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Data centers: The growing importance of sustainability

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As the emphasis on environmental, social, and governance (ESG) considerations continues to grow, so does the scrutiny on market segments that are significant contributors to emissions due to high energy use.

At-a-glance

- **Operating efficiency:** Between 2010 and 2018, data centers supported 550% more compute instances using just 6% more energy.[2]
- **Market growth:** Data center market size is projected to grow by 21.98% from 2021 to 2026.[3]
- **Geographic priority:** North America is estimated to contribute 35% to the growth of the global market.[3]
- **Mitigating risk:** Sustainable data centers address climate risk and may reduce both operational and reputational risk.

For data centers, sustainability considerations have proven to be particularly vital. These facilities account for more than two percent of global energy consumption–equivalent to the aviation industry–and is projected to rise to eight percent by 2030.[1] Consequently, energy efficiency is a priority in data center sustainability efforts that tend to include additional indicators of environmental performance such as carbon emissions, water, waste, and biodiversity.

Many of the largest data center tenants are Fortune 100 companies that are unequivocally committed to reducing the environmental impact of their infrastructure and operations. Sustainable data center practices do more than reduce the carbon footprint, they lower the tenant's total cost of ownership (TCO) and may reduce both operational and reputational risk.

Data demand is only expected to increase due to a structural shift in how consumers and corporates use data powered by Internet of Things (IoT), Infrastructure as a Service (IaaS), e-commerce, and gaming, as well as emerging technologies such as artificial intelligence (AI), driverless car technology, and 5G networks. There is rapidly growing digitalization, which places data centers at the confluence of supporting a wide variety of critical services around the clock, from email and file sharing to enterprise resource planning to support of core business processes.

[1] Data Center Frontier, "The State of Data Center Sustainability" July 2022
[2] Stream Data Centers, "Yes, the Cloud Is a Catalyst; It's Also a Competitive Benchmark" 2023
[3] Technavio, "Data Center Market Size to grow by USD 615.96 bn, Insights on the Key Drivers and Trends" November 2022

Data center market segment growth

The global data center market size is projected to grow by $616 billion, progressing at a compound annual growth rate (CAGR) of 22% from 2021 to 2026. More than one-third (35%) of that growth will come from North America (primarily from the U.S.), which is also expected to grow faster than the markets in Europe and the Middle East/Africa.[4]

One of the key drivers of global data center market growth is the rise in the adoption of multi-cloud and network upgrades to support 5G— in North America in particular, there has been a substantial increase in the adoption of cloud services by enterprises across industries. Another major factor is the rise in the adoption of edge computing, which is a network architecture wherein the data is stored and processed near its origin. There has also been a significant increase in the adoption of IT infrastructure due to the increase in demand for computing power and storage to support the growth in global data traffic.

Leading sustainability best practices

Principal Real Estate and Stream Data Centers are dedicated to providing common sense solutions that meet the needs of today's data center users while seeking to deliver positive financial and sustainability outcomes. Our sustainability objectives address environmental impact, climate resilience, data transparency, stakeholder engagement, and sustainable design.

Environmental impact is minimized through innovative cooling systems design, energy efficiency measures including raising data hall temperature setpoints, and sourcing renewable energy. Power is by far the biggest expense and most critical need for data centers, so efforts to reduce mechanical systems energy demand and offer uninterrupted power are a priority. Maintaining availability has traditionally been fulfilled with diverse utility feeds backed up by emergency diesel generators, but a more sustainable approach is to consider building an on-site substation to power the data center directly, securing power purchase agreements with local utility companies and competitive suppliers (ideally green power), or installing on-site renewable power generation along with Hydrogen Fuel Cell or LNG fueled Generators. Hyperscale providers such as Amazon, Facebook, Google, and Microsoft have led the charge toward 100% renewable energy commitments. According to the IEA World Energy Outlook 2017, the share of renewables in total power generation will increase from 24% in 2016 to 30% in 2022, and it predicts that renewable energy will account for two-thirds of global investment in power plants through 2040.[5] And, energy efficiency starts at design with efficient infrastructure and structural considerations like enhanced walls and roof that also align with withstanding natural disasters and extreme weather.

Climate resilience is fostered through climate risk analysis, site selection, and mitigation strategies to help ensure building safety and preparedness for both physical and transitional climate risks. Physical risks include natural disasters and extreme weather such as flooding, wildfire, extreme temperature, and tropical cyclones. This informs site selection or identifies high risks that require a mitigation strategy.

Data transparency involves tracking and reporting on asset performance in alignment with recognized ESG benchmarks and standards such as GRESB. Principal has clearly defined sustainability metrics and targets, benchmarks utility usage in ENERGY STAR Portfolio Manager, and discloses performance to GRESB, CDP, PRI, and others.

Stakeholder engagement focuses on tenants and industry organizations. Tenants can be effective partners in reaching sustainability goals by optimizing operations and reducing inefficiencies. Tenants may have their own ESG initiatives to support or align, which increases the likelihood for collaborative partnerships. Tenants are also integral in collecting ESG data to drive performance, such as energy usage that is used to calculate greenhouse gas emissions. Implementing green lease clauses, such as data sharing, can play an important role in effective tenant engagement and collaboration.

[4] Technavio, November 2022

[5] 451 Research "Smarter Datacenter Energy Procurement Can Improve Sustainability While Lowering Costs"

Sustainability measures are most effective when contemplated by stakeholders during the design and development phase and even earlier during site selection when cost of power and risk of natural disasters can be evaluated. Sustainability measures to reduce negative impacts on the environment and improve building performance include resource management, building certifications, and technology and equipment innovation. There are several industry organizations, such as the iMason Climate Accord, Data Center Coalition, and Data Centre Alliance that can provide valuable insight and resources for sustainable data center operations.

Innovative technology & renewables

While data centers are energy-intensive, much has been done to enable these facilities to operate more efficiently through the deployment of innovative technologies and a shift to renewable energy power sources. In the last decade, even as data use has skyrocketed, technological enhancements such as processor efficiency improvements and reductions in idle power, have reduced the electricity requirements of data center servers.[6]

Research has shown that IT Equipment has increased in density but become more efficient in doing so, which means the energy required to process a terabyte of data has fallen. Some research has estimated a 20% reduction in energy intensity over the last five years–representing a sharper decrease than other energy intensive industries.[7]

Beyond processor efficiency, landlords and tenants are seeking innovative building solutions such as hydrogen fuel cells, capturing waste heat, and water free cooling. Microsoft recently used hydrogen fuel cells to back up some of its data center services, which could help replace diesel-powered backup generators.

Utilizing the excess heat produced by data center cooling equipment is another emerging area of energy efficiency, particularly in Scandinavia, Netherlands, and Germany. For example, an initiative in Stockholm aims to use waste heat from data centers to heat 10% of the city by 2035.[8]

Water free cooling or air-cooled systems are a priority solution for water constrained climates. For example, Intel recently announced an effort to create a reference design for immersion cooling, which is a technique that involves immersing servers and other equipment in non-conductive liquids to enable hyper-efficient cooling.[9] Conversely, where water is abundant, using water can be a valuable tool for reducing emissions. However, there is increasing focus on water usage effectiveness (WUE) in data centers. As an example, Amazon committed to publishing Water Usage Effectiveness (WUE) reports on an annual basis. It also pledged to become water-positive, meaning it will make more water available than it consumes. One strategy has been to utilize recycled water for cooling in 20 of their data centers. Microsoft and Google Cloud have made similar pledges to be water-positive. Google's Senior Vice President of Technical Infrastructure Urs Hölzle also recently wrote in a post titled *Our commitment to climate-conscious data center cooling*, "There is no one-size-fits-all solution." [10]

Our energy efficiency and carbon reduction strategy is encapsulated in three stages in order of priority: reduce, renew, and restore. First, reduction in energy use and greenhouse gases is achieved by taking advantage of increased tenant thermal requirements and innovating on mechanical systems to benefit from these elevated service-level agreements (SLAs). Since up to 40% of a modern data centers energy can go to mechanical, electrical, and plumbing systems (MEP systems0 that support IT Loads, it's vital that these systems maximize the gains available from elevated thermal SLAs, better airflow design and utilize the most efficient components available.

[6] B. Wagner, "Intergenerational efficiency of DellEMC PowerEdge servers" (DellEMC white paper 2018)
[7] American Association for the Advancement of Science, "Recalibrating global data center energy-use estimates" February 2020
[8] Data Center Frontier, "Waste Heat Utilization is the Data Center Step Toward Net-Zero Energy" August 2020
[9] Data Center Knowledge, "Key Data Center Sustainability Trends in 2022" December 2022
[10] Urs Hölzle, "Our commitment to climate-conscious data center cooling" November 2022

Second, renewables are an increasingly viable investment decision for both reliable energy supply and improved environmental outcomes. Additionally, renewable energy is becoming more cost effective. Microsoft recently committed to acquiring 900 megawatts of additional solar and wind energy, which is enough to power several hyperscale data centers.[9] Along with Microsoft, large hyperscale data center tenants Amazon, Meta, and Google are represented in the top 10 of leading corporate purchasers of renewable energy globally, often by way of direct purchases from newly-built renewable generation under Power Purchase Agreements (PPAs).[11]

Third, carbon offsets can be purchased that reduce emissions and ideally are selected for their ability to restore forests, update power plants and factories or increase the energy efficiency of buildings and transportation.

Risk mitigation

Sustainable and resilient data centers address climate risk and may reduce both operational and reputational risk.

Recently 25 companies and 17 associations across Europe announced an agreement to take specific measures to make data centers climate neutral by 2030.[12] It is a best practice to implement resiliency measures into data center risk mitigation strategies. Resiliency planning can help ensure building safety and increase preparedness for physical and transitional climate risks through climate risk analysis, site selection, and implementation of risk mitigation measures.

Total cost of ownership can be directly affected by operating costs related to energy and water usage, waste production, and carbon emissions (assuming potential carbon taxes). TCO can also be affected by supply issues, whether related to energy security, water scarcity, or equipment supply chain issues. Therefore, a sustainable data center incorporates design and sourcing considerations such as reducing reliance on water for cooling, using equipment sources that provide less exposure to global supply chain risk (and lower environmental impact), and shifting to renewable energy for more energy security.

Conclusion

Forward-thinking ESG practices in data centers has the potential to benefit the environment and are good for business. By taking a proactive role in promoting and implementing sustainability initiatives, we believe the data center industry will be well positioned to service its essential role connecting the global economy.

[11] BloombergNEF " Corporate Clean Energy Buying Tops 30GW Mark in Record Year" January 2022

[12] European Data Centre Association, "Climate Neutral Data Centre Pact" January 2021

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