POLICY BRIEF

The Energy Consumption Challenge and Disparities in the Concentration of Data Centres Among the G20 Countries

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Digital Transformation

Abstract

With the rapid advancement of digitalisation and expansion in global internet users, digital-driven technologies and services such as artificial intelligence (AI), e-commerce, cloud computing, and cryptocurrencies have significantly boosted the demand for data centres. The exponential growth in data centres has resulted in substantial energy consumption challenges. The International Energy Agency (IEA) reports that data centres consumed around 1-2% of global electricity in 2022, even without including the vast amounts of energy needed to build related physical infrastructure. The trend is expected to intensify over the next decade, not least due to the increase in use of AI-driven solutions, raising concerns on global carbon emissions, energy security and the environmental footprint of digitalisation at large.

In accordance with the G20's mandate to promote responsible AI for global public good and the UN's global roadmap to achieve net-zero emissions by 2050, it is imperative for the G20 to address the energy consumption challenges posed by data centres. Importantly, as one of the world's leading economic entities, nearly 90% of global data centres are located in G20 countries.

There are, however, significant disparities in data centre distribution between and within Global North and Global South nations. To illustrate, the number of data centres in the Global North is at least sixfold that of the Global South within the G20, highlighting the predominant role of Global North (Table 1). This imbalance is likely to widen the gap in data distribution, data utilisation and the ability to materialise the potentials of digitalisation for economic and social development in the future. Among all Global North members in the G20, the US hosts 46% of global data centres, which is approximately 100 times more than South Korea. On the other hand, China is standing out among the Global South countries with 449 data centres. Despite this significance, it is far less (10x less) than in the US. Such high concentration of data centres in a few countries may raise concerns on the increasing energy consumption.

This policy brief analyses the paradoxical relationship between digitalisation and energy consumption from the perspectives of data centres within the G20. Moreover, it underscores the significant disparities in distribution and concentration, energy consumption of data centres, revealing the substantial imbalances in data power and energy resources among the G20. The policy brief proposes recommendations for the G20 to achieve climate- and resource-friendly digitalisation by balancing the increasing demand of data centres and energy requirements.

Keywords: Data Centres, Global Energy Consumption, Digitalisation, Disparities, G20, Climate Change, Concentration of Data Centres

Diagnosis

The Paradoxical Relationship Between Digitalisation and Energy Consumption

Today, the world has entered an unprecedented era of digitalisation, which is reshaping the landscape of the global economy, social development and political engagement. In this ongoing digital transformation, the rapid expansion of compute intensive technologies – such as generative AI, cryptocurrencies, cloud computing, Software-as-a-Service (SaaS), Infrastructure-as-a-service (IaaS), Platform-as-a-service (PaaS), Internet of Things (IoT) – has significantly increased the demand for data centres. However, many of the data centre-driven technologies are typically associated with productivity and efficiency, their energy consumption is wastefully high. This paradox is raising concerns on global energy consumption and global warming. According to IEA (2023)[1], global data centre electricity consumption reached 1-1.5% of total global demand in 2023, equivalent to the annual energy use of Germany and Brazil combined.

Rising Energy Demand in Data Centres: An Urgent Sustainability Challenge

The rising electricity demand is largely due to the expansion of hyperscale data centres, designed for large workloads. Such facilities contain at least 5,000 servers and occupy at least 10,000 square feet of physical space. Consequently, a single hyperscale data centre can consume over 100 MW of power – enough to power 80,000 homes (Uptime Institute, 2023)[2]. Moreover, a single query in Open AI's ChatGPT consumes 2.9 Wh of electricity – roughly 10 times that of a Google search (Kim Lokwon, 2025)[3].

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[1] International Energy Agency, *Data Centres and Data Transmission Networks* (Paris: IEA, 2023).

[2] Uptime Institute, *Global Data Center Survey* (New York: Uptime Institute, 2023).

[3] Kim Lokwon, "How on-device AI can help us cut AI's energy demand", World Economic Forum, March 7, 2025, https://www.weforum.org/stories/2025/03/on-device-ai-energy-system-chatgpt-grok-deepx/

Figure 1: Hyperscale Data Centre Capacity (MW)

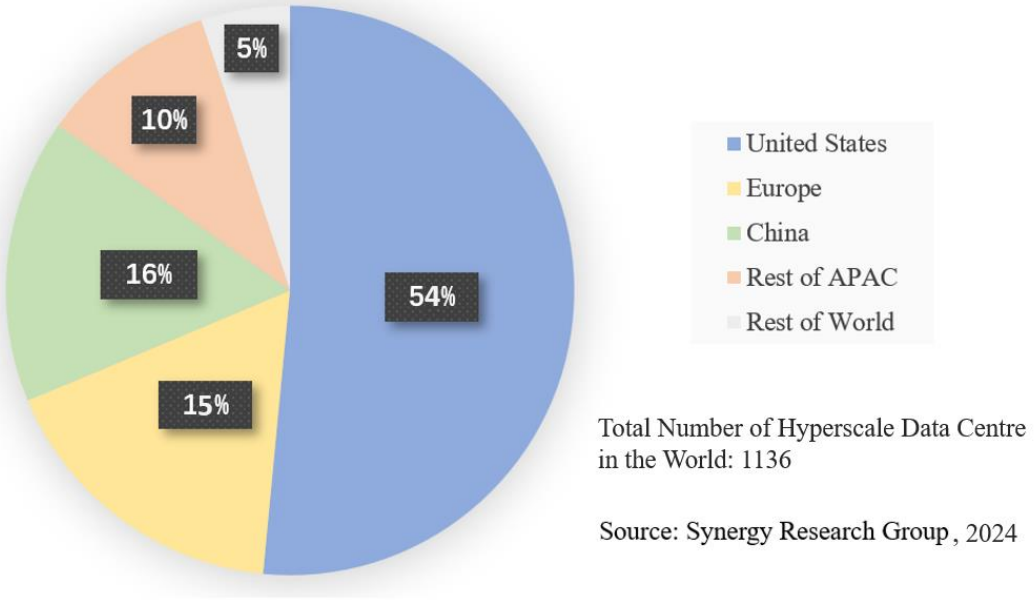

Figure 1 indicates that hyperscale providers had operated 1,136 large data centres globally by late 2024. The US holds 54% of global capacity (MW of critical IT load), while Europe and China each account for roughly a third of the remainder. Synergy (2025) [4]predicts the total capacity will double again within the next four years.

For example, Ireland's data centre electricity consumption has more than tripled since 2015, accounting for 18% of total electricity consumption in 2022, and is projected to reach 28% of national demand by 2031 (IEA, 2022)[5].

Carbon Emissions and Climate Impact of Data Centres

The expansion of data centres causes significant environmental challenges, during the phases of construction, operation, and disposal, ranging from the exploitation of minerals and water consumption to land use (Lucatello & Reiners,

[4] RENO, NV, "Hyperscale Data Center Count Hits 1,136; Average Size Increases; US Accounts for 54% of Total Capacity", Synergy Research Group, March 19, 2025. https://www.srgresearch.com/articles/hyperscale-data-center-count-hits-1136-average-size-increases-us-accounts-for-54-of-total-capacity

[5] International Energy Agency, *Data Centres and Energy Consumption: Global Trends* (Paris: IEA, 2022).

2024)[6]. Focusing on climate challenge, data centres contribute approximately 0.5-1% of global carbon emissions (IEA, 2023)[7]. However, only 30% of data centres primarily rely on renewable energy (Greenpeace, 2023)[8]. Regions like Virginia (USA) and Singapore, where data centre hubs are concentrated, surging electricity demand has led to delays in fossil fuel plant retirement (BloombergNEF, 2023)[9].

Energy Security and Grid Stability Challenges of Data Centres

The geographic concentration of data centres in key economic hubs is imposing unprecedented stress on regional power grids, threatening energy security. These challenges highlight the urgent need for coordinated planning among technology companies, utility providers, and regulators. Some promising initiatives have emerged, such as Microsoft's agreement with Georgia Power to develop modular nuclear reactors for data centre power needs, and the EU's new requirement for data centres to provide demand-response capabilities for grid stability (European Commission, 2023)[10].

Disparities in Data Centre Distribution Among the G20

The G20 hosts 10,532 data centres, representing 88.5% of the global total (Table 1). However, there are profound disparities in the number of data centres between the Global South and Global North, widening digital (Peng & Giri, 2024) [11], economic and geopolitical divides.

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[6] Simone Lucatello and Wulf Reiners, "Can We Bring Digitalisation and the Environment Together? Agenda and Coalitions Beyond Techno-Fix Illusions," *The Current Column*, German Institute of Development and Sustainability (IDOS), February 13, 2024.

[7] International Energy Agency, *Data Centres and Data Transmission Networks* (Paris: IEA, 2023)

[8] Greenpeace International, *Clicking Clean: Who Is Winning the Race to Build a Green Internet?* (Amsterdam: Greenpeace, 2023).

[9] BloombergNEF, *Data Center Boom Strains Global Electricity Grids* (New York: Bloomberg Finance L.P., 2023).

[10] European Commission, *Energy Efficiency Directive for Data Centers*, COM (2023) 150 final (Brussels: European Union, 2023).

[11] Si Peng and Tuhinsubhra Giri, "Minimizing Digital Divide to Promote Inclusive Global Digital Governance: G20-Led Regulation Platform," *T20 Brasil 2024*, Task Force 05: Inclusive Digital Transformation (2024): 2.

Table 1: Number of Data Centres in Global North and Global South within G20

Global South in G20	Number of Data Centres by Jan, 2025	Digital Competitiveness Scores (out of 100)	Global North in G20	Number of Data Centres by Jan, 2025	Digital Competitiveness Scores (out of 100)
Global South	**1435**	**56.39**	**Global North***	**9097***	**77.24***
Argentina	29	44.56	Australia	314	81.24
Brazil	181	48.88	Canada	336	83.16
China	449	82.59	France	322	76.58
India	153	51.80	Germany	529	75.32
Indonesia	84	61.36	Italy	168	62.11
Mexico	172	46.21	Japan	222	68.10
Russia	251	-	South Korea	43	88.62
Saudi Arabia	14	71.60	UK	523	78.21
South Africa	68	50.49	US	5389	91.31
Turkey	34	50.03	EU	2270	67.74
Number of Data Centres in G20	**10532 (over 88.5% in the World)**				
Number of Data Centres in the World	**11896**				
Source	Statista, Cloud Scene by Jan, 2025; World Digital Competitiveness Ranking Report 2024, IMD World Competitiveness Centre				

Global North: Given that France, Germany and Italy are part of the EU, to avoid the double-counting, the total numbers of data centres (9097) and the average score of digital competitiveness (77.24) in the Global North exclude the figures for these three countries.*

The countries subsumed as Global North host 9,097 data centres (86.4% of G20), compared to 1,435 (13.6%) in the Global South. This concentration is exemplified by the US, accounting for 5,389 data centres (59.2% of Global North, 51% of G20), along with substantial contributions from Germany (529), the UK (523), and Canada (336). In contrast, Global South demonstrates infrastructural fragmentation, with China being an exception (449, 31.3% of Global South). Other Global South countries, such as South Africa (68), Turkey (34), and Argentina (29) significantly lag behind, underscoring uneven regional digital development. These disparities are strongly correlated with digital competitiveness.

The Global North achieves an average digital competitiveness score of 77.24 out of 100, markedly exceeding the Global South (56.39), indicating the marginalisation of many Global South countries in digital innovation (Table 1). Data centres are a critical infrastructure pillar in digital competitiveness, reflecting their role in driving economic innovation. A nation's data centre capacity signals its ability to support scalable digital services, attract tech investment, and meet future computational demands, making it a tangible metric for technological readiness and resilience.

Data Centre Concentration in the Global North

The disparities in the number and geographic distribution of data centres represent a technological and economic challenge, and a microcosm of the unequal distribution of global digital power. For example, the US and EU collectively host nearly 73% of the G20's data centre capacity, reinforcing the expansion of digital infrastructure. Moreover, the US is the home country for top six major global data centre providers and operators (Table 2).

Table 2: Top 10 World's Data Centre Providers and Operators by 2024

Sl. No.	Top 10 Providers and Operators of Data Centres by 2024	Country	Number of Data Centres
1	Amazon Web Services (AWS)	U.S.	125 across 20 countries, over 100 locations
2	Microsoft Azure	U.S.	over 300 across 36 countries, 163 locations
3	Google Cloud	U.S.	37 across 26 countries, 40 locations
4	Meta Platforms	U.S.	24 campuses with 104 data centres globally
5	Equinix	U.S.	251 in 32 countries
6	Digital Realty	U.S.	312 across 25 countries
7	NTT Global Data Centres	Japan	95 across over 20 countries
8	CyrusOne	U.S.	over 55 globally
9	GDS Holdings	China	102
10	KDDI's Telehouse	Japan	45 across over 10 countries
Source: Data Centre Magazine https://datacentremagazine.com/top10/top-10-data-centre-companies-in-the-world-2024			Source: Dgtlinfra.com https://dgtlinfra.com/top-data-center-companies/

This high concentration translates into significant control over global data flows, reinforcing a digital hierarchy where the leading countries, first and foremost the US, have far-reaching power to shape the terms of cloud computing, AI development, and cross-border data governance.

Limited Infrastructure in the Global South

Global South except China has significantly fewer data centres despite their rapidly expanding digital economies. For instance, while India is a major player in IT services, it hosts merely 1% of global data centres, far below its digital demand (Table 1). Furthermore, reliance on distant data centres increases latency, undermining the efficiency of local digital services and stifling innovation in emerging markets (World Bank, 2022)[12]. Global South collectively account for around 12% of global data centre capacity. This infrastructure deficit arises from multiple systemic challenges that hinder equitable participation in the global digital economy.

Recommendations

To ensure a sustainable and inclusive digital future, it is imperative for the G20 to balance digitalisation with energy consumption challenges and address disparities in digital development among the member countries. Recommendations are as follows:

- Establish a monitoring platform for data centres to track energy consumption, carbon emissions, and water usage across G20 countries. This initiative will enforce standardised reporting, benchmark performance against climate goals, and propose corrective measures for high-disparity regions. The platform should systematically gather and assess data on climate impact of data centres throughout the lifecycle (construction, logistics, operation and disposal). Possible implementation plan as follows:

[12] World Bank, *Digital Infrastructure in Developing Economies* (Washington, DC: World Bank, 2022).

Firstly, form a joint panel among the G20 to define the standards for data collection, data update and sharing (e.g., energy supply and consumption, carbon emissions, water usage of data centres). Secondly, develop guidelines for best practice in constructing and operating climate-friendly data centres, considering the complex set of factors including climate impact, geological location, hardware selection, cooling demand, etc. Third, establish G20 Data Centre for Sustainability as the leading organisation to oversee data collection and build a monitoring platform for future use. Fourth, engage different stakeholders in this initiative, such as leading data centre providers (e.g., Amazon, Meta, Google), international institutions (e.g., IEA, OECD), relevant G20 Groups (e.g., F20, D20), financing bodies (e.g., AIIB, World Bank).

- Build shared digital infrastructures among G20 countries by developing regional data hubs, shared service facilities and cloud storage centres to serve all - alleviating the cost burden and energy constraints of member countries.
-]]Incentivise regional hubs building in underrepresented nations to reduce data centre disparities via tax breaks, PPP, and local cloud subsidies; mandate tech giants to build more regional data centres in underserved countries to decentralise reliance on hyperscale hubs. Furthermore, governments should support smaller and emerging providers to diversify the existing provider landscape.
- Implement dynamic grid integration protocols for real-time renewable energy load balancing and establish priority dispatch zones requiring data centres to reduce capacity during peak demand (Ireland's 2024 approach) to prevent grid destabilisation.
- Sensitise member countries to potential implications of public data stored outside own physical control. Encourage member countries to store sensible data in trusted facilities. Additionally, countries without their own data centres

that require access in other countries should receive support from G20 Data Centre for Sustainability (as mentioned above) in establishing their own data infrastructure. This will help mitigate their vulnerability to being compelled to comply with the rules of those who own them.

- Countries with high concentration of data centres should pay cross-border energy tariffs to compensate data-storing countries for their energy burdens. Specifically, the countries/companies owning and benefitting from their data centres, should pay tariffs/compensation for the use of local resources (e.g., electricity, water, land), which could affect climate challenges in local.
- Urge major data centre hosts, particularly from the Global North, to incentivise their data centre companies to invest more in local upskilling programmes (e.g., AWS/GCP training centres in developing nations). This should involve linking FDI in data centres to technology transfer agreements, ensuring local firms to gain access to energy-efficient designs.
- Initiate early investment in carbon removal technologies and liquid cooling systems. Also, the G20 should implement strict energy efficiency benchmarks, international standards or policy frameworks for data centres.

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