers, the premises are not marked on the system as data centres and the data is not used other than for billing or reporting.

4.6.2 Benchmarking data centre performance against key metrics

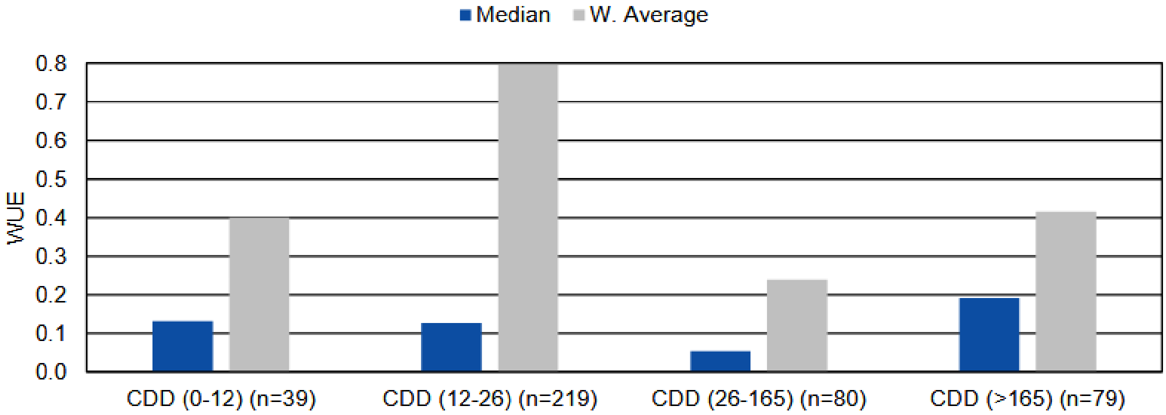
The most comprehensive and relevant data available to benchmark English data centres was identified to be the European Commission's '*Assessment of next steps to promote the energy performance and sustainability of data centres in EU, including the establishment of an EU-wide rating scheme'* (European Commission, 2025a). The report provides a benchmark, based on expert judgment combined with data reported under the EED, for percentage reduction in WUE (and change to PUE and REF) which would be expected from adoption of the following measures:

- Free cooling with filtration
- Hybrid adiabatic cooling systems
- Cold-/Hot aisle containment
- Immersion cooling & waste heat reuse with a heat pump.

Reductions are quantified relative to a baseline of the median WUE/PUE/REF of EED-reporting data centres for a subset of 'classes' where a class is a data centre of a particular age band, size band and climate (CDD band). Only the six classes where the highest impact for each intervention would be seen are reported (European Commission, 2025a).

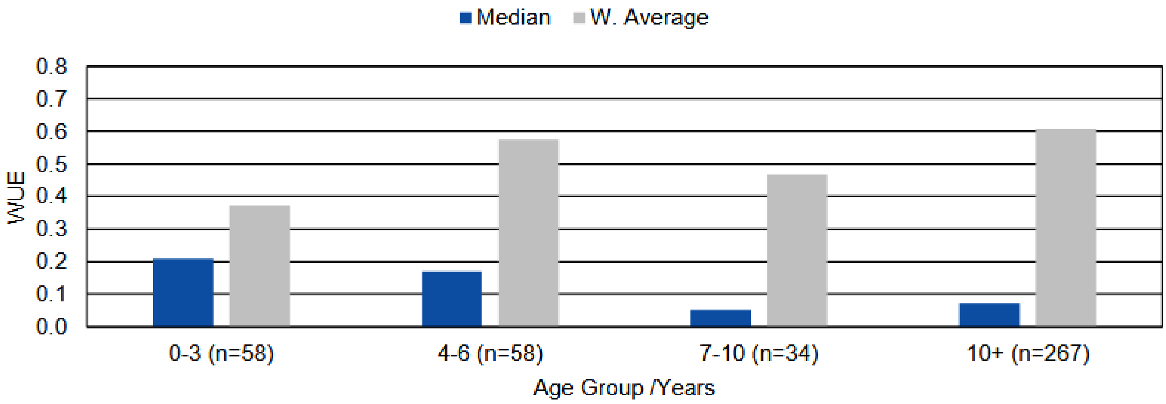
In addition, the report presents analysis of EED reported data which shows that mean and median CDD are only slightly correlated with WUE (suggesting WUE is driven more by technology choice and inefficiency rather than thermodynamics) (Figure 4.3). This is particularly true for average WUE which shows no relationship with CDD, instead being driven by the relative popularity of water-consuming cooling technologies in different EU areas with different climates (European Commission, 2025a).

Figure 4.3 Relationship between CDD and WUE (European Commission, 2025a)



The relationship between median WUE and age appears to reveal that newer data centres may use more water, suggesting a move towards hybrid cooling systems (there has been a more than doubling of the relative water use of the bottom 50% of data centres, as shown by the median). No clear relationship is seen with the mean which is far more skewed by the small number of large water-using data centres which use evaporative cooling. This suggests that, at an EU level, the use of evaporative cooling may not be decreasing. With the median generally being significantly less than the mean, which itself is a WUE of 0.35 to 0.6, this suggests that some data centres in the top 50% have WUEs much higher than this value (Figure 4.4).

Figure 4.4 Relationship between WUE and data centre age (European Commission, 2025a)



It was possible using the metric to identify a significant discrepancy between types of data centre with enterprise data centres having far higher WUEs than colocation or co-hosting sites (Figure 4.5). This is likely explained by:

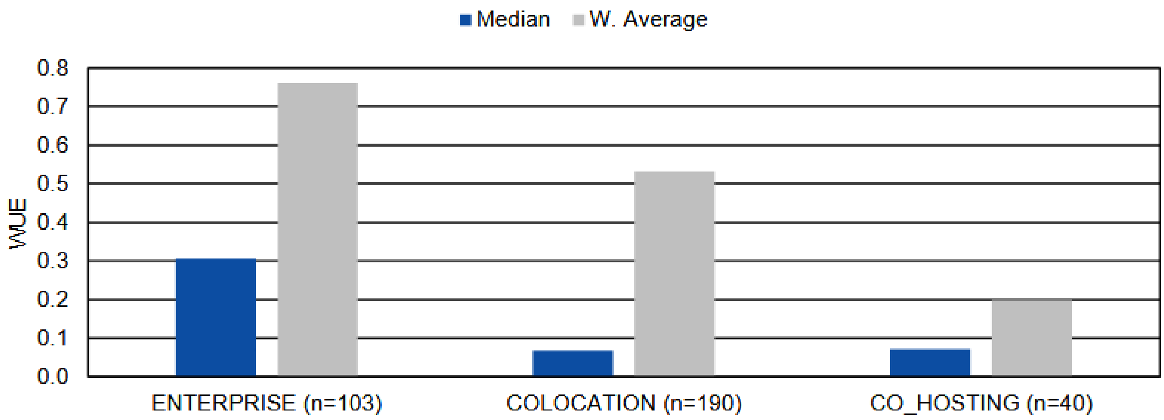
1. such data centres likely being newer

2. such data centres likely being larger

3. such firms likely to have more capital to invest to minimise long-term costs.

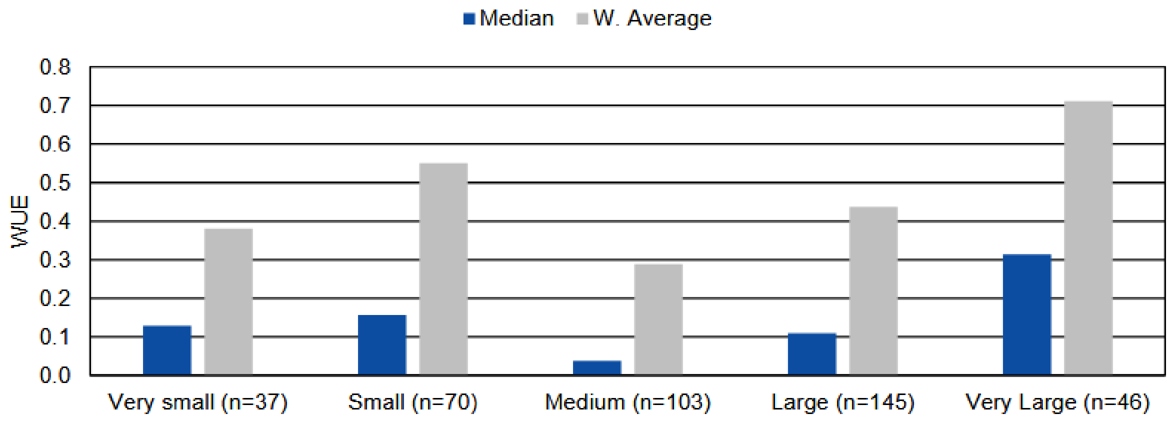
This provides evidence to the suggestion that a growth in enterprise (or hyperscale) data centres may result in significant increases in NHH demand. Comparing colocation sites with co-hosting sites we see the median and mean WUE are much closer for co-hosting sites, suggesting less variability and suggesting less adoption of very water intensive cooling technologies but also potentially more inefficiency as shown by the higher median use. The report attributed this to them typically being smaller and older data centres.

Figure 4.5 Relationship between WUE and data centre operating model (European Commission, 2025a)



When considering the relationship with size it is important to consider possible dependencies with age. Very large data centres are more likely to be new while small and very small data centres are more likely to be older. This latter point may explain the higher relative water use of small and very small centres compared to medium sites. Ignoring these sites, we see that larger data centres appear to have higher WUEs with both large and very large data centres having average WUEs in excess of the proposed minimum performance standard of 0.4 l/kWh. We also see that at very large sites even median WUE is above 0.3 l/kWh showing that the majority of data centres are using significant volumes of water (Figure 4.6). However, the average WUE of nearly 0.44 l/kWh from very small data centres is also noteworthy, particularly given that the median is more than three times lower suggesting that there are likely to be a relatively high proportion of data centres using evaporative cooling in this group.

Figure 4.6 Relationship between WUE and data centre size (European Commission, 2025a)



4.7 Existing frameworks for defining water-efficient data centres

In this section, four existing policy approaches (further information in Section 3.1.2) which could be applied to England are compared.

4.7.1 Reporting under the EU Energy Efficiency Directive

All data centres with IT power over 500kW located in the EU (with a few exceptions, like for those related to military operations) were required to report metrics, including energy use and potable and total water use, by May 2024 and annually under the European Union's EED. It also requires local planning authority reports to be produced for major data centres applications. However, reporting compliance was poor and many Member States missed the reporting deadline. As a result, the data from this first round of EED reporting is incomplete (Climate Neutral Data Centre Pact, 2025a).

Reporting is ultimately to a central EU database, although Member States can choose whether data centres should report directly into the database or report to national database which then reports into the EU database. The European Commission have produced a report based on the data submitted during the first reporting period (up to 15 September 2024) and has committed to making public summaries of the data available annually (European Commission, 2025b).

Reporting includes the following metrics relating to water:

- Total water input
- Total potable water input
- WUE is calculated by European Commission based on the reported data.

The KPIs to be reported are defined in Commission Delegated Regulation (EU) 2024/1364 of 14 March 2024 on the first phase of the establishment of a common Union rating scheme for data centres (European Commission, 2024a).

Challenges

Data quality and data completeness have been limitations with the dataset received during the first reporting period. The European Commission note the gap to be more significant for smaller enterprise data centres close to the 500-kW threshold, and note the allowance in the Directive for operators to *"omit from reporting the total energy consumption, total energy consumption of IT equipment, total water input, total potable water input, waste heat reused, average waste heat temperature, average setpoint IT equipment intake air temperature, total renewable energy consumption, total renewable energy consumption from Guarantees of Origin, total renewable energy consumption from Power"* (European Commission, 2025a). Overall, reporting compliance was only 36% and, within this, data gaps and quality issues existed. For example, only 90.6% reported water input.

Poor reporting compliance was attributed to colocation data centres where operators do not have access to all the data they are required to provide as many clients retain control over the data generated by their systems within their Service Level Agreement. Data may also be fragmented across many clients. As this represents the majority of data centres in the EU it potentially represents a significant barrier.

Another reason for limited compliance is claims of confidentiality. Article. 12.1 states that *“information subject to Union and national law protecting trade and business secrets and confidentiality”* is not within the scope of the reporting. Member States are able to expand upon what is considered trade and business secrets according to national laws and exclude such information from the reporting obligation when they transpose the Directive into national law (European Commission, 2023). However, this currently remains a grey area with many data centres seemingly willing to accept a future legal challenge rather than comply. This has been particularly true of the Netherlands where data is made available to the public, resulting in significant redactions within submissions.

Another reason for coverage being low is that *“data centres used for, or providing their services exclusively with the final aim of, defence and civil protection”* are exempt from the reporting scheme, provided that defence or civil protection represents their exclusive function (European Commission, 2023).

The EUDCA has also remarked that data centre operators are not trained data collectors/aggregators and suggests that the European Commission's requirement for "*data centre operators to request, collect and store their customers’ data […] goes against our fundamental business model, and contractual obligations*" and asserts that *"the regulation will immensely increase our industry’s reporting burden"* (EUDCA, 2024).

4.7.2 EU Minimum Performance Standards (proposed)

Article 12(5) of the EED states:

"By 15 May 2025, the Commission shall assess the available data on the energy efficiency of data centres submitted to it pursuant to paragraphs 1 and 3 and shall submit a report to the European Parliament and to the Council, accompanied, where appropriate, by legislative proposals containing further measures to improve energy efficiency, including establishing minimum performance standards and an assessment on the feasibility of transition towards a net-zero emission data centres sector" (European Commission, 2023).

Based on this, there has seemingly been an intention that Phase 2 (from 2030) of the recast of the EED will develop a rating/labelling scheme (Kontinakis, 2023), minimum performance standards for data centre facilities and a "comparative framework": a *"rating system [which] will establish performance bands per metric that reflect these categorical distinctions, ensuring that all data centres are evaluated against appropriate peer groups. Whilst the detailed performance data will continue to guide internal improvements, public comparisons will be based on consolidated scores within these well-defined categories"* (DigitalEurope, 2025a).

However, limited information from the European Commission has been identified regarding what may be implemented with sources going back to 2023. DigitalEurope's proposal discussed below makes reference to the European Commission's *"forthcoming policy proposal on a sustainability rating scheme"* (DigitalEurope, 2025a). For example, a European Commission presentation, suggests an expected timeline for adoption of a rating scheme in Q4 2025 and possible minimum performance standards adopted between Q4 2025 and Q2 2026 (Kontinakis, 2023). The European Commission also published a policy and options paper alongside the Directive in 2023 on labelling and minimum performance standards schemes for data centres which shortlisted three policy options (voluntary pass/fail labelling, labelling scheme and mandatory requirements on energy metrics or within the labelling scheme). Options one and three are notable for how they do not explicitly mention water. There has been significant concern raised within the industry regarding these proposals (e.g., observations by the Climate Neutral Data Centre Pact (2025a), particularly with reference to minimum performance standards).

DigitalEurope's proposal for an EU sustainability rating scheme

DigitalEurope proposed in March 2025 a benchmarking framework for adoption by the EU (DigitalEurope, 2025a). The framework built upon the data submitted under the EED. It suggests that a total score should be available to all external stakeholders (including the public). Individual KPIs could be published voluntarily but would be required to be made available to authorised personnel for auditing purposes and ensuring regulatory compliance. They believe the framework should be mandatory from 2027[19] for data centres (as defined by EED) with IT power exceeding 100 kW (as opposed to the 500 kW limit currently chosen by the European Commission). It is suggested that comparisons should distinguish between 'legacy' and 'new' data centres built following the introduction of the EED as well as between business models.

Three 'base KPIs' are proposed which should be equally weighted in the final score:

- PUE normalised by local cooling-degree days
- WUE[20] normalised by local cooling-degree days
- Renewable energy factor (REF): renewable energy use measured in line with EED.

In addition, a number of 'bonus' KPIs are proposed which would further improve the overall score:

- Improving water availability, quality and resiliency as quantified by the volumetric water benefit accounting (VWBA framework) (Reig *et al.*, 2019), including community work that results in waterbody restoration or replenishment. This bonus KPI is suggested only in 'water stressed' areas.
- Alignment with the EU Code of Conduct, CNDCP, LEED, recognised global ecolabel programmes (e.g., EPEAT) and Environmental Management System (EMS) Certification (e.g., ISO 14001). ISO 46001 is not explicitly mentioned.
- Use of non-potable or untreated water sources in water-stressed regions.

DigitalEurope members will next develop rating classes and a weighting mechanism and develop a *"balanced point system for both base and bonus KPIs".*

This proposal has a number of strengths, such as:

- Industry involvement and support
- Integration with EED in terms of data requirements, objectives and definitions

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[19] With 2027-2030 being implemented as a 'self-improvement' phase.

[20] The category of WUE is not specified but it appears that indirect water use is not being considered.

- Acknowledgement of trade-offs between energy and water use.

However, we note the following weaknesses:

- Bonus KPIs relating to water source should not be limited to water-stressed regions
- A water stewardship approach of 'offsetting' potable water use by environmental works in catchments may distract from the issues faced by water companies meeting potable water demand and may fail to mitigate the damage posed by abstraction in a different location to that which is being remediated
- Reporting of total score rather than individual KPIs does not provide the water industry with sufficient information to manage, plan, and assess trends
- The definition of WUE being adopted is not clear (e.g., whether water reuse and rainwater harvesting are included) and the score does not sufficiently account for the increased environmental impact of using potable water compared to other sources; water source should be incorporated into core KPIs

4.7.3 Efficiency labelling for data centres

A number of countries already adopt efficiency labelling for data centres. These are summarised in Table 4.4. Currently, the majority of these schemes are immature, voluntary, and don't require auditing of the reported figures. However, mandatory implementation of such labels, with a clear, audited, methodology for calculating metrics provides a clear opportunity for common metrics to be reported across the industry in a manner which allows for easy benchmarking, for example, the PEER-DC label (Figure 4.7) could be expanded to include WUE_1, WUE_2 and WUE_3. A survey conducted by the European Commission found that >67% of respondents supported the inclusion of WUE in an efficiency rating scheme, the third highest of tested metrics being PUE/DCiE and REF (European Commission, 2025c). It should be noted that these metrics are a proxy of efficiency.

A number of decisions would have to be taken to ensure that such a label is useful. For example,

- the scope of who should have to complete the label would need to be determined, whether the label should cover design, operation or both, and whether the label should focus on direct impacts or 'total' impact
- what water metric(s) (e.g., water use, potable water use, WUE_1, WUE_2, WUE_3 are most suitable)
- how results will be displayed and audited

- whether other metrics (e.g., CER) drive the right behaviour.

Figure 4.7 Example data centre label proposed by PEER-DC (Gröger & Behrens, 2023)

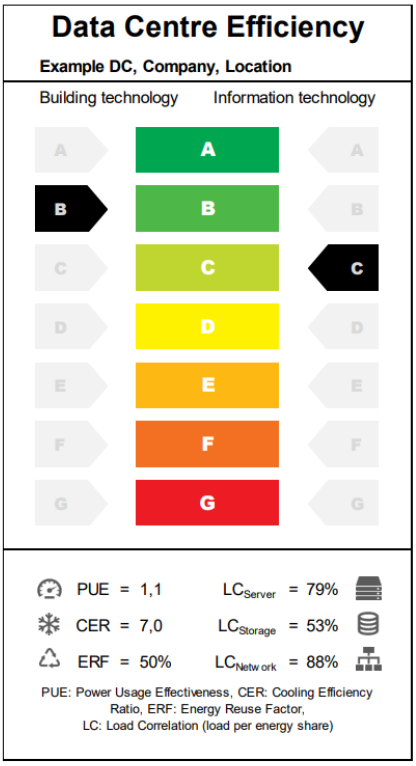


Table 4.4 Efficiency labels for data centres

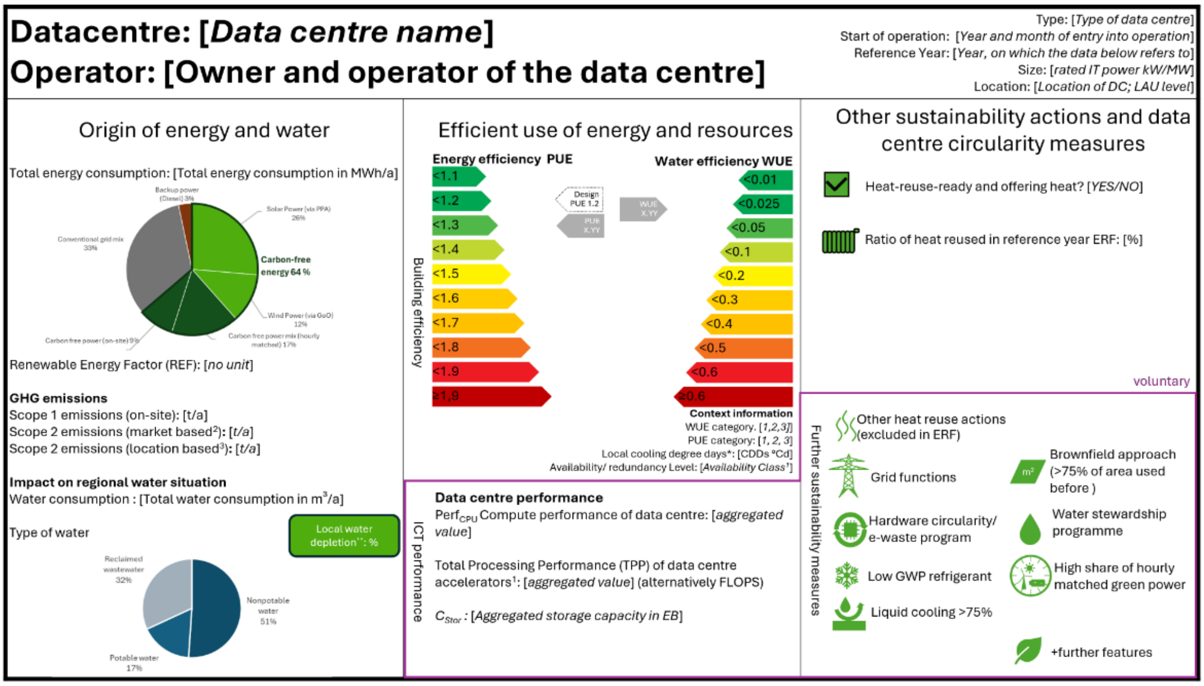
Country/ Jurisdiction	Scheme Name	Mandatory	Primary Metrics	Includes WUE	Rating Levels	Implementation Year	Comment
Australia	NABERS Data Centre	Voluntary (Mandatory for gov contracts)	PUE, fuel for back-up generators, GHG emissions.	No	1-6 stars	2013	NABERS UK doesn't cover data centres
Austria	Austrian Ecolabel UZ80	Voluntary	PUE, Energy efficiency, ERF, utilisation, renewable energy use	Yes	Bronze/Silver/ Gold	2024	
Germany	Blue Angel (DE-UZ 228)/Peer-DC	Voluntary (Mandatory for federal IT procurement)	PUE, Energy efficiency, ERF, utilisation, renewable energy use.	Yes	Pass/Fail (Blue Angel awarded)	2013 (Updated 2024)	
Germany	PEER-DC	Unknown	PUE, CER, ERF.	No	Score 1-100 with grading A-G separately for building and IT		Individual components reported on label
Hong Kong	BEAM Plus Data Centres	Voluntary	Energy use, integrated design and construction management, sustainability of site, materials and	Yes	Bronze/Silver/ Gold/Platinum	2021	

Country/ Jurisdiction	Scheme Name	Mandatory	Primary Metrics	Includes WUE	Rating Levels	Implementation Year	Comment
			waste, energy use, water use, H&S, innovation and additions. Water use contributes 10% to score.				
Korea	Green Data Center Certification	Voluntary	PUE, Green practices (20%), Technology excellence (5% bonus).	No	Three levels	2012	
Malaysia	Green Building Index (GBI) Data Centre Tool	Voluntary	PUE		Bronze/Silver/ Gold/ Platinum	2012 (V2.0 in 2026)	
Singapore	BCA-IMDA Green Mark for Data Centres	Voluntary	PUE, Cooling system efficiency, Energy management.	Yes	Certified/Gold/ GoldPlus/Platinum	2013 (Updated 2024)	
Switzerland	SDEA Label	Voluntary	PUE, Carbon Footprint (CUE), Heat recovery, IT utilisation.	No	Bronze/Silver/ Gold	2020	
United States	Energy Star	Voluntary	PUE	No	Score 1-100 (75+ for certification)	2010	

Country/ Jurisdiction	Scheme Name	Mandatory	Primary Metrics	Includes WUE	Rating Levels	Implementation Year	Comment
China	Data Center Green Rating Assessment (TGGC)	Government sponsored performance award	PUE, Energy efficiency, green management including water utilisation (4%), layout.	Yes	Five levels (1A-5A)	2013	
International (CEEDA)	CEEDA	Voluntary	PUE, CUE, WUE, Best practices implementation. Certification not based on numerical values.	Yes	Bronze/Silver/ Gold	2016	
EU	EU Code of Conduct for Data Centre Energy Efficiency	Voluntary	PUE, ITE energy efficiency, total energy, IEE energy.	No	Participant/ endorser status	2023	Not a labelling scheme but scheme permits publicising status.

However, in October 2025 the European Commission published its second technical report '*Assessment of next steps to promote the energy performance and sustainability of data centres in EU, including the establishment of an EU-wide rating scheme'* which set out its proposed efficiency labelling scheme (European Commission, 2025c). The proposal includes water sources used, WUE and other sustainability actions and circulatory measures such as memberships of water stewardship programmes (Figure 4.8). The report, however, did not conclude whether or not the labels should be published, citing potential issues with data centre willingness to share energy usage information. It also recommended that the label should not be finalised until another round of data reporting has been collected, and that there should be a push to collect data about smaller (<500kW data centres) during this period. The label currently proposes the least efficient WUE band being 0.5 to 0.6l/kWh, but the report also recommends adoption of 0.4l/kWh as a global (irrespective of climate or cooling technology) minimum performance standard (European Commission, 2025c). With respect to efficiency labels, techUK and NTT stated that they were controversial and can limit innovation, highlighting that data centres are nuanced and complex systems which cannot be rated like a product.

Figure 4.8 Proposed data centre efficiency label (European Commission, 2025c)



4.7.4 Climate Neutral Data Centre Pact

Many interviewees appeared supportive of the CNDCP, feeling it presents achievable targets which the sector is on board with and thus being reflective of the direction of travel of future energy and water efficiency of data centres in the EU and UK.

The conversations with data centres highlighted the competing priorities of space, energy, carbon and water. As such it is right that water availability should be incorporated into minimum performance standards and benchmarking. Some interviewees expressed this as data centres will work to what's available, they can use as little water as required but it will cost society in other ways. However, the scale of the multipliers applied in the CNDCP should be carefully analysed alongside the definitions of water stress. While the minimum performance standards document allows for a "similar metric"[21] to WEI+ to be used, multipliers are only provided for WEI+ (Climate Neutral Data Centre Pact, 2024). Using Eurostat's latest data (2023) only two of the 36 countries (Cyprus and Romania) are classed as High water stress (Table 4.5) (European Commission, 2025f).

Table 4.5 Categorisation of WEI+ according to definitions by CNDCP

Water stress	Number of Member States
Low	30
Medium-low	3
Medium-high	1
High	2

These definitions are consistent with Eurostat which states *"[i]n the absence of Europe-wide agreed formal targets, values above 20% are generally considered to be a sign of water scarcity, while values equal or greater than 40% indicate situations of severe water scarcity, meaning the use of freshwater resources is unsustainable"* (European Commission, 2025f).

Signatories are dominated by large companies (including AWS, Google, Meta and Microsoft) and international colocation companies (e.g., CyrusOne, Digital Realty, EdgeConnex, Equinix, Global Switch, IBM, Iron Mountain, and Vantage) (Liu *et al.,* 2025). As such, the fact that the majority of the sector is signed to the Pact should not be misinterpreted as indicative that the majority of data centre sites and operators are signatories to the Pact, particularly for small-scale data centres and those which are not the primary business purpose of a building.

Scholars have cautioned that voluntary codes suffer from inconsistent measurement of metrics and the absence of third-party enforcement (Usman & Zakir, 2025). One might also argue that

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[21] Alternatives include the Köppen climate classification *"categorises global regions based on long-term temperature and precipitation patterns, providing an ecoclimatic lens often linked to vegetation cover and water resource availability. Temperate climates, in contrast, including Cfb (temperate oceanic) and Cfa (humid subtropical), offer more favourable conditions for air-based or hybrid cooling systems thanks to lower ambient temperatures and higher humidity levels"* (Herrera *et al.*, 2025).

the compliance date of 2040 is unnecessarily lenient given the short lifespan of assets and achievability of the targets by existing technology. On the other hand, it means that new centres currently being built need to be done so with an eye to be able to meet that standard and it has been argued that this limit was set to avoid carbon impacts of early replacement of existing technology (Climate Neutral Data Centre Pact, 2022).

In hybrid cooling systems, water is only used for cooling when free air cooling is not possible. As such, its use is highly correlated to ambient temperatures and control points. Similarly, for evaporative cooling, more cooling load (using more water) will be required in hotter climates. In these cases, the 1.1 multiplier dependent on cooling degree days appears to be a sensible inclusion when benchmarking or setting minimum performance standards for data centre water use. However, we express concern regarding the water scarcity multipliers provided, both in terms of their magnitude and definition. To provide context, using the latest available (2015) data, the river basin with the highest WEI+ in the UK is the South East which has a WEI+ of 16.96 which would be classified as Medium-low, allowing for WUE of 2.5*0.4 = 1 l/kWh. However, when WEI+ is applied at water body level for multiple flow percentiles and considering future demand (as applied by the Environment Agency), a number of English water companies are classified as in serious water stress (WEI+ >51%) (Environment Agency and Natural Resources Wales, 2013), highlighting the importance of spatial scale and future demand when ascertaining WEI+. Before adopting such a framework, it should therefore be considered what level of WUE should be considered acceptable and whether WEI+ is an appropriate measure for the scarcity of potable water.

At a European level, the targets do appear to be stretching. For example, the European colocation survey by Pb7 Research in 2024 found that only 39% of respondents are currently meeting the 0.4 l/kWh potable water use limit in areas with water stress, with 23% expecting to reach it after 2030 (or never) (EUDCA, 2025b).

4.7.5 Assessment

All three existing benchmarking frameworks discussed currently have key limitations regarding their applicability for benchmarking water use by data centres:

- Voluntary pacts like CNDCP suffer from a lack of regulatory oversight, auditing and enforcement required to ensure consistency, accuracy and effectiveness
- The CNDCP could be seen to be unambitious with regard to water efficiency, particularly in the majority of locations which are deemed by the scheme not to be water stressed
- Minimum performance standards fail to consider interdependencies between energy efficiency, water use and heat reuse potential in data centres, and may become complicated if adjustments are required for climate, business models/data centre purpose, use of district heating networks, water source, water scarcity, and geographic constraints (like floor area) (DigitalEurope, 2025a)

- Minimum performance standards are, by definition, supposed to serve as a regulatory minimum, and thus are not designed to incentivise excellence or continuous improvement or allow benchmarking

- Efficiency labelling for data centres has generally been focussed on energy, sometimes even including cooling efficiency ratio which may be counterproductive to water efficiency (by encouraging power-efficiency but water intensive solutions)

- There are a large number of schemes that have been developed, but uptake appears to be low and there is not an international market leader

- There is significant inconsistency across the different schemes regarding what they include and how they incorporate water.

4.8 Recommendation: A framework for benchmarking water efficiency in data centres

Despite the limitations outlined above, each existing framework presents valuable opportunities to serve as the foundation for an English benchmarking framework. This is particularly relevant given data centre stakeholders' preference to align with established international approaches rather than create a new framework, enabling easier integration and implementation.

We suggest the following as the basis for a framework that would allow the measurement and comparison of existing and planned data centre water usage, for the purposes of measuring operational efficiency and making informed planning decisions.

- England could mandate centralised reporting of (at least a subset of) the metrics required under the EED. They may wish to consider expanding eligibility to data centres smaller than 500 kW. This data could be published in anonymised form, presenting for each data centre its area (e.g., county), PUE, REF, IT power, water use, potable water use, WUE_1, and WUE_2.

- Beyond what is required by the EED, there would be value in requiring reporting of water use by source (e.g., raw water, potable water, reused water and harvested water), water use split by purpose (e.g., domestic-like use versus other use), and annual average versus peak-month potable water consumption.

- Data centres reporting WUE should do so in a clear and consistent manner, which requires mandatory reporting against a set of defined guidelines. There should be no ambiguity regarding what it meant by WUE. It should be considered whether, in line with the direction of travel of the EU, WUE_2 should be globally adopted or whether its limitations (non-inclusion of rainwater harvesting and lack of interpretability for the general public) outweigh the benefits of international consistency.

- A minimum performance standard could be enforced on new data centre development, for example, a ban on new data centres with (design) WUE >0.7 l/kWh. Sites using alternative water sources could be mandated to less stretching WUE, as per the water source component of the CNDCP minimum performance standards or the water use from the public supply could be limited to the WUE threshold (even if supplementation from other sources increase the overall WUE above the threshold). Equally, with view to their presence as Critical National Infrastructure, the ability of water companies to object to new data centres with WUE_2 <0.4 l/kWh, or those that do not rely on potable water supply, aside from as redundancy, could be limited. This would require that WUE is made publicly available at development stage, allowing new data centres to be benchmarked.

- England could require that operators wishing to build new data centres are signed up to the CNDCP and implement regulation and monitoring of the progress towards the commitment. They should also consider whether to adopt any minimum performance standards that may be subsequently introduced by the EU.

- England could mandate efficiency labelling for data centres. In particular, England could adopt the proposed EU energy efficiency label. Similar metrics could be reported on the label to those which could be annually reported. The label would differ to annual reporting in that it would refer to design efficiency rather than operational efficiency.

- Benchmarking should take place making use of the energy efficiency label, EED reporting, and compliance with any minimum performance standards introduced, with particular consideration with how performance differs with size, age, type and location of the data centres, with an acknowledgement for how each of these factors can impact a data centre's efficiency (see Section 4.2).

5. Conclusion & recommendations

This report has explored what efficient water use looks like in data centres and how it can be driven in England. It has provided informative and valuable insights while assessing information to achieve the project objectives as well as develop recommendations. Aspects where the data centre and water industries could become more aligned through communication and collaboration have been identified, as well as through policy adjustments and aspects where further information and exploration would be beneficial have been identified, informing recommendations to support the sustainable development and growth of the English data centre sector. It should be noted that many of these suggestions could also apply to other sectors.

Current data centre potable water consumption in England is 1,879,000 m^3/year (0.2% of the NHH market) but is showing an upwards trend. The top six data centres account for 65% of the sector's water consumption; two of these data centres came online in 2024, and five of them have come online since 2020. A trend for new data centres with increased water use was indicated, although additional research into this is recommended. Due to the misalignment of water resource planning timelines and data centre industry growth, this trend has not been factored into water resource planning which has potential to impact water availability for domestic purposes if even just some of the 100 planned data centres use a significant amount of water. The rapid expansion in AI and its need for greater cooling could exacerbate this.

Furthermore, the overall amount of water required for data centres was not the primary concern of water companies. Rather they had concerns over demand on peak days, and that these would likely coincide with increased domestic demand as both have temperature as a significant driver. This was supported by the evidence review that identified peak water requirements have the potential to be significant, and the data analysis showed a clear seasonality with increased demand in summer, when domestic demand is typically greater.

Following a review of existing policy and benchmarking frameworks, we found that there would be benefits to England adopting a reporting framework and putting in place a series of policy interventions to allow for easier benchmarking of data centre water use. In particular, this would consist of mandatory, centralised reporting of (at least a subset of) the metrics required under the EED, possibly in addition to some other metrics which would allow for better comparison and interpretation of water use. The international policy review found that the EU is leading the way with regard to developing an internationally recognised efficiency label and that the proposed label has a number of strengths with respect to how it incorporates water and energy. It is recommended that England seek to emulate and adopt this system, and consider the applicability of proposed, but not yet established, minimum performance standards. However, in order to make best use of this framework, these interventions should be considered alongside a variety of additional policy options which may be required to address current issues. The interventions discussed in this report include concepts such as advancing the proposed registration of data centres in a Critical National Infrastructure register and making improvements to the planning process to improve the visibility of data centre applications and improving communication and proactive engagement between data centre designers and water companies.

Further research, engagement and collaboration with the data centre industry, water industry, regulators, and leading experts is recommended regarding how to reduce and remove barriers to use of treated sewage effluent, increase collaboration in water resource planning and develop a greater understanding of each of the industries, including the opportunities and limitations due to statutory requirements and regulatory pressures. This is particularly recommended due to the rapid evolution of the data centre industry and technology which could significantly impact water requirements and opportunities for water efficiency within data centres.

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Appendix A Secondary questions

The following secondary questions were considered when undertaking the literature review:

- What factors influence how much water a data centre uses?
- What factors influence the suitability of different cooling technologies for use in UK data centres?
- What cooling technologies are currently being used for cooling data centres, particularly in the UK?
- What cooling technologies may be used in future data centres in the UK?
- What consumptive water use and water quality requirements are associated with current and emerging cooling technologies applicable to UK data centres?
- What trade-offs are associated with water efficiency in data centres?
- How can data centres be categorised according to their water use?
- What purity of water is required for cooling and other uses in data centres and how does this change with categorisation or technology?
- What purity and sources of water are typically used for cooling UK data centres and how is this likely to change in the future?
- What risks or consequences are associated with the choice of water source and water quality?
- What regulations and standards, current and emerging, are relevant to the abstractive use, consumptive use, and water quality impact of water use in UK data centres?
- What international approaches are taken to governing and managing consumptive water use in current and planned data centres?
- What synergies can be exploited to improve the water efficiency of data centres?

Appendix B Search strings

The following search string were used during the literature search:

(WUE Water) AND (consumption intensity cooling demand abstraction footprint "foot print" usage) AND ("data centre" "digital infrastructure" "artificial intelligence" AI CRAC CRAH "computer air conditioning") doctype:(1* F) year:[2010 TO *]

(Water cooling coolant) AND (quality treatment feed intake source purity legionella hardness salinity corrode corrosion corrosivity) tit:("data centre" "data center" datacenter datacentre "digital infrastructure" CRAC CRAH "computer air conditioning") doctype:(1* F) year:[2010 TO *]

(contaminated grey gray permit consent) AND (water coolant) tit:("data centre" "data center" datacentre datacenter "digital infrastructure" "artificial intelligence" AI CRAC CRAH "computer air conditioning") doctype:(1* F) year:[2010 TO *]

(Cooling) AND (technology type chilled evaporative air economizer adiabatic liquid “direct to chip” DTC hybrid compare comparison benchmark benchmarking review BAT "best available” difference choice decision-making emerging "next gen” "next generation" innovative advanced quantum neuromorphic categorise categorisation "reject heat" "heat rejection" temperature "thermal management")

(Cooling) AND (quantum neuromorphic categorise categorisation "reject heat" "heat rejection" temperature "thermal management") tit:("data centre" "data center" datacenter datacentre "digital infrastructure" CRAC CRAH "computer air conditioning") doctype:(1* F) year:[2010 TO *]

(Cooling) AND (technology type chilled evaporative air economizer adiabatic liquid “direct to chip” DTC hybrid compare comparison benchmark benchmarking review BAT "best available” difference choice decision-making emerging "next gen” "next generation" innovative advanced) tit:("data centre" "data center" datacenter datacentre "digital infrastructure" CRAC CRAH "computer air conditioning") doctype:(1* F) year:[2010 TO *]

Appendix C Stakeholder engagement: interview questions

C1 Questions for organisations in the data centre industry

- What are your thoughts on data centre water use?
    - What is the importance of water efficiency in your business? What, if anything, drives you to become more efficient (e.g. regulation, public perception and reputation, customer / financing requirements, cost, environmental conscience, net zero or wider environmental strategies and targets, long-term security and risks of water scarcity)?
    - Do you have any water related policies, targets or strategies?
    - What measures are taken to maximise water efficiency and minimise water use?
    - What water use, water consumption or water efficiency performance metrics do you use? Do you track performance or set targets? How has performance (and how have targets) changed over time? Are you able to share any data?
    - What do you think is the most appropriate metric for measuring water efficiency in data centres?
    - When planning the development and operation of a datacentre, where does water availability and efficiency sit in terms of priorities? How important is water availability and security when choosing a location? What level of engagement do you do with water companies or environmental bodies regarding water availability?
    - Do you think there are water uses or inefficiencies that are overlooked?
- Does your company/data centre have an emergency plan for instances where there is drought/supply interruptions? How vulnerable are you to such events and how do you mitigate this?
    - What redundancy is there in the system (e.g. alternative water sources, dual supplies, on-site storage, alternative cooling systems, ability to operate with reduced cooling)?
    - What level of outage / usage restriction do you plan to? What are you able to withstand?

    - What happens beyond this point? E.g. total shutdown / reduced capacity / alternative cooling?
    - How significant is water availability as a risk to your business? Do you think it is overlooked?
    - What special arrangements do you have with water retailer / wholesaler as an operator of critical infrastructure? How do the requirements for critical infrastructure affect your emergency planning with respect to water?
- What source water do you use and why? How did you decide to use this source?
    - What treatment (if any) of this water is performed prior to use?
    - What is the water efficiency of this treatment?
    - How easy would it be to adopt a different type of source water? What would the impacts be?
- Where do you use water and what is your main water use?
- Do you think they can/should be more water efficient?
    - Do you think that efficiency changes with data centre size? e.g. economy of scale
    - What do you think a realistic minimum water efficiency value could be?
- What do you think are the barriers to water efficiency?
- What are the trade-offs to be considered when reducing water use?
- How viable are water efficient cooling technologies in the UK? E.g. those that use recycled water, sea water, adiabatic cooling? What do you see the future looking like? E.g. are we moving towards water efficiency, energy efficiency or both? What are the barriers?
- How is wastewater treated and discharged from your site (e.g. environmental permit, public sewer, trade effluent by other means)?
    - Why was this method of discharge chosen?

    - If you discharge to sewer or rely on water company treating the effluent, how significant do you perceive the risk that they choose not to accept the effluent?

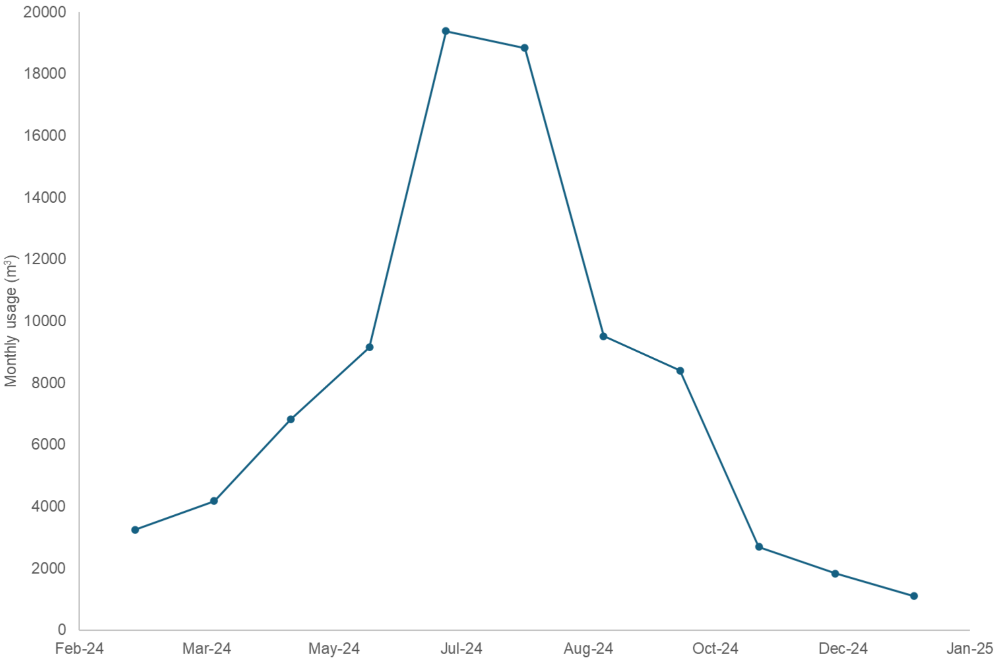
- Is there any relevant literature you recommend?

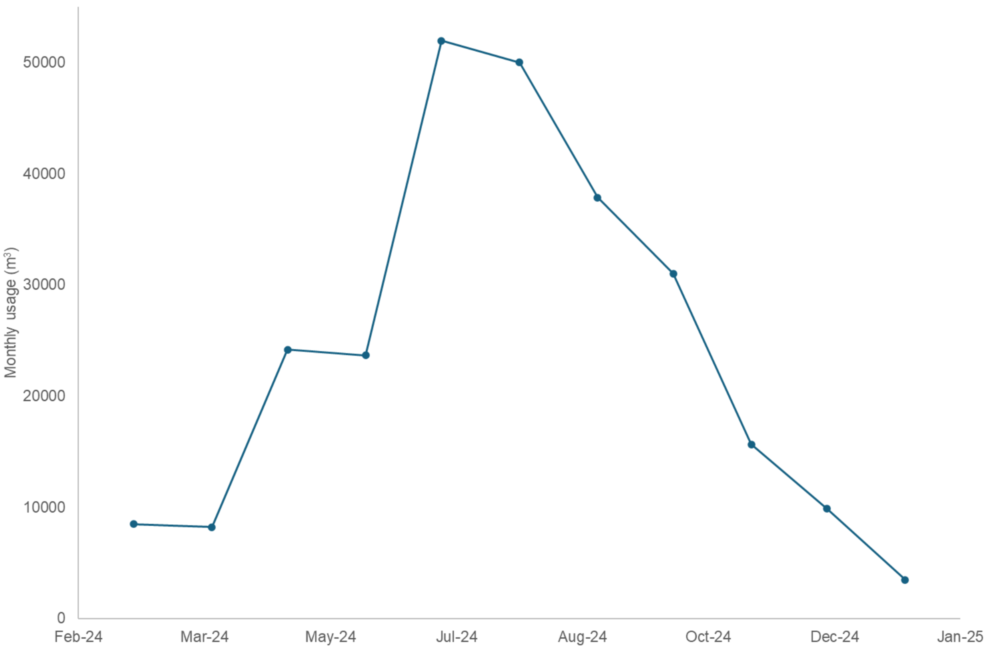
C1.1 Questions for organisations in the regulatory/water sphere

- What are your thoughts on data centre water use?
- With respect to data centre water use, do you want them to be more efficient or reduce overall consumption? These may not go hand in hand.
- Have you got any existing/emerging policy regarding data centres? If not, what regulations would they be regulated under?
- Do you know of any existing environmental regulations that apply to data centres?
    - What, in your opinion, are the environmental impacts relating to data centre water use? How do you think this compares with the impacts of energy and carbon?
    - Do you think the environmental impact/water use of data centres should be regulated/more strongly regulated
- How much water do you believe they use?
- Do you track their water use?
- Who do you think the onus is on to make data centres more water efficient?
- Is there any relevant literature you recommend?
- Do you have any data centre contacts?

Appendix D Supplementary information

Figure D.1 Water consumption profile for data centre IDs 207 and 208 respectively





Appendix E Considerations for planning

The following considerations are drawn from the findings of the above report in order to provide a starting point for non-specialist decision-makers who are involved in reviewing proposed data centre developments. The following considerations relate only to *potable water use and its impacts*. There are a number of interacting and competing priorities to consider when planning for data centre development and designing data centres; not least demand for services, capital, ongoing and whole-life cost, space, power availability and resilience, embodied and operational carbon, public opinion, opportunity cost, resilience, ease of waste heat recovery and environmental impact. In particular, the reader is warned against making decisions unduly influenced by any one driver. The trade-off between water use and energy use for cooling is well documented. However, the appropriateness of water-based cooling can also be influenced by many other factors such as availability of space and cost, and the impacts of such a system are highly dependent on its specifics (e.g. its water source and how commonly water is used).

When assessing proposals the following *aspects of the cooling system design* should be considered when evaluating the likely potable water requirements:

- Cooling systems described as 'open-loop' or 'evaporative' are likely to be water intensive. However, the reverse is not necessarily true; heat transfer systems (sometimes loosely referred to as the cooling system) may be 'closed-loop' but the heat rejection system may be evaporative resulting in the same amount of water use. Such systems are likely to have high water use year-round which increases slightly with warmer weather as cooling demand increases.

- Cooling systems described as 'hybrid' may rely on evaporate cooling when free air cooling is insufficient or not possible (ambient temperature exceeds heat rejection temperature). Such systems would typically use no water *for cooling* during cooler periods with water use occurring during periods of high temperatures. The ambient temperature at which water cooling is invoked will be determined by other aspects of the design, particularly the *set (a.k.a control) points* (see Section 4.2). However, hybrid cooling can also refer to non-consumptive systems (such as a closed-loops combined with air cooling or air units with direct-to-chip or immersion cooling).

- Heat rejection systems described as 'dry', 'air cooled', and 'mechanically chilled' are unlikely to use water *during use* for cooling. However, small amounts of water use should be expected for domestic-like purposes and initial filling of any closed-loop systems (if used).

- The amount of energy and water used for cooling will be primarily driven by the cooling demand. In simple terms, this is a function only of the heat produced (strongly correlated with the IT power consumption, number of servers and weakly correlated with overall power consumption and physical footprint), operating temperature (the temperature setpoint, weakly correlated with the data centre operating model, required level of uptime/resilience, and type of servers deployed; itself related to the data centre purpose), and cooling method.

The following, relating to the *data centre water system*, should be considered:

- The likely water use should be interpreted in the context of the demand and the water source(s) and their local availability. Should the design not require water for cooling then the water use by the site will likely be very minimal (see Section 3.3) and minimal scrutiny is likely to be proportionate. However, should designs propose use of the public water supply **and** rely on a water-consumptive design, particularly if water availability if limited, it would be proportionate to challenge the applicant to evidence that:
    - efforts have been made to minimise water use and maximise efficiency
    - the best overall design and location has been chosen.
- Relevant questions might include:
    - Whether risks and negative impacts are being mitigated through investment (e.g. network expansion or reinforcement, new reservoirs etc.).
    - Whether alternative water sources (e.g. raw water, treated effluent) have been duly considered and the reasons for rejection.
    - If the system is hybrid, when the water-using element will be invoked and what water use, at what times, this would be likely to result in over a future climate scenario.
    - Whether there are opportunities for increased efficiency through, e.g. water reuse or rainwater harvesting.
    - Why a water-consumptive cooling system was chosen.
    - Whether the incumbent water wholesaler (and incumbent wastewater company, if different) has been sufficiently engaged with and is compatible with the company's water resource management plan.
    - Whether/how the proposed development fits into the regional water management plan and whether any additional engagement with the regional water resources group is necessary.

- What on-site water storage (if any) is being proposed and whether this should be optimised to minimise, e.g., peak demand.

The following, relating to the *data centre design*, should be considered:

- The effluent discharge mechanism and any opportunities for reuse, heat recovery and any potential negative impacts of discharge to sewer (e.g. the presence of over-capacity combined-sewer systems),

- The criticality of the data centre, required level of resilience, and any knock-on impacts on water companies of providing the required level of service.