KAO DATA

This new whitepaper explores the sustainability challenges affecting the data centre industry and how Kao Data is helping customers to reduce their environmental impact.

The Growth in Data and the Role of Data Centres Within a Sustainable Environment

Introduction

In the blink of an eye, the data centre industry has emerged as the backbone of modern economies, influencing the lives of billions across the globe.

From sprawling hyperscale facilities to nimble edge centres, these hubs of digital activity thrive in every imaginable corner. Data centres play an indispensable role in facilitating and sustaining the digital infrastructure that underpins nearly every aspect of our daily lives, from communication and entertainment to commerce and information access.

Yet, amid the seamless benefits they offer, we often turn a blind eye to their costs — particularly their significant appetite for power and the consequential toll on our environment and climate. As our focus continues to sharpen on sustainable business practices and governmental pledges toward achieving Net Zero emissions, the pivotal role of data centres in maximising efficiency and eco-consciousness becomes imperative. As the foundational platforms that underpin everything digitally across the globe, data centres will be a central pillar of any efforts to reduce carbon emissions and address global climate change.

Growth in Global Data Consumption

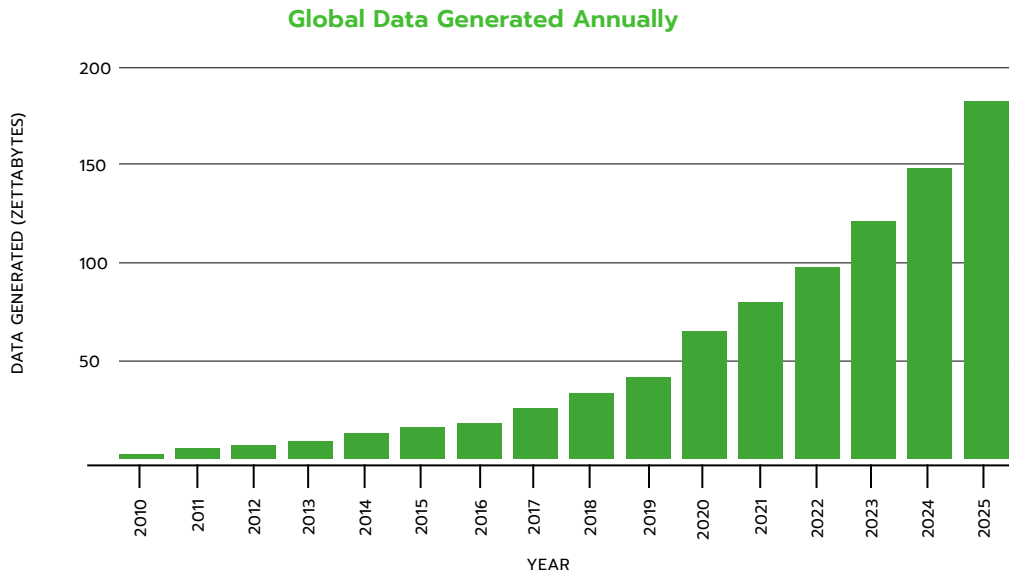
Global data consumption has surged at an unprecedented rate, perpetually expanding in scope and scale.

This exponential growth is propelled by a myriad of interconnected factors—technological advancements, burgeoning digitalisation, the growth of AI, and the omnipresence of interconnected devices. The proliferation of smartphones, the advent of the Internet of Things (IoT), and the increasing reliance on cloud-based services collectively fuel an insatiable appetite for data.

Every online interaction, from social media engagements to streaming entertainment, contributes to this data surge. Businesses, too, are entrenched in this data deluge, employing sophisticated analytics, machine learning, and AI-driven technologies that demand vast troves of information for optimal functionality. The pandemic further accelerated this trajectory, catapulting remote work, telemedicine, and virtual collaboration into the mainstream, amplifying data consumption to unprecedented levels.

This growth trajectory shows no signs of abating. Statista estimates that by 2025 global data creation is projected to grow to more than 180 zettabytes. That represents a nearly 3x growth from 2020 when 64.2 zettabytes were created. The International Energy Agency (IEA) puts this demand for digital services growth into further context. They have found that since 2010, the number of internet users worldwide has more than doubled, while global internet traffic has expanded 20-fold.

Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2020, with forecasts from 2021 to 2025
(in zettabytes)



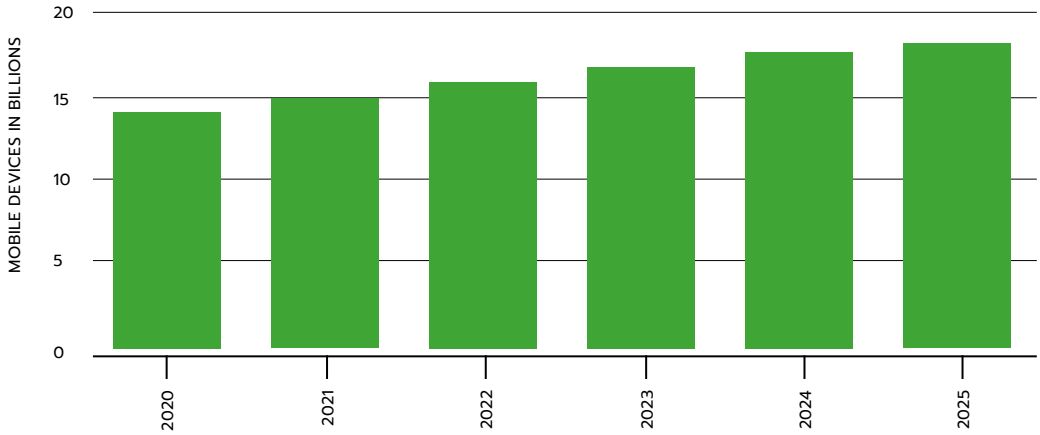
Source: Statista

Mobile Data Consumption and 5G

Emerging technologies like 5G networks promise faster connectivity, inspiring the creation of even more data-intensive applications and services. With its lightning-fast downloads and seamless connectivity, reduced latency for powering real-time applications, and enhanced capacity to support connected devices, it holds real promise as a catalyst for innovation and socio-economic advancement. Oxford Economics recently issued a report estimating that 5G has the potential to boost global productivity by 1.7% of global GDP in 2030, equivalent to 10% GDP growth today.

According to Ericsson, the monthly global average data usage per smartphone already exceeds 20GB. With the number of mobile devices operating worldwide expected to reach 18.22 billion by 2025, that is a lot of data being generated and consumed right at our fingertips.

Forecast number of mobile devices worldwide from 2020 to 2025 (in billions)



Industry Digitalisation

Within industry, data is becoming the oil that greases the wheels of productivity. Manufacturing processes are becoming more automated as AI, machine learning and Industry 4.0 take hold. Digital technology – often enabled by AI, robotics, VR and thousands of automated sensors – is increasing the efficiency of industrial processes, many of which were once labour intensive.

Finance is maybe one of the biggest areas of transition. The trading arms of the finance industry have been technology leaders since the 1980s and continue to invest heavily using high performance computing (HPC), grid computing and intensive blockchain applications to gain competitive advantage. Branch banking has shrivelled on the high streets and digital challenger banks have driven increasing numbers of transactions online and through the mobile and data centre networks. Quantitative research using racks of GPUs to accelerate big data analytics, has become the prerequisite for financial investments and trading portfolios.

Healthcare is another key sector that is being disrupted by data-hungry technology. New digital diagnostic capabilities offer clear opportunities to identify and treat problems earlier, while more local surgeries offer remote appointments with patients using electronics to connect to their health practitioner, once again routed through the data centre. AI is revolutionising how healthcare is delivered, recorded and coordinated. Hospitals are becoming homes to data centres as much as they are places of care and treatment, and the market for AI within health systems is booming.

According to Precedence Research, the global AI in healthcare market size was estimated at US$15.1 billion in 2022 and it is expected to surpass around US$187.95 billion by 2030, growing at a CAGR of 37% during the forecast period 2022 to 2030.

Artificial Intelligence in Healthcare Size, 2021 to 2030 (USD Billion)

Source: Precedence Research

"Even the world's oldest industry – agriculture, is adopting the big data trend and using HPC to transform its farming processes."

Within the automotive sector we are anticipating a tsunami of data to be generated over the next decade as manufacturers start mass-producing autonomous vehicles, which will require mile-by-mile roadside connectivity. Here, edge data centres and near-constant satellite connectivity work to operate safely and effectively, with each car essentially becoming a mobile data centre, relaying back terabytes of data in real-time. According to an article by CBRE, International Data Corporation (IDC) predicts that "by 2025, the average person will interact with a smart device nearly 4,800 times a day," all of which are underpinned and directly connected to both data centres and network infrastructure.

Even the world's oldest industry – agriculture, is adopting the big data trend, with autonomous vehicles in fields, robotic water spraying, crops genetically engineered and grown in laboratory brackets and advanced, higher resolution and localised weather forecasting – thanks to HPC – becoming an essential tool for farming communities worldwide.

Across the board, industry and commerce in whatever shape, form or geography is increasingly reliant on data and behind this lies a global fabric of data centres that power, store and secure all of the digital information. The crucial role data centres play in the way our developed, connected world lives, learns, socialises, plays and does business cannot be overstated. There is no turning the technology backwards – data centres are here to stay and will become our newest best friends. While we're often not aware of it, already, humans interact more frequently with a data centre than fellow humans on a daily basis.

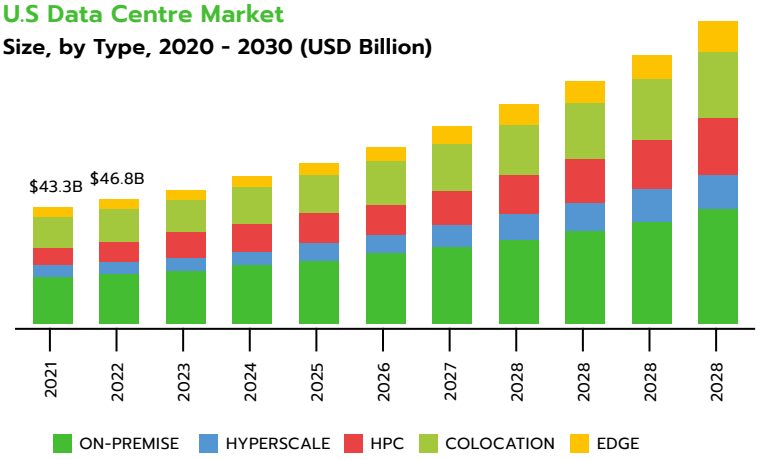
Global Data Centre Growth

Unsurprisingly, it's boom time for the global data centre industry and indeed the myriad of companies that support it.

The global data centre market size is predicted to continue to grow by a CAGR of 11% towards 2030, and leading the charge there are now more than 700 hyperscale data centres globally and this is expected to top 1000 by the end of 2024. Set against the backdrop of an economically turbulent last few years - which have witnessed economic recession, a worldwide pandemic, global supply chain issues, the war in Ukraine and now the Middle East – this form of accelerated, resilient growth has become a hallmark of the data centre sector and a reason why so many investors are looking to support its continued expansion.

U.S Data Centre Market

Size, by Type, 2020 - 2030 (USD Billion)

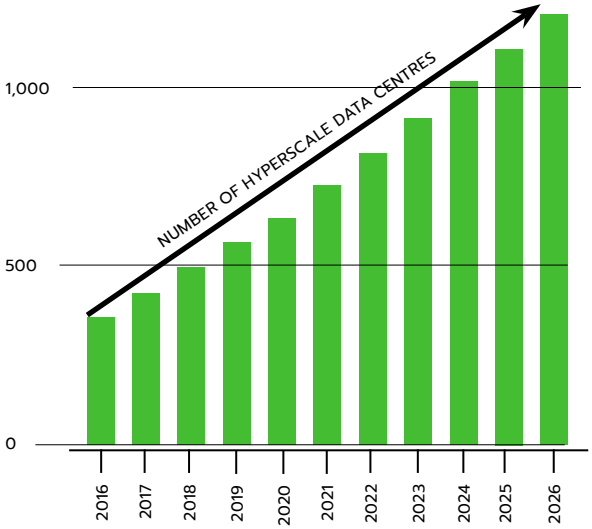


10.7%

U.S Market CAGR 2023-2039

Source: GrandView Research

Hyperscale Data Centre Forecast



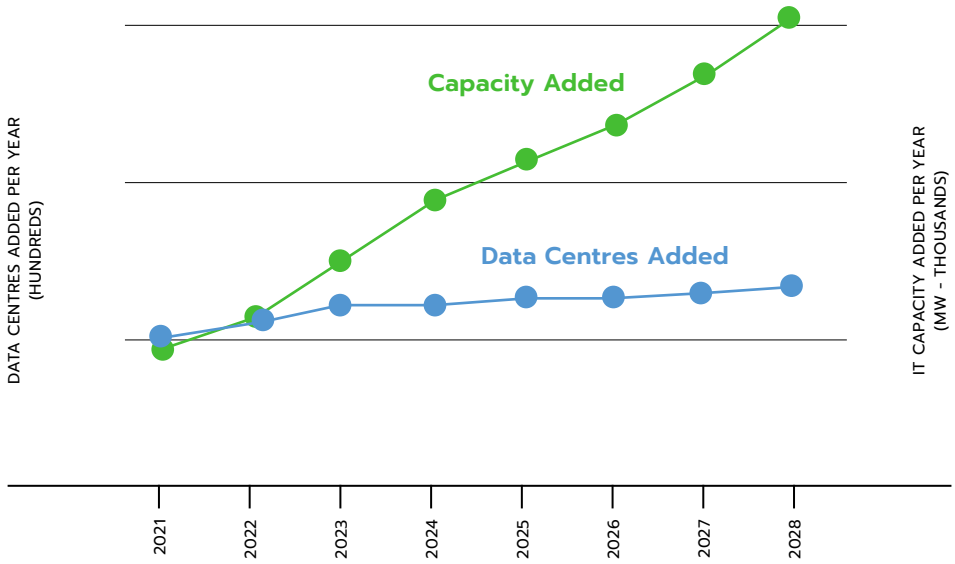
New Data Center Pipeline

United States
China
Ireland
India
Spain
Israel
Canada
Italy
Australia
UK
Other

Source: Synergy Research Group

While 'cloud-first' is continuing to be a popular mantra within government and industry, colocation – both retail and wholesale - is also seeing sustained growth due to the desire to consolidate hardware, outsource IT services, improve business continuity processes and streamline IT expenditure.

The amount of power is one of the most critical issues facing the industry. This is compounded by the steady increase in rack densities within data centres – from an average of 6kW per rack in 2017 to higher densities of 10kW-20kW becoming increasingly common, especially within the confines of HPC, AI and GPU-powered compute. As the graph shows below, to reduce costs, floor space and to increase data hall utilisation, technicians and engineers are being tasked with packing more compute in per square metre, which is having an impact on power demand and cooling requirements.

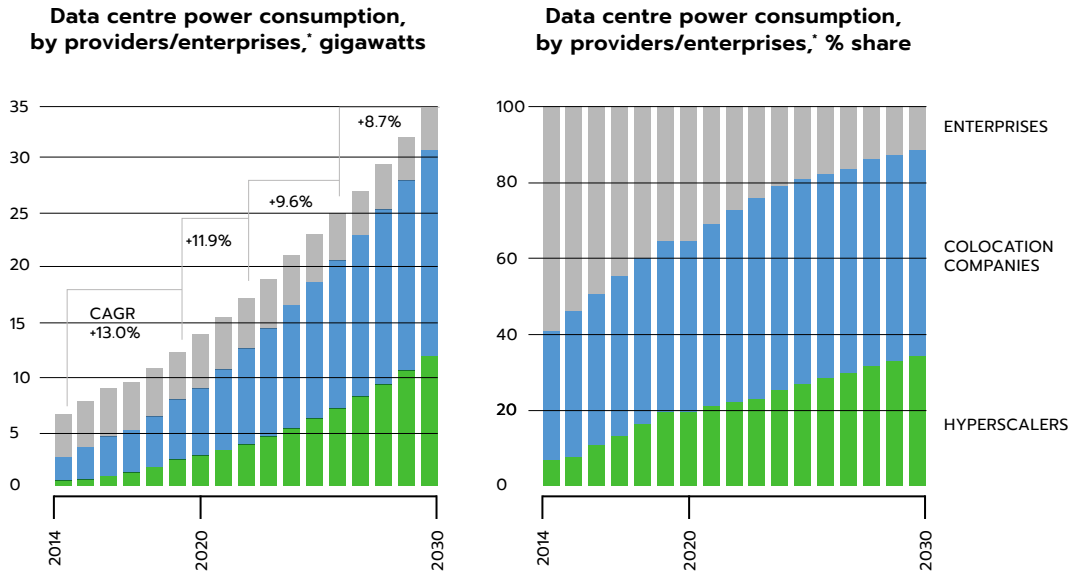


Source: Tech Capital

Data Centre Efficiency and PUE

Data centre operators, technicians and engineers are continually trying to make power usage within data halls and hot aisles more efficient as a way to curb spiralling power demand. According to McKinsey, data centre power consumption in the US alone is expected to reach 25 gigawatts (GW) of power by 2030, up from 17 GW in 2022.

US data centre demand is forecast to grow by some 10% a year until 2030



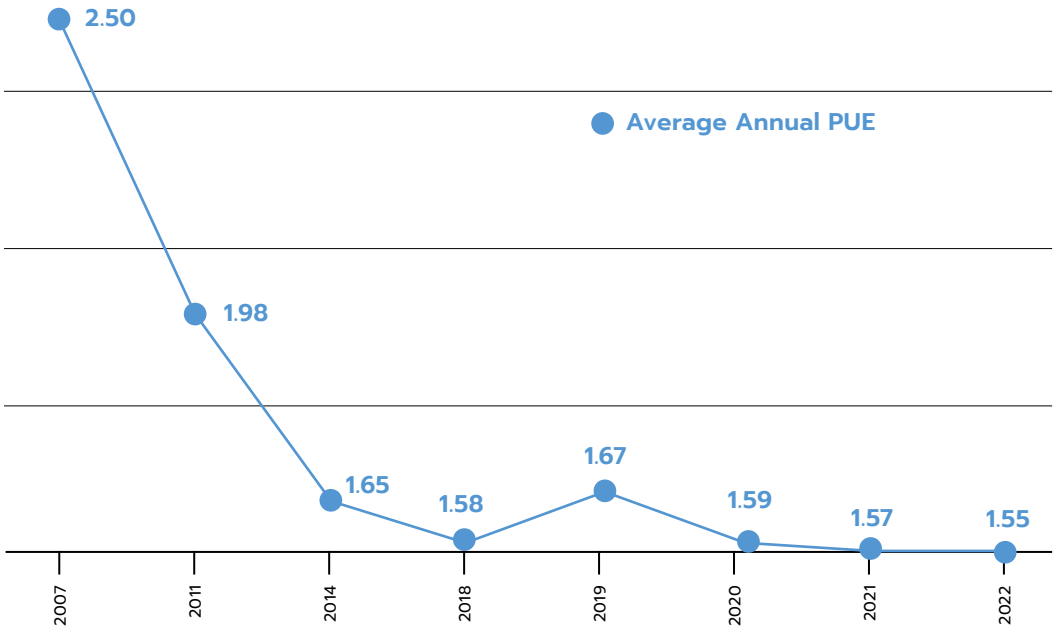
*Demand is measured by power consumption to reflect the number of servers a data centre can house. Demand includes megawatts for storage, servers, and networks.

Source: McKinsey

One of the most common metrics used to measure efficiency within the data centre environment is power usage effectiveness. PUE determines the energy efficiency of a data centre by dividing the total amount of power entering a data centre by the power used to run the IT equipment within it. According to the 2022 Uptime Institute Global Data Centre Survey, the average annual PUE in the data centre industry is 1.55. This is consistent with the trends observed by Uptime in recent years that initially saw large efficiency gains, but have remained stable in the last five years.

PUE Progress has stalled

What is the average annual PUE for your largest data centre?



Source: Uptime Institute

As facilities become more efficient, measuring improvements becomes harder and gains become increasingly incremental. New data centre builds and technologies may see lower PUE ratings because they have the advantage of making more efficient decisions from the start - location for ambient temperature, architectural design of the building, etc.

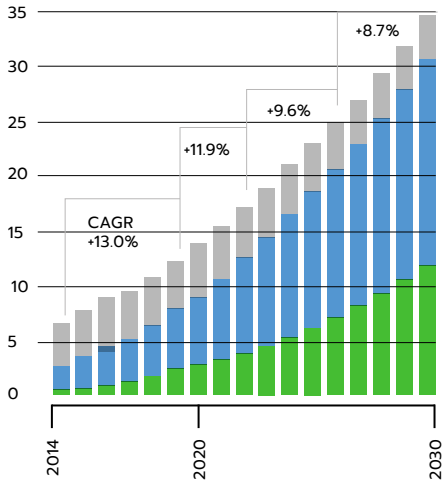
Global Power Usage

IDC estimates the global energy consumption of data centres in 2022 at 382 Terawatt Hours (TWh), with a CAGR of 16.0%, leading to 803TWh by the year 2027. These estimates don't necessarily take into account the full impact of Generative AI technologies either. These power-hungry applications place an unprecedented demand on data centre workloads. The energy consumption to train GPT-3 (a precursor to Chat GPT 3.5) is estimated to be 1.287 gigawatt hours. This does not include end user consumption while interacting with the model either.

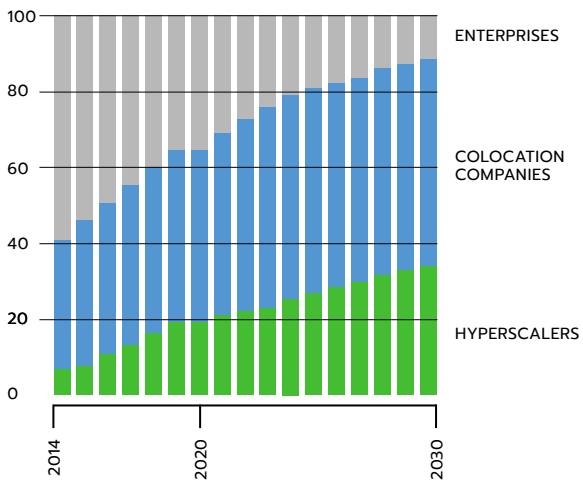
How does the world provide enough power, in enough time, to cope with what is more than a 600% increase in data centre power demand (2016 – 2030), while allowing for improved data centre efficiency and consolidation of less-efficient data centres in hyperscale facilities? And secondly, how do we mitigate the data centre industry's existing carbon footprint (estimated to be 2-3% of global emissions) let alone offset the carbon emissions behind a 600% power increase?

US data centre demand is forecast to grow by some 10% a year until 2030

Data centre power consumption, by providers/enterprises,* gigawatts



Data centre power consumption, by providers/enterprises,* % share



*Demand is measured by power consumption to reflect the number of servers a data centre can house. Demand includes megawatts for storage, servers, and networks.

Source: Business Process Incubator, 2020

Source: McKinsey

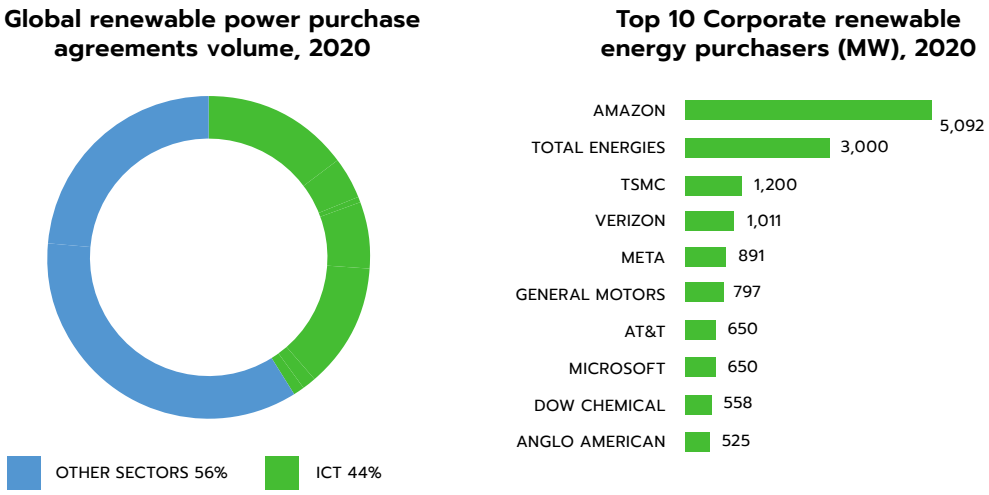
Data Centres and Sustainability

The evolution of data centres toward sustainability is a complex but important journey.

While challenges persist, opportunities abound for innovation and transformation. Embracing renewable energy, implementing energy-efficient technologies, and adopting circular economy practices constitute pivotal steps toward building environmentally conscious data centres. Collaboration, innovation and a collective commitment to sustainability can drive the industry toward a future where data centres not only meet technological demands but also lead in responsible environmental stewardship.

To operate effectively a data centre needs three fundamental things – a plentiful power supply, an ability – and power – to effectively cool hardworking servers, and lastly, connectivity to ensure the servers and processors are connected to their users.

Figure 3.3: Global renewable power purchase agreements volumes by sector and top ten corporate purchasers of renewable energy, 2020



Source: ITU

Transitioning to renewable energy sources, such as solar or wind power, presents a significant opportunity for data centres. By leveraging green energy, these facilities can drastically reduce their carbon footprint and contribute positively to sustainability goals. It is incumbent upon data centre operators to do the maximum they can to use sustainable, green energy within their facilities. Now is the time to push the boundaries of sustainability and explore every area of operations and energy usage to reduce the industry's ties to fossil fuels. From the graph above, you can see that ICT is playing a significant role in making this happen.

The majority of data centres, whether these are on-premise facilities within corporate spaces or large-scale colocation facilities will always need to be located near an urbanised environment. While it would be nice and a convenient solution to move all data centre compute to locations lucky enough to be directly connected to a nearby renewable energy source such as the Nordics with Europe, that just isn't feasible in all cases.

Remote, arctic circle data centres in regions such as the Nordics are great for certain types of back-end compute, but such is the industry demand on availability, latency and proximity, locations like Frankfurt, London, Amsterdam, Paris and Dublin (FLAP-D) will remain Europe's leading data centre hubs. As a result, data centre operators within these locations need to look for the incremental steps they can take in their sustainability journey to make their data centres as environmentally friendly as possible.

One way for this to happen is for legacy data centres to consolidate their compute into efficient hyperscale facilities – a process that is already happening. Another is through Renewable Energy Guarantees of Origin (REGO) to ensure energy was produced from renewable sources. While not perfect, for data centre operators not directly connected to a renewable source, REGOs are the best current option available provided by the energy industry. Providers like Kao Data have gone one-step further to this and ensure through agreement with their energy provider that their energy usage is matched by an equivalent, new renewable generation at a fixed UK asset.

As HPC, AI, and machine learning continue to change the way companies across all industries are doing business, new technologies are emerging to improve sustainability efforts as well. These high-intensity workloads are increasing business efficiencies, improving decision-making and generating new revenue streams. They are also redefining the compute boundaries of CPUs and GPUs, leading to increased rack density and pushing the limits of traditional air-cooling technology. As a result, liquid cooling is poised for mainstream adoption in the next few years. Liquid cooling simplifies the server hardware by removing fans; it reduces energy consumption and increases efficiency of the server, improving data centre PUE.

In addition, good industry stewardship from bodies like the Infrastructure Masons, AFCOM, the Uptime Institute, Open Compute and ASHRAE is essential, as are the highest sustainability standards from hyperscale players such as Amazon, Microsoft, Google, Facebook/Meta, Oracle and NVIDIA alike. Industry stewardship has already created movements like the excellent Open Compute Project (OCP), in which sustainability is a key.

Through industry bodies, organisations like OCP and the actions of individual data centre developers and operators, there is substantial progress being made, both in terms of physical architecture, power provision, operating efficiencies and environmental standards. With attitudes to green data centres changing, there are considerable economic and environmental advantages to being 'clean and lean'.

"REGOs are the best current option available provided by the energy industry, but operators such a Kao Data have gone one-step further with their energy procurement processes."

"The company's leadership recognises the key role the data centre industry must play in leading by example to reduce carbon emissions and become carbon neutral."

Kao Data's Approach

From its inception, Kao Data has been committed to developing and operating one of the UK's most sustainable and energy efficient data centre portfolios.

This ambition included a number of technical design and engineering "firsts" that were incorporated into the structure and operations of our first facility, KLON-01 in Harlow. We have committed to following this design blueprint to ensure all our data centres thereafter be 100% certified, renewable energy. From our award-winning CSR-strategy, to our comprehensive annual Sustainability and ESG report, to our innovative ultra-efficient cooling technology – and even the eco-charging stations for visiting cars – sustainability has been engineered into the data centre from the very first foundations.

The company's leadership recognises the key role the data centre industry must play in leading by example to reduce carbon emissions and become carbon neutral. This emphasis on energy efficiency and sustainability not only benefits the environment, but also delivers reduced Total Cost of Ownership (TCO) to our customers. Many of our customers heavily rely on compute-intensive technologies like HPC, AI, and GPU-powered supercomputing, making these sustainability efforts especially critical for them.

How We Are Championing Sustainability

- Award-winning corporate social responsibility (CSR) strategy including green supply chain management.
- BREEAM Excellent architecture. Our first data centre – KLON-01, achieved the Building Research Establishment's (BRE) BREEAM "excellence" certification in construction, which assesses the building's energy efficiency as well as its environmental and sustainability competency. Our second data centre in Harlow, KLON-02, and our Manchester data centre KMAN-01.
- All data centres are powered by 100% certified renewable energy.
- Data centres are backed-up by hydrotreated-vegetable oil (HVO) fuel. Kao Data was the first data centre operator in Europe to transition all our generators to HVO fuel, reducing the carbon emissions of our generators by 90%.
- OCP-Ready™ data centres comply with the highest efficiency and environmental credentials outlined by the Open Compute Project.
- Data centre PUE of 1.2 (backed by SLA) - providing hyperscale levels of energy efficiency (even at partial loads).
- Campus wide recycling.
- Electric vehicle charging points on campus.

Understanding the exponential rise of the digital economy and its associated impact on sustainability, Kao Data knows we play a key role in mitigating climate change within our business and enabling our customers and stakeholders to do the same. Our approach to 'climate-conscious computing' is outlined in our inaugural Environmental, Social & Governance Report 2022. This report features information about our vision and transparency for sustainability, our commitments, and progress in driving positive impact through our strategic sustainability pillars: Design & Build, Efficient Operations and Industry Leadership & Advocacy.

"At Kao Data, we know we play an essential role in mitigating climate change within our business."

Find Out More

As data, power, cooling and connectivity demands increase, data centres will continue to be instrumental for governments, business and consumers alike. Today's operators must focus on sustainability and energy efficiency to enable digitisation, while helping to overcome the challenges and impacts of climate change.

For more information on how Kao Data can support your big data compute requirements whilst ensuring we do not increase your organisation's carbon footprint, please speak to one of the team: info@kaodata.com or visit www.kaodata.com

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