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Centre for Sectoral Economic Performance

UK Data Centres Sector

UK Leadership in Digital Infrastructure

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Executive Overview and Study Objectives

Objective of This Study

This study reviews the UK data centre landscape, examining its current status, technological advancements, and economic opportunities. It focuses on understanding the role of data centres in the development of artificial intelligence (AI) and identifying related policy challenges. The report aims to determine how investment in data centre infrastructure can provide benefits to local communities and the nation. Additionally, it seeks to identify specific areas for further investigation to capture economic advantages regionally and nationally while promoting sustainability and innovation within the data centre sector.

Data centres are recognised as essential infrastructure for digital services and a crucial enabler of the AI revolution. The significant global investments in this sector underscore its importance, presenting considerable opportunities that necessitate well-defined policies and strategies to support data centre infrastructure. This study specifically explores avenues for UK leadership in data centre infrastructure, culminating in a set of conclusions and recommendations for UK policymakers. The structure of the report is intended to create a clear progression from understanding the current state to identifying future potential actions. It aims to build a coherent narrative, starting with an initial overview, moving through the current landscape, identifying gaps, exploring key trends and economic impacts, consolidating opportunities, and finally presenting recommendations and conclusions.

A core consideration of this study is how data centre investment can yield broader economic, social and societal benefits. To address this, the study identifies both local and national initiatives capable of steering development towards these greater benefits. The long-term vision is for UK data centres to become a catalyst for new economic growth, notably by driving innovation in AI, and by offering solutions to societal problems through the nurturing of a virtual ecosystem of new technologies and business models.

We adopt a multi-tiered approach to presenting our final analysis as a pragmatic approach to facilitate staged implementation. Accordingly, observations and suggestions are grouped into three clusters:

- **Cluster 1: Positioning the UK for organic data centre growth.** This set of suggestions represent minimum criteria intended to position the UK as "selectable" when companies consider data centre investment. It is "organic" in the sense that the recommendations here address the minimum required to keep the UK "in the game" rather than to differentiate it.
- **Cluster 2: Leveraging the circular potential of data centres.** Here the focus is on how to achieve additional economic growth, locally and nationally, because of data centre investment in a region. In particular, the core principle here is to leverage circular economy thinking to identify where there are adjacent opportunities with the potential to both stimulate additional growth and help all stakeholders address key environmental, social and governance (ESG) challenges and regulations. The recommendations in this section can position the UK as a leader in the sustainable development of data centres.
- **Cluster 3: Sustainable leadership through innovation.** The final cluster addresses applying recognised UK RD&I leadership to produce a deep ecosystem based on know-how and technology that is difficult to displace and provides more resilience to disruption in the data centre market.

The UK Data Centre Landscape: Status Quo and Economic Context

A Brief History of Data Centres

The concept of a data centre, as a dedicated location for large-scale, general-purpose computing, dates back to 1946 with the construction of the ENIAC computer at the University of Pennsylvania.[1] Initially, before the widespread adoption of the Internet, data centres were primarily viewed as remote, highly secure storage units, often with military applications where computing power was added for complex calculations such as missile trajectories in a controlled environment.

Up until the 1980s, the evolution of data centres centred on improving reliability through data storage integrity and corruption prevention. During this period, computing power remained expensive, leading many organisations to outsource their computing needs to specialist providers rather than maintaining in-house data centres, indicating that these early specialty data centres did not significantly add value to the broader economy per se.

A new phase of data centre evolution commenced in the 1990s, driven by the microprocessor boom, which enabled widespread access to desktop computing, the adoption of client/server application architectures, and critically, the rise of the Internet. This era focused on more agile IT, accelerating application delivery. Data centres transformed from hosting large mainframes to housing multiple racks of microprocessor-based servers, giving birth to the modern data centre. The early 2000s saw a surge in data centre growth, spurred by the critical need for businesses to have an Internet presence and the dot-com boom. However, the Nasdaq crash between 2000 and 2002 led to a significant downturn, resulting in the closure of many data centres globally.[2]

This downturn prompted a renewed focus on efficiency. New technologies such as virtualisation drastically reduced power consumption, space requirements and cooling needs. The 2008 financial crash further amplified the emphasis on efficiency and cost management, driving the rapid growth of IT collocation to reduce IT costs and leverage economies of scale, a market trend that persists today.

Current data centre evolution is being shaped by transformative trends such as cloud computing, the Internet of Things (IoT), and artificial intelligence (AI), with AI notably increasing demand for processing power, efficiency and scalability. Beyond economic and technological drivers, the industry is increasingly influenced by Sustainability, Environmental, Social, and Governance (SESG) regulations and reporting requirements. SESG practices have moved beyond mere compliance, with green and sustainable energy, carbon neutrality and infrastructure repurposing becoming major factors in data centre location and operational strategy[3].

In conclusion, data centres have become a vital and critical element of modern business infrastructure, agile in adapting to new trends and increasingly focused on achieving commercial advantage through proactive SESG engagement and operational sustainability.

[1] https://www.seas.upenn.edu/about/history-heritage/eniac/
[2] https://www.xyzreality.com/resources/evolution-and-future-of-data-centers

Core Data Centre Business Models

As discussed above, over the past decade, data centres have expanded rapidly, first in response to the global adoption of cloud computing, and, more recently, to meet the computational demands of artificial intelligence. The ways in which these facilities are owned, operated, and monetized vary widely, with significant differences between large "hyperscale campuses" and smaller, "edge-oriented" sites. In this section, we will discuss these different data centre "business models." A business model is, essentially, a description of how an organization creates, delivers, and captures value in order to achieve its goals (Massa et al., 2017)[4]. For data centres, that means the services they provide, the customers they serve, and the mechanisms by which they generate revenue.

There are several business models evident in the data centre ecosystem (see Figure 1 and Table 1). One prominent category is the hyperscale cloud provider model, exemplified in the UK not by domestic companies, but by the local operations of global firms such as Amazon Web Services (AWS), Microsoft Azure, Google Cloud, and Oracle Cloud[5]. These companies design, finance, construct, and operate very large facilities—often exceeding 20–50 megawatts (MW) of IT capacity — to host both their own products and the workloads of paying customers[6].

[3] https://www.digitalrealty.ie/resources/articles/europes-sustainable-data-centers-can-help-boostgrowth
[4] Massa, L., Tucci, C.L. and Afuah, A., 2017. A critical assessment of business model research. Academy of Management Annals, 11(1), pp.73-104.

Companies such as Google, Meta, and Apple do not operate UK hyperscale campuses solely for their internal use (much of their European private capacity is concentrated in Ireland and the Nordics). They do, however, maintain UK-based edge and network facilities / points of presence to support their services. Hyperscale operators can directly monetize their capacity that they own and operate through cloud services—computing, storage, networking, and increasingly AI training and inference—sold on a usage basis. They have large capacity for more virtual machines, storage volumes, and AI workloads. These companies also employ indirect monetization models through the local footprints of global platforms.[7] These sites enable high-margin products such as advertising, content delivery, and app marketplaces, making them economically important even though they do not generate revenue from direct hosting contracts.

A second major business model is retail colocation, well represented in the UK by companies such as Telehouse (KDDI's subsidiary with major sites in London Docklands), Equinix (with multiple London and Manchester facilities), and Global Switch (Canary Wharf)[8]. These firms own and operate facilities that host IT equipment for many different tenants, often in small increments from a single rack upwards. Their value proposition lies in providing highly connected environments, giving customers direct access to multiple telecom carriers, cloud on-ramps, and Internet exchanges such as LINX (London Internet Exchange). The revenue model is predominantly recurring: customers pay monthly for space, power, and cooling, plus premium charges for cross-connects (private network links between tenants) that are profitable because they encourage more organizations to colocate in the same building. Contracts are often priced per kilowatt or per megawatt committed.

Wholesale colocation is also well established in the UK, with operators such as Virtus Data Centres (now part of ST Telemedia Global Data Centres), Kao Data (focusing on AI and high-performance computing workloads), and Digital Realty (with large campuses in Slough and Chessington)[9]. Wholesale providers lease large suites or entire buildings, often under multi-year agreements, to hyperscalers, large enterprises, or government clients. Many operate under real estate investment trusts (REITs) structures or with infrastructure-fund backing, prioritizing high occupancy and efficient capital deployment so that each MW of IT capacity is matched by committed tenants[10]. MW of IT capacity is a primary driver in revenue forecasting and asset valuation, as it sets the ceiling for achievable rental income.

Next, the telecom-integrated model has strong UK roots[11]. BT, for instance, operates data centres that support both its retail and wholesale network businesses, while Virgin Media O2 integrates hosting with its connectivity services for enterprise customers. International telecoms with a UK presence, such as NTT and Colt, also use data centres to anchor network services, capturing value both from colocation fees and from increased demand for bandwidth, managed security, and cloud connectivity.

Specialist developers and build-to-suit operators are active in the UK market as well[12]. Compass Datacenters and EdgeConneX have delivered or planned UK facilities tailored to specific clients, often hyperscalers or content delivery networks. These developers essentially build datacentres and earn revenues from project delivery, construction margins, and, in some cases, long-term leases. Here again, the ability to bring capacity online rapidly is a competitive advantage, especially in markets such as London and Slough where power availability is a growing constraint.

[5] See https://www.mordorintelligence.com/industry-reports/united-kingdom-hyperscale-data-centermarket, https://www.channelfutures.com/cloud/aws-azure-gcp-dominate-global-data-center-capacity,https://www.nmrk.com/storage-nmrk/uploads/documents/Uk-site/Research/Newmark-UK-datacentres-0625.pdf, https://www.grandviewresearch.com/industry-analysis/hyperscale-data-centermarket, https://stlpartners.com/articles/data-centres/regional-data-centre-strategy-at-a-crossroads/,and https://www.reuters.com/technology/amazon-invest-10-billion-uk-data-centres-2024-09-10/.
[6] MW of IT capacity is a key industry metric, referring to the maximum continuous electrical load that can be delivered to computing hardware such as servers, storage, and networking devices, excluding the additional power used for cooling and other building systems. This metric is critical because it directly defines the sellable capacity of a facility.
[7] E.g., https://aws.amazon.com/about-aws/global-infrastructure/, see also https://www.credenceresearch.com/report/united-kingdom-data-center-market and https://www.nmrk.com/storage-nmrk/uploads/documents/Uk-site/Research/Newmark-UK-datacentres-0625.pdf.
[8] See https://www.credenceresearch.com/report/united-kingdom-data-center-market,https://www.globenewswire.com/news-release/2025/05/14/3080872/28124/en/European-Data-Center-Construction-Market-Industry-Outlook-Report-2025-2030-New-Entrants-Stir-Up-Competition-in-Europe-Data-Center-Market-A-32-27-Billion-Market-by-2030-Rising-at-a-.html,https://finance.yahoo.com/news/uk-data-center-market-investment-181200134.html,https://datacentremagazine.com/top10/top-10-data-centre-leaders-in-the-uk-europe-june-2025, and https://www.byteplus.com/en/topic/406821.
[9] https://www.credenceresearch.com/report/united-kingdom-data-center-market,https://www.byteplus.com/en/topic/406821, https://www.marketresearchfuture.com/reports/uk-datacenter-market-44820, and https://www.thetimes.com/business-money/companies/article/the-newwave-of-mega-data-centres-coming-to-a-town-near-you-0flklr0d9.
[10] See https://finance.yahoo.com/news/uk-data-center-market-investment-181200134.html, https://www.businesswire.com/news/home/20250707067846/en/Western-Europe-Existing-Upcoming-Data-Center-Portfolio-Database-2025-UK-Spain-Germany-Lead-Upcoming-Data-Center-Developments---ResearchAndMarkets.com, and https://www.globenewswire.com/newsrelease/2025/05/14/3080872/28124/en/European-Data-Center-Construction-Market-Industry-Outlook-Report-2025-2030-New-Entrants-Stir-Up-Competition-in-Europe-Data-Center-Market-A-32-27-Billion-Market-by-2030-Rising-at-a-.html.
[11] See https://www.marketresearchfuture.com/reports/uk-data-center-market-44820,https://www.globenewswire.com/news-release/2025/05/14/3080872/28124/en/European-Data-Center-Construction-Market-Industry-Outlook-Report-2025-2030-New-Entrants-Stir-Up-Competition-in-Europe-Data-Center-Market-A-32-27-Billion-Market-by-2030-Rising-at-a-.html, and https://www.credenceresearch.com/report/united-kingdom-data-center-market
[12] See https://www.thetimes.com/business-money/companies/article/the-new-wave-of-mega-datacentres-coming-to-a-town-near-you-0flklr0d9 and https://www.thetimes.com/businessmoney/technology/article/uk-plays-catch-up-in-data-centre-race-v82jrckhw.

Across these models, the UK industry structure mirrors global patterns but with its own mix of players and market dynamics. Hyperscale capacity is provided by multinational cloud operators with UK units (e.g., AWS London, Azure UK South/North, Google Cloud London). Retail and wholesale colocation markets are mature and densely interconnected, with London ranked amongst the world's largest colocation hubs.Telecom-integrated operators remain significant given the UK's established communications sector. Specialist developers focus on niche or high-performance segments, while indirect monetization is tied to the UK's role as a network and content distribution node.

In summary, data centre capacity links the physical constraints of power delivery to the financial potential of the asset, whether that revenue comes from selling cloud compute cycles, renting racks in a colocation hall, leasing wholesale suites, bundling hosting with network services, or enabling entirely different profit streams. In the UK context, where power availability, land cost, and fibre connectivity are all highly concentrated in certain metropolitan areas, the ability to secure and monetize capacity is a decisive factor in the success of every business model in the data centre ecosystem.

Data centre business models are rapidly changing due to advances in AI and greater needs for flexibility and sustainability. The move to "as-a-service" (OpEx) models is reshaping IT resource acquisition, while providers invest heavily (CapEx) to enable usage-based pricing. Sustainability regulations now strongly impact site selection and operations, making green energy, carbon neutrality, and waste heat reuse important commercial considerations.

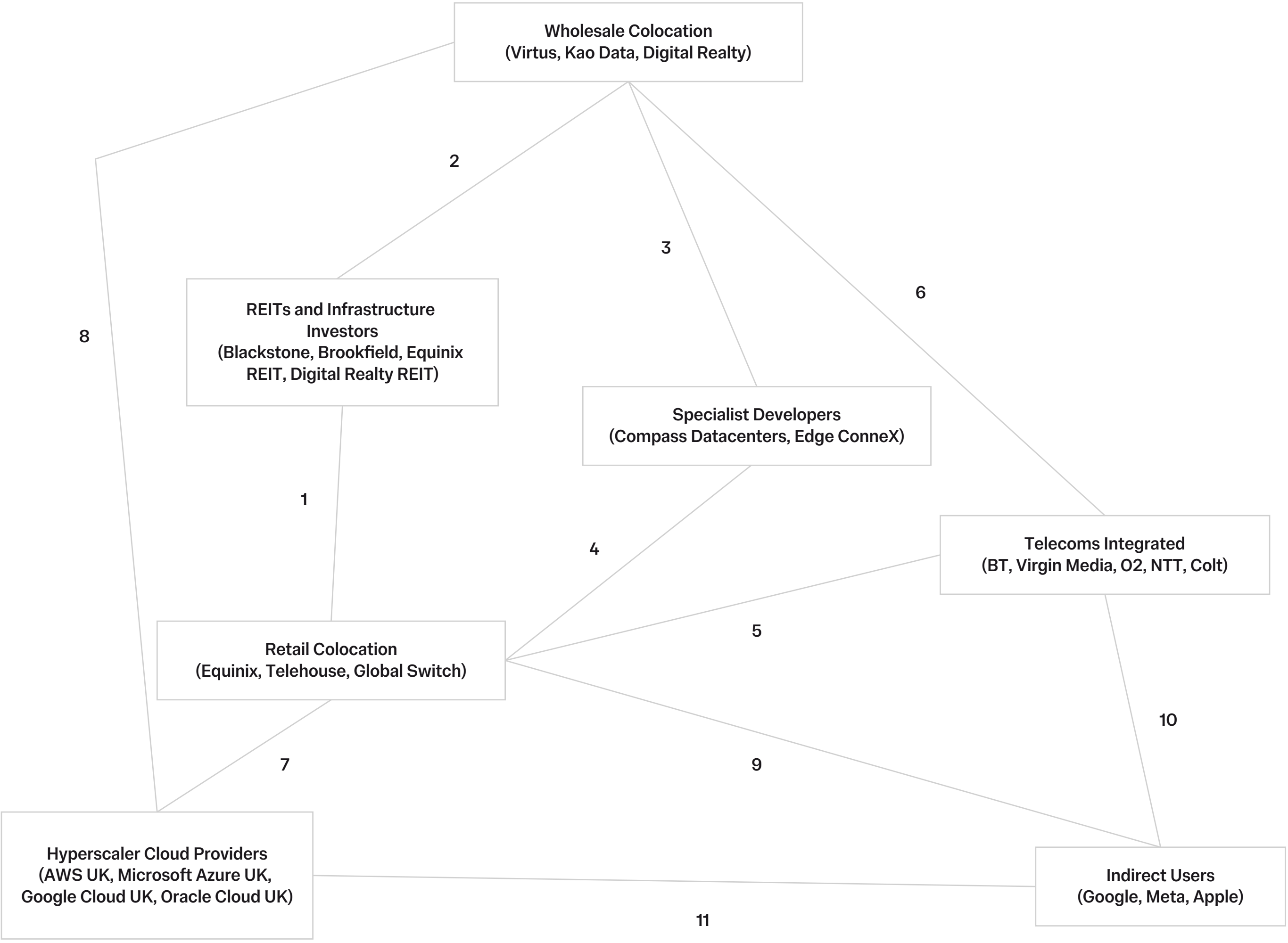


Figure 1. Data centre business model configurations

#	From → To	Commercial Relationship	Who Pays Whom	Revenue Type	Business Model Implication
1	Infrastructure Investors / REITs → Retail Colocation	Investors provide capital to build/acquire facilities; colocation operator leases them	Retail colocation operator pays rent/lease fees to investor (if externally owned)	Direct (lease income for investor)	Retail operator monetises space/power; investor captures steady real estate yield
2	Infrastructure Investors / REITs → Wholesale Colocation	Same as #1 but for large-scale wholesale facilities	Wholesale colocation operator pays investor	Direct (long-term lease income)	Investor gets predictable returns; wholesale operator sells MW capacity to hyperscalers
3	Specialist Developers → Wholesale Colocation	Developer builds custom facility; leases or sells to wholesale operator	Wholesale operator pays developer (purchase price or long-term rent)	Direct	Developer monetises build expertise; wholesale operator expands capacity without own construction risk
4	Specialist Developers → Retail Colocation	Developer delivers powered shell or full site; retail colo takes over	Retail colocation operator pays developer	Direct	Retail operator expands into new markets faster; developer profits from project delivery
5	Retail Colocation → Telecom-Integrated	Tenants in retail colo need network access; telecom sells connectivity	Customer in colo pays telecom for connectivity; may also pay cross-connect fee to colo	Direct (telecom), Direct (colo crossconnect)	Hosting generates follow-on network revenue; ecosystem stickiness
6	Wholesale Colocation → Telecom-Integrated	Large wholesale tenants (e.g., hyperscalers) buy network services from telecom	Tenant pays telecom	Direct	Telecom monetises connectivity to major tenants; can bundle with other services
7	Hyperscale Cloud Providers → Retail Colocation	Cloud provider presence (onramps) drives other tenants to colocate	Other tenants pay retail colo for racks and cross-connects to cloud	Indirect for cloud provider; Direct for colo	Cloud's infrastructure acts as anchor tenant, boosting colo occupancy
8	Wholesale Colocation → Hyperscale Cloud Providers	Hyperscaler leases large capacity from wholesale provider	Hyperscaler pays wholesale colo	Direct	Wholesale operator monetises MW-scale deals; hyperscaler scales region without building
9	Indirect Users / Edge → Retail Colocation	Content platforms/CDNs place edge servers in colo sites	Content provider pays colo for space/power	Direct	Colo gains premium tenants with high interconnect needs
10	Indirect Users / Edge → Telecom-Integrated	Edge traffic requires bandwidth and backhaul; telecom sells capacity	Content provider pays telecom	Direct	Telecom benefits from content-driven data flows
11	Hyperscale Cloud Providers → Indirect Users / Edge	Hyperscaler's private infrastructure supports platform services (ads, content, apps)	No external payment; internal cost allocation	Indirect	Data centre is cost centre enabling profitable services (ads, SaaS, marketplaces)

Table 1. Value capture in data centre business models (description of arcs in Figure 1)

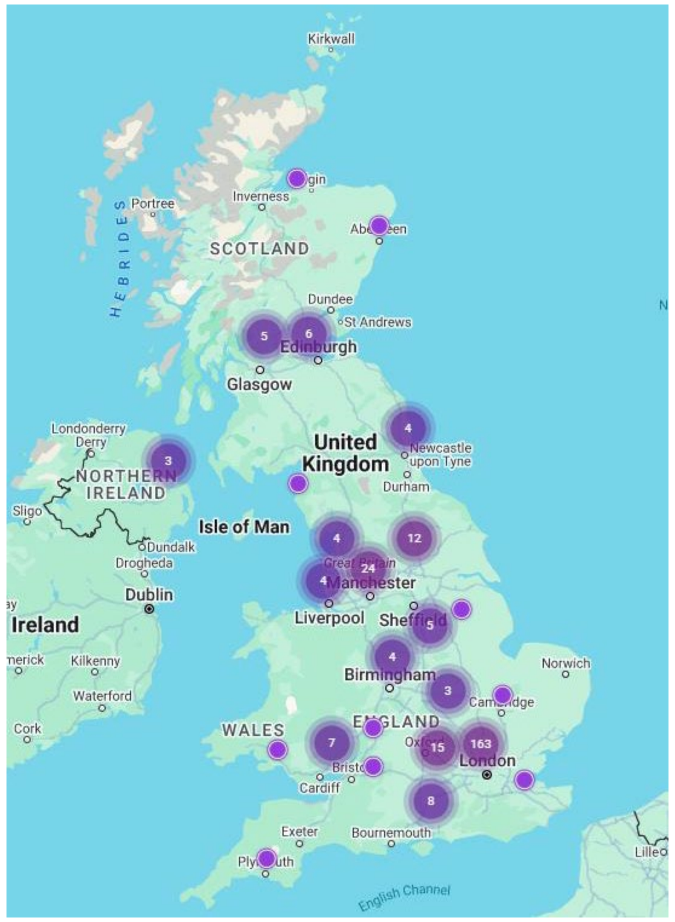


Figure 2. Geographical distribution of data centres in the United Kingdom (source: datacenters.com)

Data Centres in the United Kingdom

The number of data centres in the UK correlates with its population size, economic status and international technological standing. Globally, the United Kingdom ranks 3rd in terms of major data centre facilities. When considering major data centre facilities per capita, the UK ranks 12th globally, with 2.5 data centres per million people. Among a selection of leading international digital technology countries, the UK stands at 6th position for data centres per capita (7.6 per million people), trailing the Netherlands, USA, Australia, Ireland and Canada. Table 1 shows an indicative ranking of countries based on the number of data centres per capita. It includes a representative selection of nations, with rank numbers reflecting their overall global positions among all countries. The values provided were sourced or calculated from publicly available data.[13]

Country	No. of DCs	DC / 1m capital	DC / 1t$ GDP
Australia	106	11.8	182
Canada	127	8.5	157
China	343	0.3	25
France	101	4.8	106
Germany	150	6.3	119

Table 2: Data centres in indicative selected countries (source: cloudscene.com, 2025)

In terms of data centres per unit of Gross Domestic Product (GDP), the UK shares the 4th position with Canada (157 per trillion $ GDP), behind the Netherlands, the USA and Australia. These rankings provide an indication of the UK's development and international standing in data centres, though they do not account for the size or capacity of individual facilities.

[13]datacentres.com, worldometers.info, wikipedia.org

The United Kingdom's Market Share and Direct Economic Contribution

The UK's international commercial standing in data centre technology can be assessed by comparing its annual revenue in the sector to global figures. The UK's market share has remained between 4.0% and 4.3% in recent years. However, slower growth is projected for the next four years, with an expected drop to 3.8% within the next three years.

Data Center - Revenue by Segment

United Kingdom (billion USD (US$)

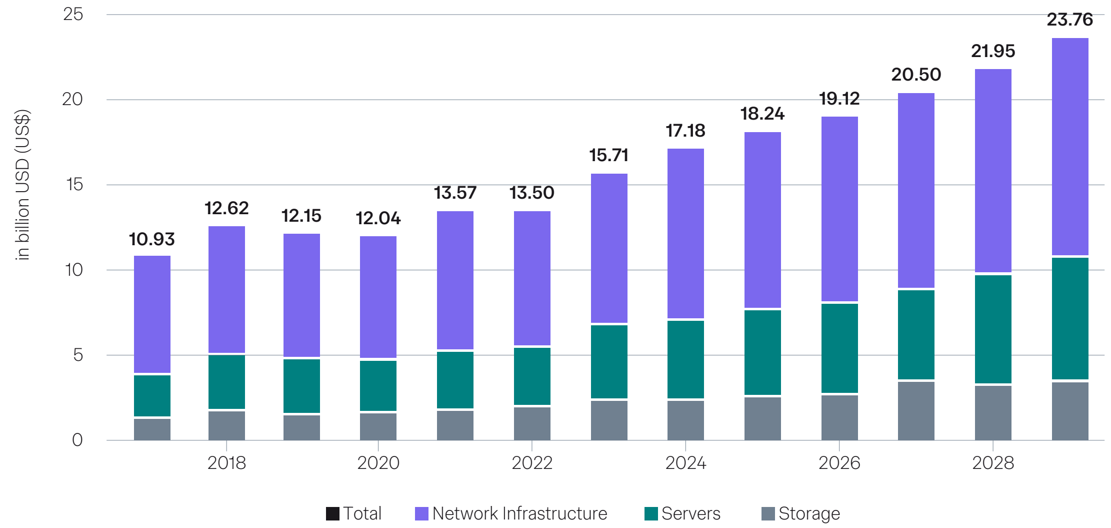


Figure 3: United Kingdom data centre revenue between 2017 and 2029 (projected) (source: Statista)

Data Center - Revenue by Segment

Worldwide (billion USD (US$))

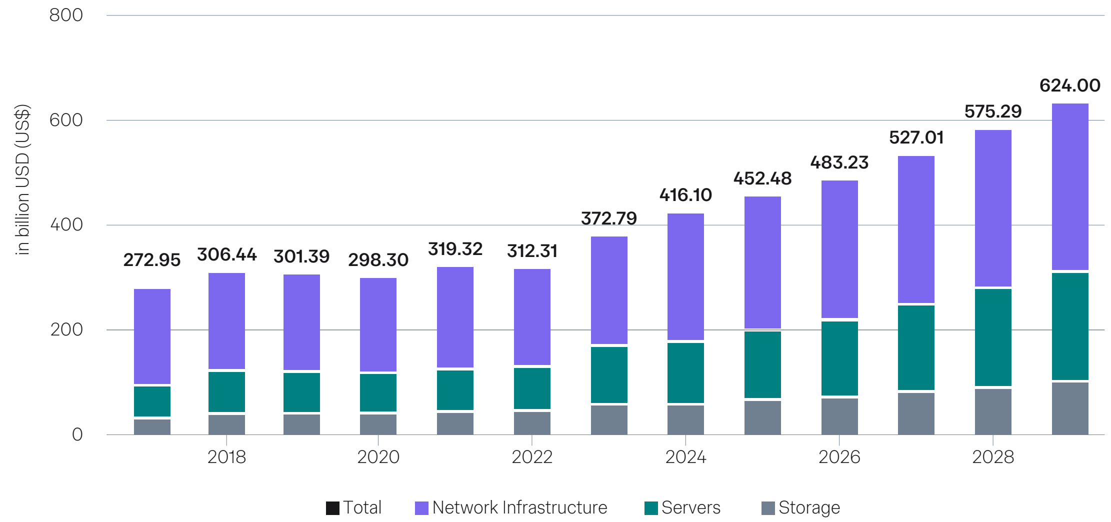


Figure 4: Global data centre revenue between 2017 and 2029 (projected) (source: Statista)

Conversely, the UK data centre market size as a percentage of GDP has grown from 0.4% to nearly 0.5% between 2017 and 2023. This percentage is larger than that for most other key data centre countries, indicating significant gross revenue and investment in both absolute and relative terms.

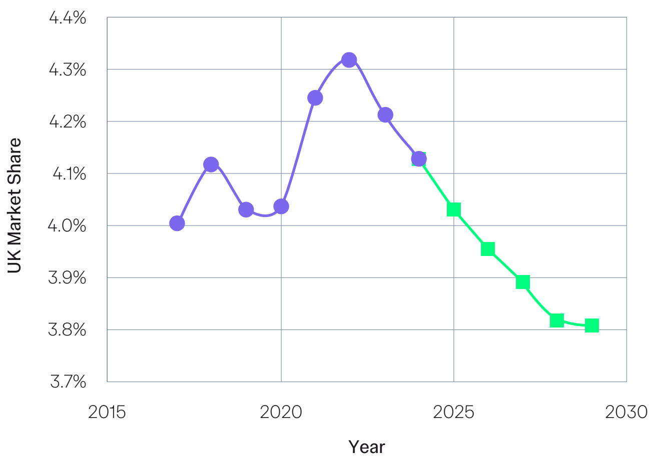


Figure 5: United Kingdom data centres market share between 2017 and 2029, calculated from Figure 2 and Figure 3.

To assess the economic contribution, it is important to consider the specificities of the data centre business model. Due to the relatively small number of personnel required for operations, revenue from service provision and data exploitation is primarily distributed among real estate, electricity, software and electronic infrastructure costs, as well as profit. While real estate and electricity sectors are saturated in demand and thus offer limited margin for significant national economic contribution, the productive part of data centre revenue corresponds to associated software and electronic hardware market investments. This highlights that the national economic benefit from data centre infrastructure partly relies on the nation's standing in underlying technologies such as data processing, storage and transmission hardware, and supporting software. The UK's global market share in electronic products and components manufacturing is only 1%. Therefore, investment in support of the electronic industrial sector, including research, development and manufacturing, is necessary in the UK to fully capitalise on data centre market development.

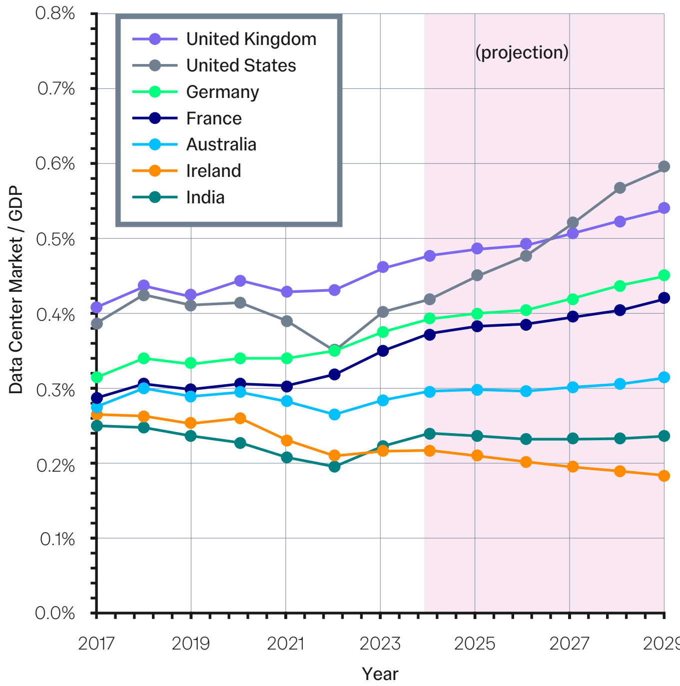


Figure 6: Market size as % of GDP for UK in comparison with Australia, France, Germany, India, Ireland and USA. Data Source: Statista.

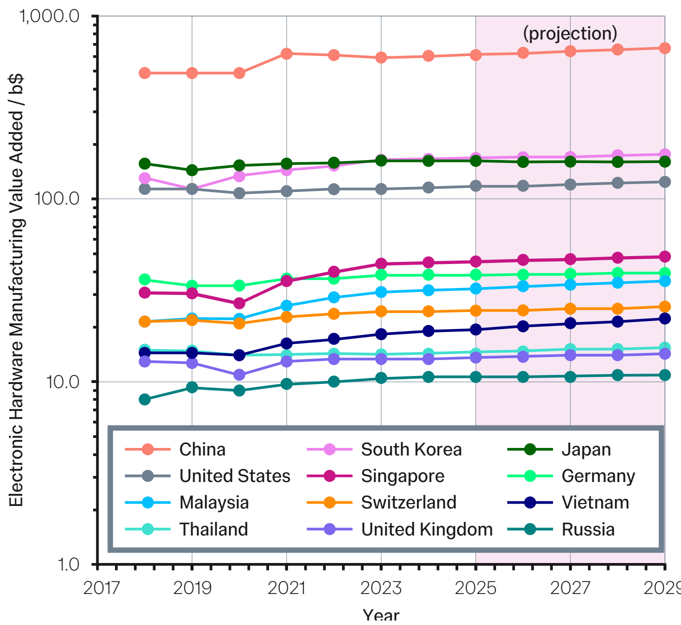
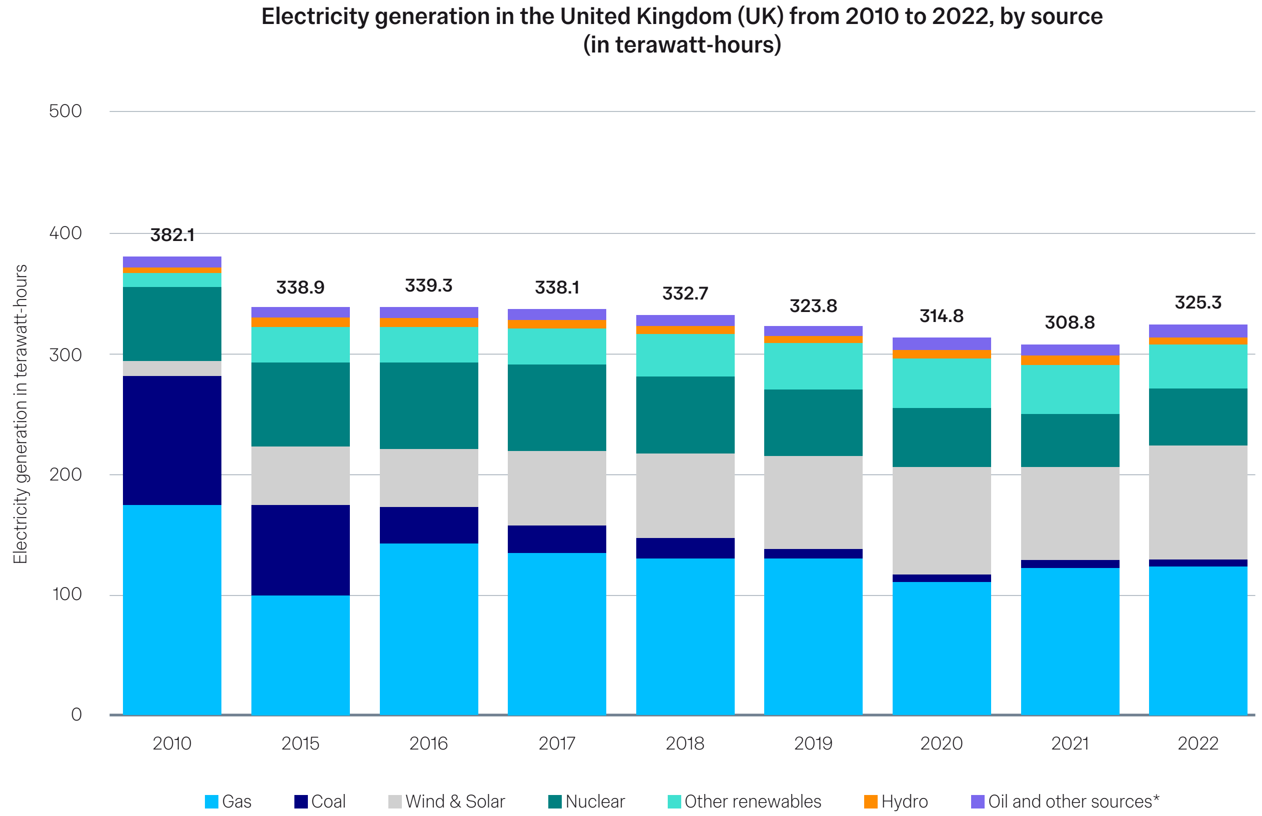


Figure 7. Added value of the electronic products and components market, including computer, electronic, and optical products, for the top twelve countries worldwide (source: Statista)

The market for cloud services, enabled by data centres, is growing rapidly, with global estimates reaching $678 billion in 2023 and projected to grow to $2.4 trillion by 2030. The UK cloud computing market was approximately £19 billion in 2023, projected to reach £73 billion by 2032. This growth is driven by increased demand for IT scalability, cost-effectiveness, remote work and corporate/state digital transformation. Amazon Web Services (AWS), the largest cloud provider globally, recently announced an £8 billion investment in AWS infrastructure in the UK over the next ten years. There is also a trend towards data protection investments, such as Salesforce's Data Cloud services in the UK, enabling local companies to comply with regulatory requirements.

Data Centres, Power and Geographical Distribution in the UK

The UK's international commercial standing in data centre technology can be assessed by comparing its annual revenue in the sector to global figures. The UK's market share has hovered between 4.0% and 4.3% in recent years. However, slower growth is projected for the next four years, with an expected drop to 3.8% within the next three years.



Sources
Office for National Statistics (UK); GOV.UK; Department for Energy Security and Net-Zero (UK)

Additional
United Kingdom; Office for National Statistics (UK); Department for Energy Security and Net-Zero (UK); 2010 to 2022

Figure 8: United Kingdom overall electricity demand between 2010 and 2022.

Currently, the annual energy consumption of data centres in the UK is approximately 5 TWh, representing 1.5% of the total electricity generation projected for 2025. However, projections indicate that data centre power demand could significantly increase, reaching up to 35 TWh by 2050, which would equate to 10% of current UK generation (Figure 8). This growing demand may be met through the development of renewable energy sources, provided an effective strategy for location selection and time-synchronisation is implemented.

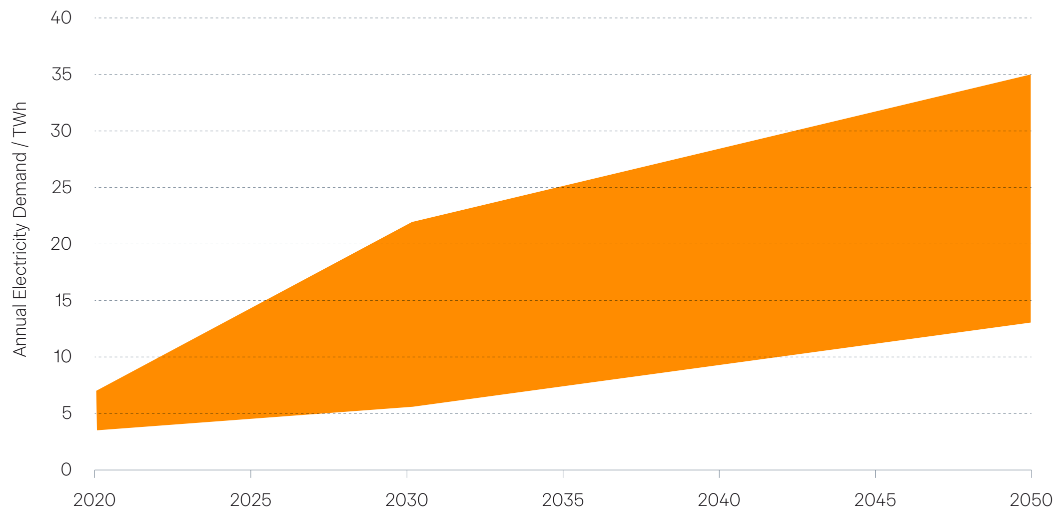


Figure 9: United Kingdom data centre power consumption projection between 2020 and 2050 (source: What are data centres and how will they influence the future energy system? National Grid ESO, March 2022)

The efficiency of energy use within a data centre is measured by power usage effectiveness (PUE). PUE is calculated by dividing the total power entering a data centre by the power used exclusively by IT equipment. The industry globally aims for a PUE of 1.0, meaning all energy entering the data centre powers IT equipment. While the worldwide average PUE was 1.55 in 2022, with large technology companies achieving as low as 1.08, the average PUE for British data centres was 1.35 in 2024, with a reported range between 1.12 and 1.90. Reducing PUE is a key strategic focus.

The current distribution of UK data centres has evolved organically, driven by demand location and data connection infrastructure (Figure 9). Approximately 68% (116 out of 170) of UK data centres are located within Greater London, reflecting a concentration of service demand. Other major clusters include Manchester (13%, 22 data centres), Glasgow and Edinburgh (3%, 5 data centres), Cardiff (3%, 5 data centres), and Birmingham (2.4%, 4 data centres). This distribution largely aligns with telecommunication hubs, especially in London, indicating that data network development and data centre concentration have been driven by similar digital service demands. The UK's position as a landing point for a large proportion of high-capacity data links from North America provides a strategic advantage in data handling services.

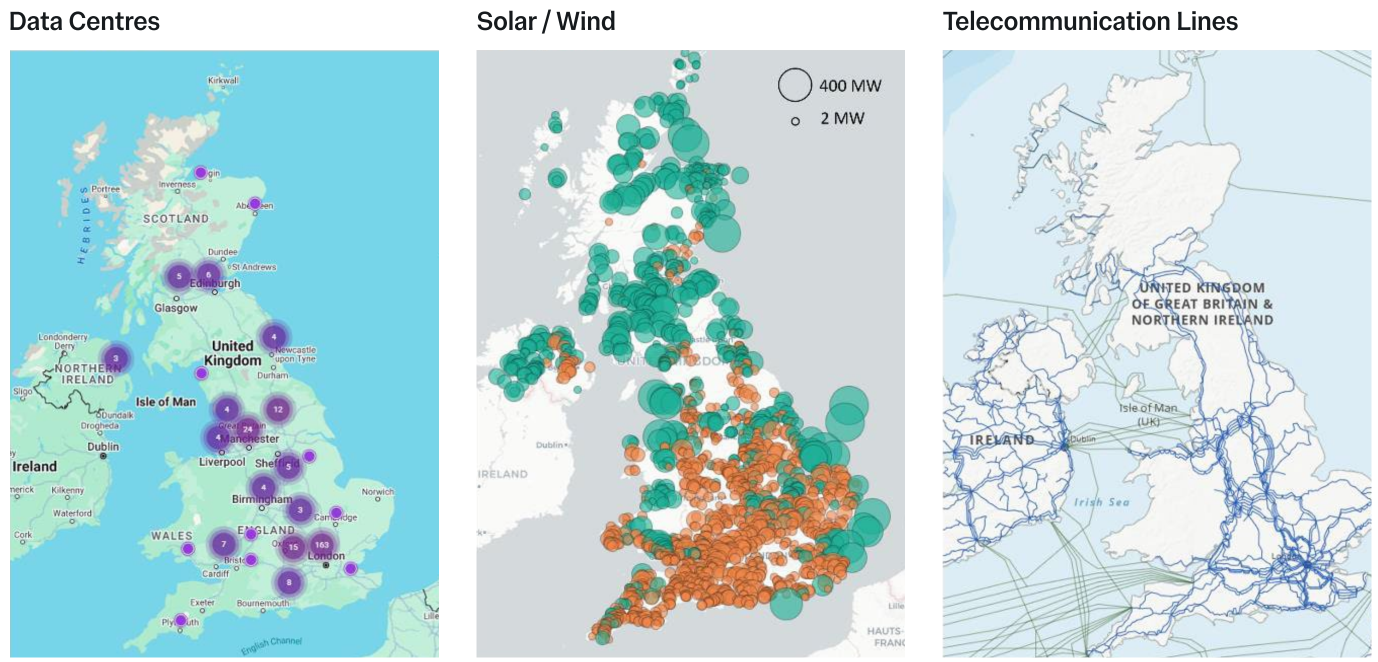


Figure 10: Location distribution of data centres (Left), renewable power plants (Middle) and optical fibre telecommunication lines (Right) in the United Kingdom (sources: bbmaps.itu.int/bbmaps/, datacenters.com, energydashboard.co.uk/map)

There is limited geographical alignment between wind power generators, which are concentrated in Scotland and the east coast of England, and data centre locations (Figure 9). Solar power plants, however, are more distributed in the south, including around London and Cardiff, providing some coincidental alignment. The timing mismatch between renewable energy production and demand necessitates significant investment in large-scale energy storage (Figure 10). Given the high storage capacity requirements and costs of current technologies, other load balancing techniques are necessary. One solution is time-shifting a substantial portion of data centre processing tasks, such as large language model training, data analysis and software updates, closer to renewable energy sources.

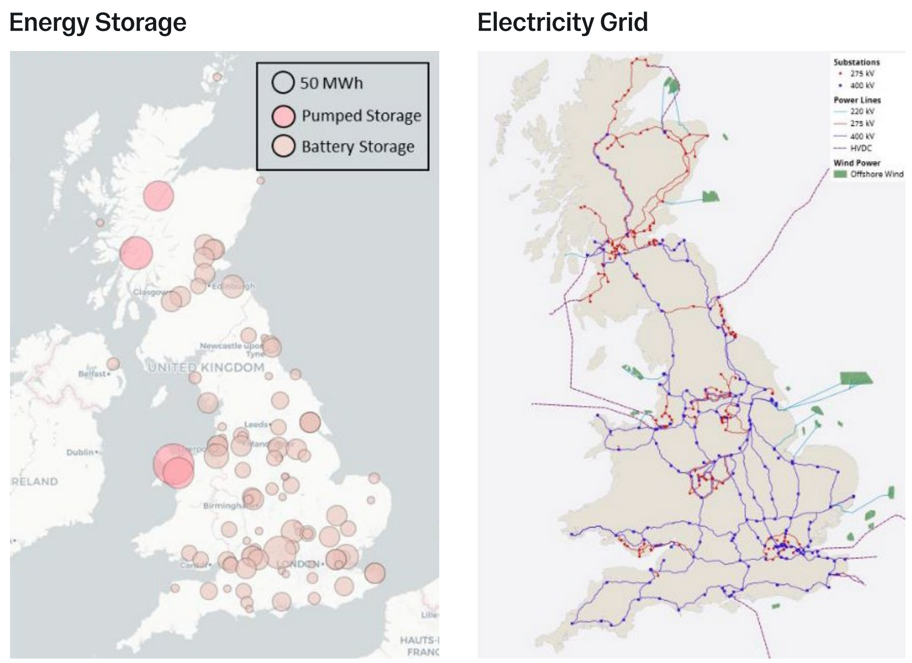


Figure 11. Distribution of energy storage (left, from energydashboard.co.uk) and power transmission lines (right, from National Grid, Russss, OpenStreetMap contributors, CC BY-SA 4.0) in the UK.

A significant consideration is the large amount of waste heat generated by data centre operations. Reusing this waste heat for district heating of adjacent neighbourhoods or for agricultural operations is a practical solution to maximise benefits and minimise environmental impact. For example, in Stockholm, 30,000 homes were heated this way by 2022, demonstrating successful implementation. This underscores the advantages of a national strategy and regional coordination for data centre development in the UK, focusing on co-location with renewable power plants, telecommunication hubs, and areas with high heating demand or potential agricultural users. Investment in digital storage, processing, and networking technology would improve access, influence, security and national economic gain from data centre technology growth.

Current Strategic Alignment Efforts and Identified Gaps

Review of Current UK Stakeholder Alignment Initiatives

Efforts to strengthen strategic coordination among UK data centre stakeholders are becoming increasingly visible, woven through both government policy and industry-led initiatives. The significance of data centres to the nation's digital backbone has been recognised at the highest levels, prompting a suite of supportive measures designed to foster growth, resilience and security.

For example, data centres have now been officially designated as critical national infrastructure (CNI). This vital status ensures that robust protections are in place against disruptive events, such as cyberattacks or power outages, reflecting their indispensable role in keeping the UK connected and secure. Policymakers have also taken steps to streamline the planning and development process: updates to the National Planning Policy Framework (NPPF) acknowledge the essential nature of data centres, making it easier to identify suitable sites and deliver the supporting infrastructure they require. The introduction of AI Growth Zones further underscores this commitment, with these zones aiming to speed up planning approvals and improve access to the national energy grid—essential ingredients for the next generation of digital innovation.

Broader strategies underpinning the UK's digital future are also taking shape. The National Data Strategy brings a renewed focus to risk management within the country's data infrastructure, while the recently introduced Security and Resilience Regulations create a legal framework to safeguard data centres from a wide variety of threats. Collaboration within the industry itself is another cornerstone of progress. A number of dedicated groups are working to unite operators, government, and other stakeholders around common goals. The Data Centres Council, for instance, provides strategic guidance and acts as a bridge between industry and government, ensuring the sector's voice is heard in policy discussions. The Data Centres ESG+ Group is championing sustainability and positive social impact, while the Data Centre Skills Group is actively promoting careers in the sector and supporting professional development for those already working within it. In addition, the Data Centres Policy Working Group keeps members informed of the latest policy changes, regulatory developments, and best practices—ensuring that the industry as a whole remains agile and well-prepared for future challenges.

Together, these efforts are building a foundation for a more resilient, secure and forward-looking data centre ecosystem in the UK—one that is well equipped to support the country's growing digital ambitions.

Collaboration on standards is a primary focus, with the industry adopting international standards like ISO/IEC 27001 and participating in government-backed schemes such as Cyber Essentials. These efforts demonstrate a dedication to fostering a secure, sustainable and resilient environment for data centres.— to host both their own products and the workloads of paying customers.

Addressing the complex challenges facing the UK's data centre sector requires more than just technical fixes—it demands a collaborative and forward-thinking approach. Several key areas are now the focus of both government and industry efforts, each contributing to a more resilient digital future:

(1) Grid Connections Reform: The National Electricity System Operator (NESO) is taking decisive steps to prioritise projects essential to the country's technological backbone, with data centres high on the list. New reforms will help ensure that such critical projects get the grid connections they need, when they need them. In addition, the government is considering using new powers provided by the Planning and Infrastructure Bill to directly accelerate grid connection timelines for projects that have wide-reaching national significance.

(2) Energy Supply and Sustainability: On the energy front, there is a clear drive to power data centres sustainably. The government and industry are joining forces to expand the use of renewable energy sources and embrace cutting-edge advances, such as Small Modular Reactors (SMRs), as part of the solution. The establishment of an AI Energy Council further underlines this commitment, creating a dedicated forum for dialogue between the AI sector and energy providers to ensure the needs of tomorrow's digital infrastructure can be met reliably and responsibly.

(3) Planning Bottlenecks: Recognising the need to keep pace with digital transformation, the government has streamlined planning pathways for data centres by including them in the National Planning Policy Framework and creating specialised AI Growth Zones. These measures are designed to make the development process swifter and more predictable. Looking ahead, there is ongoing consideration to classify certain largescale data centre projects under the Nationally Significant Infrastructure Projects (NSIP) regime. This change could empower ministers to make decisions in the national interest—potentially overcoming local obstacles that might otherwise slow progress.

(4) Public Awareness and Education: Efforts are also underway to demystify the world of data centres for the wider public and to nurture the next generation of talent. Initiatives range from public education campaigns that highlight the crucial role data centres play in everyday life, to embedding knowledge of digital infrastructure and operations into STEM curricula at schools and universities. These steps aim to build wider understanding and enthusiasm for the sector, ensuring the UK has both the public support and skilled workforce necessary for continued growth and innovation. By tackling each of these areas with purpose and partnership, the UK is steadily laying the groundwork for a data centre ecosystem that will help power its digital ambitions for years to come.

There are significant areas of synergy between existing UK stakeholder initiatives and the key opportunities identified in this report which may provide opportunities for better alignment:

- Planning and Site Selection: Recommendations to identify high-potential locations align with NPPF updates and AI Growth Zones, with co-funding mechanisms providing practical alignment.

- Energy Efficiency and Sustainability: Existing efforts to use renewables and explore SMRs, along with the ESG+ Group, are reinforced by recommendations for PUE reduction, co-location with renewables, and reliable power supply. The AI Energy Council also aligns with meeting future energy demands.

- Data Security and Resilience: Government designations (CNI, National Data Strategy, Security and Resilience Regulations) directly support prioritising hardware-implemented security for data sovereignty. Industry collaboration on standards like ISO/IEC 27001 further strengthens this.

- Skills and Workforce Development: Initiatives by the Data Centre Skills Group and STEM curricula align with promoting skills development.

- Innovation in AI Infrastructure: AI Growth Zones and the AI Energy Council align with supporting research-led innovation in AI workloads and fostering UK AI hardware and model development, leveraging the UK's academic and entrepreneurial ecosystem.

Areas of Potential Gaps in Current Policy and Coordination

Despite existing initiatives and synergies, the report highlights several areas where current policy and coordination may fall short. These identified gaps underscore the need for further investigation and subsequent action:

- National Network Latency: London's connectivity to other major UK cities is noted as less efficient than its international links. The explicit recommendation to reduce national network latency to regions outside the London-M25 area addresses a specific infrastructural challenge not prominently detailed in current policies.

- Coordinated National Strategy and Governance: Coordination across the full spectrum of stakeholders is largely left to the initiative of individual organisations. This suggests a gap in overarching, integrated strategic planning. The strong recommendation to establish a national data centre strategy with clear objectives and a dedicated coordination committee, potentially within the Department of Energy Security and Net Zero, directly addresses this perceived lack of a cohesive, centralised strategic body. A "Data Centre Coordination Committee" for heating demands and operator assistance is also proposed.

- Deep Investment in Underlying Hardware Technology: While there is a general focus on AI innovation, the UK's market share in electronic products and components manufacturing is only 1%. The report explicitly recommends investing in enhancing access to underlying and novel data storage technologies (e.g., optical microchips) and promoting recycling through sustainable and modular chip integration methods. This indicates a gap in direct, targeted investment in the manufacturing and R&D of core data centre hardware components beyond just AI accelerators.

- Community Engagement and Social Integration: Existing policies facilitate planning and energy access, but recommendations extend to emphasising engaging with local communities to avoid displacement, ensure local employment, provide safe working conditions, and integrate data centres with societal entities like libraries, universities, and district heating systems. This level of direct social and community integration is not as explicitly detailed in current policy descriptions.

- Waste Heat Reuse Implementation: Although sustainability is a goal, the specific and significant opportunity of waste heat reuse for district heating or agricultural operations, as demonstrated by examples like Stockholm, is highlighted as a more emphasised recommendation for future development rather than a current widespread policy focus.

- Comprehensive Data Governance (beyond Security): While current regulations address risk management and security, the recommendations delve deeper into policy and regulation for transparency of data status, clarification of data ownership and privacy, and exploring legislative measures to expand the creative commons framework for analysis and intellectual content rights. These broader governance and ethical considerations for data use extend beyond mere data security, indicating a potential area for more comprehensive policy development.

Key Technology Drivers: Trends, Economic Impact and Business Models

Key Mega-Trends Driving Data Centre Evolution

Several profound technological shifts, popularly termed "mega-trends," are transforming data centre operations and present opportunities for UK leadership through focused research, development and innovation. These trends span from physical location to hardware and software stacks, driven by pragmatic application needs:

Trend 1: The Rise of Edge and Mega Data Centres (Architecture)

Driven by evolving application requirements, data centres now range from vast mega hubs to compact, strategically placed sites. Hyperscalers, i.e. companies that operate massive data centres such as Google and Microsoft, are investing in building large data centre hubs. AI workloads—such as those powering ChatGPT—are fuelling hyperscaler investment in immense facilities, with Google projecting $75bn in infrastructure spending for 2025.[14] These mega data centres span hundreds of thousands of square metres and demand tens of megawatts to operate.

At the same time, demand is rising for smaller, well-connected data centres in dense urban areas. These points of presence (PoPs) meet local compute and networking needs, while content delivery networks (CDNs), deployed by companies such as Akamai, CloudFlare and AWS, cache data close to users, reducing latency and backbone load.[15] Services such as Netflix and YouTube, which comprise 26% of US internet traffic, rely heavily on these networks. Advancements in wireless, such as 5G and emerging 6G, are also pushing base stations to become small data hubs supporting low-latency workloads.[16]

Regardless of scale, every data centre site must satisfy critical requirements: sufficient space, strong network connectivity, ample power grid capacity or microgrid options (plus backup), favourable climate for heat management, and protection from natural disasters.

[14] https://www.datacenterfrontier.com/featured/article/11436953/the-new-megacampuses-the-worldslargest-data-center-projects, https://www.datacenterdynamics.com/en/news/google-expects-2025-CapEx-to-surge-to-75bn-on-ai-data-center-buildout/

[15] https://dl.acm.org/doi/pdf/10.1109/TNET.2024.3443600, https://www.microsoft.com/enus/research/publication/beyond-the-mega-data-center-networking-multi-data-center-regions/, https://www.cloudflare.com/en-gb/network/, https://www.akamai.com/legal/compliance/privacy-trustcenter/list-of-countries-with-server-points-of-presence

Trend 2: Increased Sustainability Concerns (Management Software)

The expansion of data centres has significantly increased their carbon footprint. The ICT sector now accounts for 1.8%–3.9% of global carbon emissions, including both operational use and hardware manufacturing. Data centres alone use over 1% of the world's electricity, and up to 21% in concentrated regions like Ireland. As a result, sustainability in ICT infrastructure is a growing concern, prompting industry and academic initiatives, such as specialised workshops, to address measurement and reduction of emissions.[17]

Complicating these efforts, data centres must also maintain high availability—99.999%, or just 5.26 minutes of downtime per year. Power outages remain a leading cause of downtime, so sustainability measures must not compromise service level agreements.[18]

Opportunities for improvement include integrating renewable or green energy sources. Hyperscalers are exploring microgrids—resilient, localized energy systems—to increase independence from the main grid and accommodate unpredictable workloads.[19] Smart workload scheduling can dynamically shift operations in time or location based on the availability of green energy.[20] Reducing embodied carbon is also a focus, with strategies such as reusing or extending the life of costly components such as DRAM memory.[21]

[16] https://5g-ppp.eu/wp-content/uploads/2022/12/6G-Arch-Whitepaper_v1.0-final.pdf

[17] See https://dl.acm.org/doi/pdf/10.1145/3483410, https://www.sciencedirect.com/science/article/pii/S095965261733233X, https://www.sciencedirect.com/science/article/pii/S2542435122003580, https://www.sciencedirect.com/science/article/pii/S0301479720300992; annual workshop https://hotcarbon.org/2022

[18] Data centre energy use: https://www.science.org/doi/full/10.1126/science.aba3758, Ireland example: https://www.irishtimes.com/business/2024/07/23/electricity-consumption-by-data-centres-rises-to-21-eclipsing-urban-households/, availability loss: https://journal.uptimeinstitute.com/data-centeroperators-will-face-more-grid-disturbances/, https://www.eaton.com/content/dam/eaton/markets/datacenter/WP_DC_Availability_2013.pdf

[19] Green energy integration: https://www.datacenterdynamics.com/en/news/three-mile-island-nuclearpower-plant-to-return-as-microsoft-signs-20-year-835mw-ai-data-center-ppa/; microgrids: https://www.microgridknowledge.com/data-center-microgrids/article/21452204/data-centers-needmicrogrids-heres-why

[20] Smart workload scheduling: https://blog.google/inside-google/infrastructure/data-centers-workharder-sun-shines-wind-blows/, https://dl.acm.org/doi/abs/10.1145/3627703.3650079

[21] Embodied carbon and hardware: https://www.microsoft.com/enus/research/uploads/prod/2024/03/2024-GreenSKU-ISCA2024.pdf

Trend 3: Rise of AI Workloads

The proliferation of AI workloads, particularly with large language models (LLMs), has profoundly impacted data centre infrastructure and model design. Companies such as Google, Microsoft and OpenAI are driving growth in model size, increasing demands for compute and networking, and spurring the construction of larger data centres. This expansion has fostered innovation in hardware, especially GPUs—NVIDIA forecasts over $130 billion revenue for 2025, more than double 2024's figure.[22] Companies are also developing custom AI accelerators, such as Google's six generations of TPUs and similar projects at Meta.[23] Alongside compute advances, networking is evolving, with the Ultra Ethernet Consortium aiming to redesign Ethernet for AI workloads, and Google exploring reconfigurable optical networks.[24]

In contrast, smaller firms and those affected by export controls innovate differently, as they cannot match the escalating infrastructure needs. For example, DeepSeek-R1, developed by a small team at Chinese hedge fund High-Flyer, offers a novel architecture that is cheaper and more sustainable to train and use, yet competitive with leading models.[25] Constraints, such as limited access to NVIDIA hardware, have driven these teams to seek efficiency through algorithmic and system-level innovation—demonstrating that progress in AI can come from diverse approaches, not just larger models and data centres.

Trend 4: Increasing Demand for Flexible, Resilient, and Secure Deployment

Another trend highlighted by the AI boom is the need for flexible, resilient and secure deployment models and infrastructure access. As infrastructure requirements grow, dedicated resources become unsustainable for most companies, driving demand for shared, multi-tenant solutions that maintain performance and security guarantees. Protecting data—technically and legally—becomes paramount, necessitating infrastructure that ensures robust isolation alongside appropriate legal frameworks.

Today, nearly every digital organization requires compute resources. Managing onpremises infrastructure is increasingly impractical due to the demands for continuous availability and advanced computational needs. The cloud addresses these challenges, offering on-demand, globally managed resources and facilitating sustainability. Cloud revenue surpassed $500 billion in 2021, with forecasts exceeding $2.5 trillion by 2031.[26] The rise of serverless computing further abstracts deployment and scaling, streamlining development for users.[27]

Data quality and quantity are fundamental to AI success, but increasing reliance on sensitive data elevates concerns around confidentiality, privacy and compliance. Historically, cloud adoption was limited by trust, as providers could potentially access tenant data during processing. Recent advances in hardware, such as trusted execution environments (TEEs), now enable data confidentiality and integrity even while in use, promoting broader cloud adoption.

Balancing data utility and privacy is both a technical and legal challenge. Technical measures such as TEEs address data protection at rest, in transit, and in use, while regulations such as GDPR and CCPA foster trust and compliance, ensuring responsible data use and AI deployment.[28]

[22] NVIDIA revenue: https://www.macrotrends.net/stocks/charts/NVDA/nvidia/revenue
[23] Google TPUs: https://cloud.google.com/transform/ai-specialized-chips-tpu-history-gen-ai, Meta custom accelerators: https://ai.meta.com/blog/next-generation-meta-training-inference-accelerator-AIMTIA/
[24] Ultra Ethernet Consortium: https://ultraethernet.org/, Google optical networks: https://research.google/pubs/jupiter-evolving-transforming-googles-datacenter-network-via-opticalcircuit-switches-and-software-defined-networking/
[25] DeepSeek-R1 model: https://www.deepseek.com/
[26] Forbes Cloud Revenue: https://www.forbes.com/councils/forbestechcouncil/2023/07/24/poweringthe-growth-of-cloud-computing-infrastructure-challenges-and-solutions/
[27] Serverless Computing: https://www.datadoghq.com/state-of-serverless/
[28] GDPR: https://gdpr.eu/what-is-gdpr/, CCPA: https://oag.ca.gov/privacy/ccpa

Downstream Economic Impact and Enabled Innovation

Data centres are not just standalone entities; they enable broader economic growth in downstream sectors. Since the 1990s, with the acceleration of the Internet, data centres gained a commercial nature. The scalability and increased security offered by data centres made them attractive for large organisations, marking the beginning of the cloud computing era, where services are provided remotely.

Data centres are now considered critical infrastructure for the economy. The market for cloud services, which data centres enable, is estimated at $678 billion in 2023, growing to $2.4 trillion by 2030. The UK cloud computing market alone was approximately £19 billion in 2023, projected to reach £73 billion by 2032.[26]

Data centres have underpinned several technological "waves":

- Client-server model: Enabled by early data centres, this shifted computing power closer to the "edge".
- Internet connectivity: From the 1980s, this meant data centres were no longer limited to on-premises locations, leading to the development of Internet routers and web servers that dramatically increased demands on geographically dispersed data centres.
- Internet of Things (IoT) and "Big Data": Since the early 2000s, cheaper devices and sensors generated an explosion of data from diverse sources (e.g., health, weather, social media, financial markets). This necessitated massive cloud storage and real-time data analysis services built upon data centre infrastructure.
- AI technologies: While AI existed earlier, machine learning models became more efficiently trained in the cloud using data centre infrastructure. The early 2020s saw the rise of generative AI.
- Distributed Ledger Technologies: These also require massive computing resources beyond local capabilities.
- Quantum Computing: In the future, quantum computing is likely to further increase reliance on cloud computing and the data centre ecosystem, making data centres even more central to the economy.

Beyond direct services, data centres are crucial for the resilience and security of the UK economy. As industries such as finance, healthcare, logistics and advanced manufacturing become increasingly reliant on digital infrastructure, the smooth operation of data centres is essential for business continuity and national security. The UK's position as a global financial hub and leader in AI research means it relies on robust cloud computing services. Disruptions could have widespread economic consequences. Enhanced cybersecurity, energy-efficient infrastructure and regional data centre hubs ensure greater resilience and reduce reliance on overseas providers.

The rapid expansion of data-driven industries also raises important questions about sustainability, aligning with the UK's net-zero economy transition. The significant energy demands of data centres necessitate investments in green energy solutions, such as direct renewable energy sourcing and improved cooling technologies. AI, fintech and life sciences—sectors where the UK is internationally recognised—mean data centres will continue to be central to economic growth, attracting investment and fostering innovation. Future developments will further reinforce the UK's global competitiveness in the digital economy.

For entrepreneurs and innovators to develop new business models in the data centre space, access to scalable, cost-effective infrastructure is essential. Innovations such as modular and edge data centres are lowering barriers to entry. Government incentives, tax relief and public-private partnerships can encourage startups. Cloudbased solutions and co-location services allow smaller firms to utilise existing infrastructure while focusing on innovative applications such as AI-driven resource allocation, energy efficiency solutions or distributed computing models.

A supportive regulatory environment is crucial for fostering innovation. Policies promoting competition, streamlining planning approvals and encouraging green investments create a dynamic landscape. Regulations facilitating data sovereignty compliance, cybersecurity standards and cross-border data flow are also beneficial. The UK's approach to digital infrastructure and sustainability regulations will shape how startups innovate in areas like data privacy, AI-powered security and carbon-neutral data management.

Success also depends on access to highly skilled professionals in cloud computing, AI, cybersecurity and energy management. Investments in education and training programmes, alongside partnerships between universities, tech incubators and industry, can bridge skills gaps. Research and development funding, from government and venture capital, can support breakthrough innovations in areas such as liquid cooling, AI-driven automation and quantum computing infrastructure.

There is a growing market for innovative, sustainable data centre solutions due to increasing concerns over energy consumption and environmental impact. Entrepreneurs developing energy-efficient cooling systems, renewable-powered data centres and AI-driven energy optimisation technologies will find significant opportunities. Innovations such as waste heat reuse for local communities, new battery storage technologies and improved data compression techniques can reshape downstream sectors. Startups offering cost-effective, low-carbon data solutions will have a competitive edge.

Speculatively, a £2 billion investment in data centres and technologies could yield substantial benefits:

- Economic Growth (GVA): Potentially an additional £1-2 billion in GVA annually in the medium term, beyond the current £4.7 billion contribution.

- Job Creation: Potentially 15,000-20,000 new direct and indirect jobs. The sector currently supports over 40,000 jobs.

- Tax Revenues: An additional £160-250 million in annual tax revenue, a 30-40% increase on the current £540-640 million.

- Long-term Economic Impact: The UK data centre sector could grow tenfold by 2035, potentially becoming worth £40-50 billion.

- AI Leadership: This investment could provide infrastructure to train and deploy next-generation AI, positioning the UK as a leader and attracting foreign investment and high-value jobs.

- Sustainability & Energy Efficiency: New data centres could incorporate cuttingedge energy-efficient technologies, reducing consumption and carbon footprint, aligning with UK carbon reduction targets.

- Regional Development: New projects could create jobs across the UK, contributing to the levelling-up agenda.

Strategic Opportunities for UK Leadership

Research-Led Innovation Tracks for UK Leadership

Aligned with the mega-trends, specific research-led innovation tracks are proposed to enhance the UK's attractiveness for data centre investment and future sustainability. Further research in these areas is crucial to delivering global leadership.

Theme 1: Technologies to Address Scaling Trends in Future Data Centres

The UK is a prime location for data centres due to its:

- Major global hub for internet traffic with subsea cables connecting to key markets, and London as one of the world's largest Internet Exchange Points (IXPs).

- Cool climate without extreme temperature fluctuations, reducing cooling costs and improving energy efficiency.

- Presence of major cloud providers (AWS, Microsoft, Google). Identifying highpotential data centre locations (considering land, power, network proximity and fresh water) and creating a supportive framework (planning, regulatory conditions, expectations of data centre companies) is a priority. Technical challenges include intra- and inter-data centre network topology, management software for traffic routing and job placement, and reliability trade-offs. UK academics have made substantial research breakthroughs, and existing data centres can serve as testbeds.

Theme 2: Sustainability: Energy Management & Carbon Neutrality Leadership

Addressing the increasing power needs of data centres is critical. The UK should incentivise data centres in locations with low grid intensity (where power is mostly from renewables). The creation of microgrids managed by data centre providers should be encouraged, potentially allowing data centres to act as power generators during low compute loads. At the micro level, integrating data centres with their surroundings can avoid energy waste. This includes:

- Repurposing existing industrial buildings to reduce embodied carbon.

- Smart heat dissipation by using waste heat for local hot water networks or district heating.

- Temporal and spatial workload shifting based on power grid conditions, requiring tools for accurate carbon measurement and complex optimisation algorithms. Incentivising UK academia to tackle these challenges can establish the UK as a case study for dynamic, sustainability-aware workload placement.

Theme 3: Designing Data Centres for Future AI Workloads

The UK has opportunities for leadership in AI by creating a welcoming environment for data centre construction and innovating at both the AI model and infrastructure levels. This leverages the UK's strong AI research presence, rich datasets (e.g., NHS data) and fertile entrepreneurial ecosystem.

- Algorithmic and Model Level: Recent advances like DeepSeek-R1 challenge the notion that bigger models are the only way forward, indicating a need for diversified model architectures. Opportunities exist for creating transparent, domain-specific (e.g., medical, public sector) Large Language Models.

- Infrastructure Level: The rise of AI necessitates alternative compute, storage, and networking infrastructure. There are emerging startups designing AI accelerators (e.g., UK's Graphcore, US's Enfabrica, Cerebras Systems) as alternatives to GPUs and improving communication for AI training. Generating more success stories such as Graphcore and Correct Networks (acquired by Broadcom) should be a priority.

Theme 4: Designing for Resilience and Shocks

Opportunities for the UK arise from the need for resilience, security, and privacy, spanning both technical and legal issues. Open questions exist regarding architecture and system design for secure and private systems. Prior UK-driven efforts like CHERI capabilities (hardware-implemented security) and hubs like SALIENT demonstrate the UK's innovation ability in this field, requiring more support.

The UK's position (outside the EU, owner of large datasets like NHS data) uniquely positions it to:

- Design and enforce appropriate legal frameworks for data protection and privacy.
- Envision business models around data without violating privacy and confidentiality. A clear legal framework can attract privacy-conscious parties to host infrastructure and data in the UK. Possessing rich, privacy-sensitive datasets (e.g., NHS, HMRC) allows the UK to innovate in creating new business models for private data leasing and controlled access to trusted parties, requiring both technical and legal expertise.

Overall, the UK's strengths in internet traffic hubs, cooler climate and robust academic and entrepreneurial ecosystem position it well for leading development in these technologies. Key technologies influencing data centre investment decisions include:

- Computing hardware: Microprocessors, AI accelerators (GPUs, TPUs, IPUs) and advancements in storage (HDDs, SSDs, optical tech).
- Networking infrastructure: High-speed connectivity, low latency technologies, new protocols for AI workloads, reconfigurable optical networks and the presence of IXPs.
- Energy efficiency and sustainability technologies: Reducing PUE through improved cooling, power conditioning, virtualisation, renewable energy integration, microgrids, waste heat reuse and smart workload scheduling.
- Software and management tools: Sophisticated software for workload placement, cloud computing, serverless computing and confidential computing.
- Physical infrastructure and design: Available space, climate, disaster protection, modular/upgradeable chip methods, reusable chip technologies and building repurposing.

Market and Operational Opportunities

There are significant opportunities for improved communication, collaboration and strategic alignment among various stakeholders, including local and national government, data centre operators, local communities, regional bodies, energy providers and academia. While existing activity occurs at government policy and industry practice levels, broader coordination across all stakeholders is suggested to optimise the advantages of data centre infrastructure in the UK.

Key potential opportunities that we identify include:

- **Local and National Policy Coordination:** Policies should steer data centre investments toward broader economic, social and societal benefits. Local authorities should manage the collective impact of multiple data centre developments. Incentives should be in place for data centres to facilitate highperformance services for local data-intensive companies, including ultra-low latency access.
- **Collaboration with Communities and Regional Stakeholders:** Data centre operators should work with local communities to achieve sustainability and social goals, such as employing local people and integrating data centres with societal entities such as libraries and universities. Collaboration with regional stakeholders is also recommended to share benefits and address challenges of new facility locations.
- **Coordination among Government, Industry, Academia, and Energy Providers:** Essential for developing supportive policies and strategies. Incentives for academia to address sustainability challenges and integration with energy providers for renewable energy initiatives are recommended.
- **Governance and Oversight:** Establishing a Data Centre Coordination Committee within the Department of Energy Security and Net Zero (or similar body) is recommended to coordinate with renewable energy facilities, manage heating demands and provide data centre operators with coordinated assistance.
- **Self-driven Demand Management:**

- **Drive Power Usage Effectiveness (PUE):** Incentivise data centres to achieve a PUE closer to the global target of 1.0, encouraging innovation and energy efficiency. This involves smarter cooling, AI-driven workload distribution, and power-saving automation.
- **Support Microgrid Development:** Provide incentives for data centres to create microgrids, integrate them with the main grid, and use them as power generators during low compute loads.

- **Optimise Location and Power Supply:**

- **Synchronise with Renewable Power:** Adjust data centre operations to match local renewable power availability, optimising costs and supporting the national grid.
- **Encourage Renewable Energy Integration:** Promote alignment with renewable energy sources and waste heat reuse to enhance sustainability and support ESG goals.
- **Utilise Reliable Power Locations:** Choose locations with fewer power disruptions to reduce energy wastage from backup systems.

- **Promote Sustainability and Community Engagement:**

- **Promote Waste Heat Reuse:** Use server heat for local hot water networks and co-locate data centres with sites that have high heat demands, such as greenhouses or food processing plants. This turns operational byproducts into valuable resources, reduces emissions and strengthens community relations.
- **Secure, Sovereign Data Storage:** The UK has the potential to become a global hub for secure, sovereign data storage and processing, given increasing regulatory focus on data privacy and localisation, amplified by geopolitical shifts and legislation like UK GDPR. This can attract international investment from sensitive sectors like finance, defence and healthcare.
- **Integration into Regional Economic Development Strategies:** Placing data centres in underserved or deindustrialised regions can create new growth poles, acting as digital infrastructure anchors for technology clusters and research hubs. Edge data centres can support rural and “peri-urban” areas by reducing latency and bringing cloud services closer to users. Strategic alignment with regional upskilling programmes and green infrastructure investment can foster inclusive growth, aligning with the UK's levelling-up agenda.
- **Intersection of AI, Sustainability and Infrastructure:** There is a fast emerging opportunity to design AI-specific data centres with advanced cooling, energy recovery systems and smart workload management, while meeting net-zero targets. Companies innovating at this crossroads can benefit from both public and private sector demand.

Key Policy Observations

We remark on several areas for consideration by UK policymakers, organised into three clusters:

Cluster 1: Positioning the UK for Organic Data Centre Growth

This cluster focuses on establishing the essential minimum criteria to ensure the UK remains a viable location for data centre investment, aiming to keep the UK “in the game” rather than differentiating it.

Key areas include:

- Reducing national network latency to regions outside of the London-M25 area is crucial for these areas to become competitive data centre locations.
- While managing overall power consumption is important, a strategic focus should be on incentives and measures to drive UK data centre PUE towards the global target of 1.0. This supports data centre operators and encourages innovative, community-cooperative approaches.
- Identify high-potential locations for future data centre investment where infrastructure and transport are already high quality or can be improved with cofunding from data centre investors.

Cluster 2: Leveraging the Circular Potential of Data Centres

The focus here is on achieving additional economic growth, locally and nationally, from data centre investment by applying circular economy thinking. This cluster aims to address Environmental, Social, and Governance (ESG) challenges and regulations, positioning the UK as a leader in sustainable data centre development.

Key observations include:

- Co-locating data centres with renewable energy sources and developing operational capabilities for waste heat reuse to enhance sustainability.
- Prioritising locations with reliable power supply to minimise energy waste from less efficient backup systems.
- Ensuring data centre development engages with local communities, avoids displacement, employs local people, and provides safe working conditions to achieve social goals.
- Exploring the potential for synchronising data centre processing demands with renewable power availability to enable greener and lower-cost operations and provide demand management for the UK electricity grid.

Cluster 3: Sustainable Leadership through Innovation

This cluster addresses applying recognised UK Research, Development, and Innovation (RD&I) leadership to produce a deep ecosystem based on know-how and technology that is difficult to displace and provides more resilience to disruption in the data centre market.

Key observations include:

- Investing in enhancing access to underlying and novel data storage technologies (e.g., magnetic, capacitive, optical microchips).
- Prioritising leadership in data security through investment in hardwareimplemented security functionalities to ensure data sovereignty.
- Promoting the recycling of data storage and facility materials through investment in sustainable and modular chip integration methods and upgradeable infrastructure.
- Developing policies and regulations that promote transparency of data status, clarify data ownership and privacy, encourage efficient data distribution through local data centres integrated with society, and foster energy sustainability through coordination with renewable energy and heating demand.
- Actively supporting and investing in research-led innovation tracks aligned with mega-trends such as technologies for scaling data centres, energy management and carbon neutrality, designs for future AI workloads, and resilience and security. This includes fostering the growth of UK companies innovating in AI hardware and model development.

Conclusions and Next Steps

Data centres are now vital infrastructure supporting digital services and AI, necessitating a strategic policy approach. The UK has significant opportunities to lead globally in this sector, but it faces considerable competition and must effectively adapt to evolving technological trends and ambitious sustainability goals. Future UK leadership in this domain depends on a coordinated approach that extends beyond merely attracting investment.

Key areas of focus for the UK include:

- Strategic distribution of data centres, leveraging existing telecommunication and renewable energy infrastructure.
- Enhancing energy efficiency through aggressive Power Usage Effectiveness (PUE) reduction and greater integration of renewable energy sources.
- Fostering innovation in AI infrastructure, sustainable computing solutions, and secure systems, by capitalising on the UK's robust academic and entrepreneurial strengths.
- Developing comprehensive policies that actively promote sustainability, ensure data sovereignty, and facilitate deeper community integration.
- Recognising and exploiting the circular economy potential of data centres.
- By adhering to these principles, the UK's data centre ecosystem can be transformed into a powerful catalyst for new economic growth and a source of innovative solutions to pressing societal challenges.

Future Actions

This study outlines suggestions for the United Kingdom to achieve a leading position in the global data centre market while simultaneously delivering significant economic, social and environmental benefits. The subsequent crucial steps require active engagement and robust collaboration among policymakers, industry stakeholders, research institutions and local communities:

- Establishing a national data centre strategy: This strategy should integrate the recommendations presented in this study, clearly defining objectives, setting ambitious targets (e.g., for PUE reduction and renewable energy integration), and developing incentives to steer the comprehensive development of the UK's data centre sector. Consideration should be given to forming a dedicated coordination committee, potentially within the Department of Energy Security and Net Zero, to oversee this strategy.
- Developing targeted policy and regulatory frameworks: This involves streamlining planning processes for strategically important data centre locations, providing specific incentives for energy efficiency and sustainability and establishing explicit guidelines on data governance, security, and community engagement.
- Investing in research and development: Focused funding programmes should be established to support innovation in the identified mega-trends, actively promoting collaboration between academia and industry. Support should be provided for pioneering initiatives such as CHERI and hubs like SALIENT in the critical areas of security and privacy, with a clear emphasis on nurturing and generating success stories akin to Graphcore in AI hardware development.
- Promoting skills development and logistics: Ensuring the availability of a skilled workforce and efficient supply chains is paramount for both the construction and ongoing operation of data centres. Co-funding arrangements between data centre investors and local authorities could be instrumental in enhancing infrastructure and transport in high-potential areas, ensuring readiness for new developments.
- Facilitating local community engagement: Mechanisms must be established to ensure transparency in all data centre developments, foster active community engagement, and ensure tangible contributions to local economic and social well-being. Initiatives could include integrating data centres with local services such as libraries, universities, and district heating systems, thereby embedding them as beneficial community assets.
- Monitoring and evaluation: A robust framework for monitoring the progress of the UK's data centre sector against its set objectives and targets should be established. This framework will allow for strategic adjustments as necessary, ensuring that policies remain effective and responsive to evolving market and technological landscapes.

By progressing these items, the UK will be better positioned to effectively leverage the growing significance of data centres, fostering innovation, promoting sustainable development and firmly establishing itself as a global leader in this vital digital infrastructure domain. Legislative measures should be explored to expand the creative commons framework, encompassing analysis and intellectual content rights, to encourage open access while meticulously protecting data owner control.