Call for Evidence - Risks and opportunities to the sustainability of data centres in the UK

Inquiry: Call for Evidence - Committees - UK Parliament

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Questions

1. What current and future factors and trends are driving demand for data centres and what opportunities and challenges do they pose for the UK?

Demand for data centres is increasing rapidly, driven by advances in artificial intelligence (AI), growing data volumes, and expanding digital services. These trends are expected to continue, placing further pressure on infrastructure while also creating opportunities for the UK to lead in sustainable and efficient data centre development. Key drivers include:

- **Rising computational requirements for training**: The scale of data and processing power required to train advanced AI models continues to grow significantly. Since 2010, the computational effort used in training notable machine learning models has increased by around 4.4 times per year. If this trend continues, models could be trained on datasets comparable in size to the total stock of publicly available human-generated text as early as 2026.
- **Growing demand for data storage**: Storage requirements are projected to increase substantially, from 10.1 zettabytes in 2023 to approximately 21 zettabytes by 2027, partly driven by AI uptake. For context, one zettabyte is equal to one trillion gigabytes.
- **More resource-intensive inference**: The use phase of AI systems is also becoming more demanding. Larger inputs (e.g. increased token limits) and more complex models with greater numbers of parameters are driving higher compute requirements. While smaller models may moderate this trend, the use of multiple models within agent-based systems could result in comparable overall impacts.
- **Increasing demand for data centre capacity**: In 2023, demand across Europe's 14 largest data centre markets reached 601 megawatts, up from 546 megawatts in 2022. Over the same period, 561 megawatts of new supply was delivered. This marked the second time in five years that demand exceeded supply, contributing to record-low vacancy rates of 10.6% across major markets including London, Frankfurt, Amsterdam, Paris and Dublin.

These trends present an opportunity for the UK to position itself as a global leader in sustainable data centre development. Achieving this will require proportionate and effective regulation, clear guidance to monitor and reduce environmental impacts, and engagement in shaping international standards. Key areas for action include:

- **AI assurance technologies**: Tools and frameworks that assess and mitigate AI-related risks, including environmental impacts, can support more responsible deployment. Introducing requirements for environmental impact assessments and compliance audits could drive adoption. The UK AI assurance market has the potential to reach £6.53 billion in gross value added by 2035.
- **Alternative models and hardware approaches**: More efficient AI models and emerging chip architectures offer opportunities to reduce data storage, processing time, water consumption and energy consumption, while maintaining or improving performance. Targeted incentives could encourage greater uptake of environmentally conscious approaches across the AI value chain.
- **Smaller, task-specific models**: Smaller models, including those under 7 billion parameters, can often deliver comparable performance for specific tasks while requiring significantly less data and compute. These are increasingly being deployed on edge devices and may help reduce overall resource demands.

2. What are the environmental impacts of different types of data centre currently having in the UK and what are the future impacts likely to be?

Data centres are already contributing significantly to environmental pressures in the UK, particularly through energy use, water consumption, and demand for critical materials. As digital infrastructure continues to expand, driven in part by AI, these impacts are expected to intensify, raising both sustainability and resilience challenges. Key impacts include:

A. Energy demand

Data centres are a rapidly growing source of electricity demand. It has been suggested that UK data centre energy consumption could increase up to sixfold over the next decade. This growth is likely to be further amplified by the increasing use of AI, particularly as inference workloads, already estimated to account for up to 80% of AI computational demand, continue to expand.

This rising demand adds to the system-wide challenge of decarbonising the electricity grid. Delivering the UK’s target of at least 95% clean power by 2030 will already require a substantial expansion of renewable generation, with wind and solar capacity needing to increase by around 2.7 times. Continued growth in data centre demand will increase the scale and urgency of this transition.

Future projections also highlight the scale of potential demand. The National Energy System Operator (NESO) Future Energy Scenarios suggest that data centre capacity could reach between 9.9 GW and 14.6 GW by 2050. However, more recent evidence from grid connection queues indicates significantly higher potential demand, with around 50 GW of projects reportedly seeking connection and approximately 20 GW already having submitted formal applications. This points to a substantial pipeline of anticipated growth, far exceeding earlier scenario assumptions.[1] As a result, government should consider mandating the placement of data centres closer to energy sources to reduce line losses for high energy consumers.

B. Water use

Data centres are also placing increasing pressure on water resources. Major operators have reported consistent year-on-year increases in water consumption since 2020. As facilities typically draw water from local sources, areas with high concentrations of data centres may face heightened risks of water stress.

This is particularly relevant in England, where public water supply deficits are projected to reach 4,860 million litres per day by 2050[2]. By 2030, seven regions are expected to be severely water stressed[3], including London, which hosts the majority of the UK's data centre capacity. There may become capacity issues if data centres continue using water at this rate and alternative data centre cooling technologies need to be mandated by government.

Water impacts extend beyond operation. Significant volumes are also required in the manufacturing of compute hardware. A single semiconductor fabrication facility can use over 37 million litres of ultrapure water per day, while the global semiconductor industry consumes an estimated 1.2 trillion litres annually. Water is also used extensively in electricity generation, particularly for cooling in thermal and nuclear plants and through evaporation in hydropower systems.

C. Critical materials

Data centres rely on hardware containing a range of critical materials, including antimony, gallium, indium, silicon and tellurium. The extraction and processing of these materials can have significant environmental impacts, including land degradation, biodiversity loss, pollution, and pressure on water resources.

Demand for these materials is increasing, particularly due to the growth of specialised AI hardware. This creates both environmental and strategic risks, as supply chains are highly globalised and complex, with semiconductor production involving inputs crossing around 70 international borders. Disruptions to these supply chains can lead to shortages and wider economic impacts.

Improving recycling and reuse offers a pathway to mitigate both environmental harm and supply chain vulnerability. However, the UK currently performs poorly in this area, generating one of the highest levels of e-waste per capita globally. Addressing this will be essential to improving long-term resilience.

1. *What are the potential short, medium and long-term projections of these impacts?*

N/A

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[1] https://www.neso.energy/document/364541/download
[2] A summary of England's revised draft regional and water resources management plans - GOV.UK
[3] Seven regions in England will face severe water stress by 2030 as Brits significantly underestimate their daily water usage – Kingfisher plc

3. What impact are data centres having on climate change and the Government's Net Zero targets and how will this change in the short, medium and long term in the UK?

Data centres are playing an increasingly significant role in the UK's emissions profile, driven in large part by the rapid expansion of AI and digital services. Their growing demand for electricity, water and materials presents a direct challenge to achieving Net Zero, particularly as demand is expected to rise substantially over the coming decades.

In the UK, while data centres currently represent a relatively modest proportion of total electricity demand (1.6GW in 2024), this is expected to grow rapidly as highlighted in question 2. Analysis by the House of Commons Library suggests that electricity consumption from data centres and AI could increase significantly over the next decade, placing additional pressure on generation capacity and network infrastructure.[4] At a global level, AI-related energy use is already estimated to account for around 2–3% of total greenhouse gas emissions, and this share is likely to increase as adoption accelerates.

In the short term, rising demand for data centre services is likely to increase overall electricity consumption, particularly where new capacity is not fully matched by low-carbon energy supply. This risks slowing progress towards decarbonisation targets, especially if grid constraints delay the deployment of renewable generation or require continued reliance on higher-carbon sources during peak demand periods.

In the medium term, the scale of demand growth driven by AI training and, increasingly, inference may require substantial expansion of clean energy generation, grid infrastructure, and energy storage. Without coordinated planning, there is a risk that data centre growth could outpace the UK's ability to deliver sufficient low-carbon electricity, thereby increasing system costs and complicating progress towards Net Zero. At the same time, there are opportunities for data centres to support the transition, for example by providing flexible demand, co-locating with renewable generation, or utilising waste heat.

Medium term policy arrangements for the growth of AI will also have to be stringent. Whilst a package of reforms and investment to accelerate AI-driven growth will provide many benefits to the UK, this must be underpinned by strong data foundations, clear competencies, and full transparency. Informed rules on what data can and cannot be used to train AI systems are essential to ensure products are developed safely. This will also help build public trust. Robust legal and regulatory frameworks are needed to support the safe development and use of AI without stifling innovation.

In the long term, the overall impact will depend on the extent to which efficiency improvements, regulatory frameworks, and technological innovation can offset rising demand. Advances such as more efficient AI models, improved cooling systems, and lower-impact hardware could help to reduce emissions intensity. However, if total demand continues to scale rapidly, absolute environmental impacts may still increase.

Beyond carbon emissions, data centres also contribute to wider environmental pressures. Their operation can lead to air and water pollution, thermal pollution, and the generation of

[4] Data centres: planning policy, sustainability, and resilience - House of Commons Library

electronic waste. These impacts can affect both environmental and human health, and may exacerbate existing inequalities, as the environmental costs of digital infrastructure are often unevenly distributed geographically and socially.

Overall, while data centres are essential to the UK's digital economy and can support decarbonisation in other sectors, their rapid expansion presents a material risk to Net Zero delivery unless managed through coordinated policy, infrastructure investment, and a stronger focus on sustainability across the AI and data centre lifecycle.

4. To what extent will Artificial Intelligence (AI) accelerate the need for data centres and is this being adequately taken account of by the Government and relevant bodies, such as the Climate Change Committee and the Office for Environmental Protection, in terms of nature, the environment and climate change?

While the Government and advisory bodies such as the Climate Change Committee and the Office for Environmental Protection have begun to consider the implications of digital infrastructure, there remains limited evidence that the specific impacts of AI-driven demand are being fully integrated into assessments of climate, nature and environmental risk.

Stronger alignment is needed between AI policy, environmental regulation and infrastructure planning. This should include improved measurement and reporting of AI-related resource use, greater transparency from industry, and incentives to prioritise more efficient approaches. Without such measures, the accelerating uptake of AI risks driving data centre expansion in ways that are not compatible with the UK's environmental and Net Zero objectives.

5. To what extent do existing policies, such as the Environmental Improvement Plan and the Planning and Infrastructure Act and associated policies, take account of the potential impact of data centres, particularly in terms of water use, nature and the environment?

Existing policies often impact data centres in an indirect generic way. Data centre developments can impact habitats and ecosystems, yet current planning guidance relies largely on generic Environmental Impact Assessments and developer-led mitigation, leading to variable outcomes. There is scope for clearer, prescriptive guidance on site selection, habitat protection, and net biodiversity gain specific to data centre projects. While general environmental objectives are addressed, we recommend that government explicitly consider the ecological footprint of data centres and integrate specific criteria for biodiversity protection and environmental performance in planning approvals.

1. *How should the impact of data centres be factored into future policies, such as the Land Use Framework, regional planning, housebuilding and reform of the water sector?*

Future policies such as the Land Use Framework, regional planning, housebuilding strategies, and water sector reform, should incorporate mandatory reporting for data centres on key environmental metrics. These should cover energy use and sources, water consumption and supply, carbon emissions, e-waste management, and Power Usage Effectiveness (PUE). Reporting standards should align with industry guidance for climate-related disclosures and consider emerging practices for sharing resource consumption data, such as those outlined in the proposed UK Net Zero Carbon Buildings Standard (UKNZCBS).

We also advocate for mandatory reporting on server equipment reuse. Research from 2021 shows that around 28% of organisations globally reuse or repurpose IT hardware internally. Programmes like the Circular Electronics Partnership (CEP) demonstrate the benefits of circular practices. Requiring reporting would help policymakers understand barriers and opportunities for reuse, supporting improved circularity in data centres, which not only reduces environmental impact but also mitigates supply chain risks for UK operators and enterprises.

Finally, policies should consider reporting on workload distribution within data centres. The UK should work with international partners to develop a standard for measuring and reporting workload balance without compromising security or business sensitivity. Integrating these measures into future planning and regulatory frameworks will provide a stronger basis for sustainable and resilient data centre operations.

2. *How important is the location of data centres and what factors should be considered for optimum siting of them?*

Government must encourage developers and planners to prioritise locations that offer access to renewable energy and are resilient to climate-related risks. It is vitally important to consider the capacity of the UK grid when planning the development of data centres. Achieving net-zero whilst supporting the proliferation of data centres will require a comprehensive understanding of the most carbon efficient AI models, and the offsetting powers of technology. Therefore, there needs to be serious thought on the placement of data centres where climate impact and resilience can be minimised with local access to green energy generation.

To help guide responsible development, government should impose a 'bronze, silver, gold' standard for data centres: bronze for excessive energy consumption which is harmful to the environment, silver for less harmful, and gold for environmentally sustainable operations. This would emphasise the moral responsibility surrounding data centre energy consumption. Government should subsequently encourage the removal of "bronze" data centres (those not using green energy) in the UK. Similar to the country's shift away from coal energy, this could support the push for sustainable technological progress. It would also be appropriate to tangibly recognise instances where developers have acted sustainably by adapting an existing product, for example an LLM, rather than retraining or starting from the beginning, which has led to a lower carbon footprint.

6. Has the Climate Change Committee adequately taken account of the impact of data centres, especially in its advice on the Seventh Carbon Budget?

The Seventh Carbon Budget's long-term trajectories need to be assessed against recent developments in demand to support data centres and whether this affects any of the outlined assumptions (Source: IET response to the Seventh Carbon Budget inquiry).

In several instances within the report, it was not possible to identify the evidence supporting specific assumptions. The repeated use of the term “CCC analysis”, without citation, hinders scrutiny and limits confidence in the robustness of the conclusions. Furthermore, it introduces ambiguity regarding the claims made in CB7 and the mechanisms proposed to deliver its intended outcomes. This needs to be urgently addressed if the impact of data centres are to be truly and fully understood by the CCC and wider government.

7. What existing and emerging technologies can be used to minimise the environmental and climate change impact of data centres?

The UK must be cautious about investment in technologies that may or may not have reached their peak to minimise the environmental and climate change impact of data centres. There should be consideration surrounding whether the UK should invest in current technologies that are excelling so the tech’s security and durability is enhanced, invest in next generation technologies in an effort the lead in the field, or target and lead in niche topics such as: smaller machine learning or narrower AI approaches.

1. *How mature are these technologies and are they ready to be rolled out at the scale and pace required to match the potential expansion of data centres?*

N/A

2. *What specific role can renewable energy play in reducing the carbon footprint of data centres?*

A clean, modern and decarbonised grid will be vital in reducing the carbon footprint of data centres. Companies like Microsoft and Google are already exploring alternative power options such as nuclear technologies to power Large Language Models (LLMs). Government should invest in other clean energy technologies such as offshore wind, which has a proven track record in the UK to reduce data centres reliance on carbon heavy energy sources. recognising that current storage models (data centres) are unsustainable without greener infrastructure, government should build sustainability into appropriate regulation of new and expanding technologies to support renewable energy production playing a larger in reducing the carbon footprint of data centres, for example, the bronze, silver and gold rating system recommended by the IET.

8. What opportunities do data centres offer in helping to power and heat local communities and amenities and what will be required to deliver benefits?

Data centres present a significant opportunity to capture and repurpose waste heat to supply local communities and amenities. Realising these benefits could be supported through policies that encourage or require the availability of waste heat for reuse, alongside coordinated spatial planning to optimise its integration into local energy networks. Guidance from the UKNZCBS should inform this approach, particularly regarding best practice for connecting to district heating networks and for monitoring and measuring heat export in ways that address operational and security challenges for data centres.

9. Are there beneficial or precautionary lessons to learn from the impact of data centres outside the UK?

International experience underscores both beneficial insights and important precautionary lessons for the UK in shaping future planning and energy policies related to data centres. A detailed review published by the Virginia Joint Legislative Audit and Review Commission (JLARC)[5] assesses the economic, environmental and infrastructure impacts of data centres. This report highlights that while data centres contribute significantly to local economies, they have also driven very large increases in electricity demand, challenging utilities' ability to meet unconstrained growth and raising concerns about grid infrastructure capacity and costs for other customers. It notes that future energy generation and transmission expansion will be difficult to achieve in Virginia without targeted planning and investment, illustrating the need for early coordination between data centre deployment and electricity infrastructure planning.

America's energy pricing model is decentralised, and prices have been increasing in areas where data centres have been installed. This has led to consumers in areas where data centres are installed paying a higher price for electricity. As a result, serious discussions within the US surrounding legislation for energy pricing have taken centre stage. Given the discussions in the UK about local energy pricing, this issue could be an advance factor that the UK finds itself having to confront in the future.

Virginia's experience also reveals operational challenges when large clusters of data centres disconnect from bulk power following grid disturbances, as observed in regulatory filings indicating a near miss event in 2024 when 60 facilities collectively switched to backup power, forcing grid operators to take rapid action to rebalance supply and demand and avoid reliability risks. Formal analysis by the North American Electric Reliability Corporation (NERC) identifies such sudden load shifts as an emerging reliability issue that requires forward-looking grid planning and dynamic operational standards to ensure system stability.

Research from Sweden highlights how rapid data centre expansion can interact with regional grid capacity constraints[6]. In some Swedish regions, where distribution system operators are obliged to connect applicants to the grid on a non-discriminatory, "-first come, -first served-" basis grid capacity deficits have led to the postponement or refusal of grid connections for other local industries while data centres have been connected, raising equity concerns about how cultural, industrial and public infrastructure demands are balanced when capacity is limited.

New data centres in Frankfurt are facing the possibility of connection delays until the mid-2030's, as expansion and reinforcement of the grid hasn't kept pace with the IT and AI sector's

[5] https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf

[6] https://www.tandfonline.com/doi/full/10.1080/15487733.2021.1901428#d1e167

rapid expansion over the past years.[7] This is further compounded as grid reinforcement measures, such as large new cables and substations, often take several years to complete.

In Mexico, renewable plant operators are now mandated to add battery storage capacity to help stabilise the grid.[8] This, together with fees to cover grid connection costs, could be applied to Data centres as well. A mandated MW scale battery storage quota would increase the cost to IT operators, but would help match power demand and supply capacity, as batteries could be charged during times of lower power grid load, or high load from wind or solar generation. They would internalise real external cost of growing data centre fleets and would also provide operators backup in case of a power outage.

These international cases offer precautionary lessons for the UK's evolving policy context. Under the Planning Act 2008 and National Policy Statements, strategic infrastructure decisions require evidence of compatible grid capacity and resilience; Virginia's experience demonstrates the importance of linking long-term data centre approvals with clear load forecasts and capacity plans to avoid costly retrofits and unintended consequences for wider energy system users. Similarly, Sweden's example underscores the value of planned, transparent prioritisation frameworks when grid capacity constraints are acute something that could inform future UK grid access arrangements, Distribution System Operator (DSO) investment strategies and land use planning decisions.

More broadly, these experiences show that while data centres bring economic and digital benefits, ensuring compatibility with NESO forecasts and local electricity network plans, as well as embedding grid resilience criteria into local plans and development management, can help mitigate risks and align new development with national energy security and net zero objectives.

10. To what extent will the resource demands of data centres impact on other sectors with regard to competition for resources and decarbonisation?

Electric vehicles (EVs), heat pumps, artificial intelligence models and industrial electrification are all dependent on the timely expansion of low-carbon power generation, flexible system operation and reinforcement of electricity networks. Equally the economic viability of new generation and network development is dependent on the development of these demands to share the costs. The sequencing of generation, network capacity and end-use deployment must be carefully managed to avoid system constraints and affordability issues that could delay decarbonisation progress (Source: IET response to the Seventh Carbon Budget inquiry).

[7] https://www.fr.de/frankfurt/zu-wenig-strom-in-frankfurt-betreiber-von-rechnenzentren-mehr-als-ernuechternd-94224761.html
[8] https://www.pv-magazine.com/2025/03/31/mexico-announces-battery-storage-mandate-for-renewable-energy-plants/