Data Centers & Power Demand

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Data centers play a critical role in the digital economy, making up a growing source of non-negotiable energy demand. Efficiency improvements have helped keep electricity consumption flat over the past two decades, but power-hungry artificial intelligence servers appear to be catalyzing the most meaningful inflection in power demand for decades. Clean energy, battery storage, power equipment and efficient cooling are all vital to ensuring AI related energy consumption grows at a manageable pace. In this Smarticle, we discuss data centers and their impact on the sustainable energy landscape.

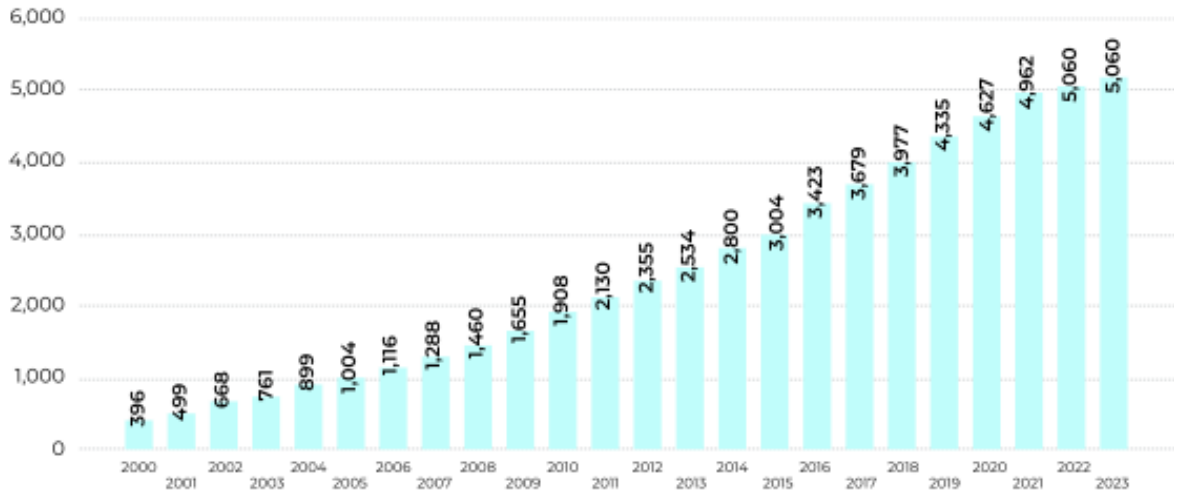
What is a Data Center?

Data centers play a critical role in the digital economy by housing servers which process, store and disseminate data. Traditionally, servers would have been stored locally in dedicated computer rooms. However, as demand for connectivity grew, the cost of hosting these servers on-site became increasingly expensive. This opened a gap in the market for co-location providers to host customer servers in secure facilities with shared access to power, cooling, and network connectivity at scale. In recent years, hyperscale cloud service providers ("**Hyperscalers**") have removed the need for customers to own a server at all; selling access to storage and computing power on third party equipment, housed in their own facilities in return for an annual fee.

Data Centers & Global Electricity Demand

As the world has become increasingly digitalized, demand for data center services has risen rapidly. The number of internet users more than doubled to over 5 billion between 2010 and 2023, with the amount of data created and replicated increasing by over 60 times over the same period. A huge amount of energy is required to support the vast and expanding installed base of internet infrastructure. The IEA estimates that data centers consumed 240TWh (terawatt-hour) of electricity in 2022, while "Thunder Said Energy" estimates broader internet related energy demand (including transmission, networking, blockchain, and AI) to be closer to 800TWh, around 2.5% of global electricity demand.

Number of Internet Users by Year
(in millions)



Source: Data Reportal

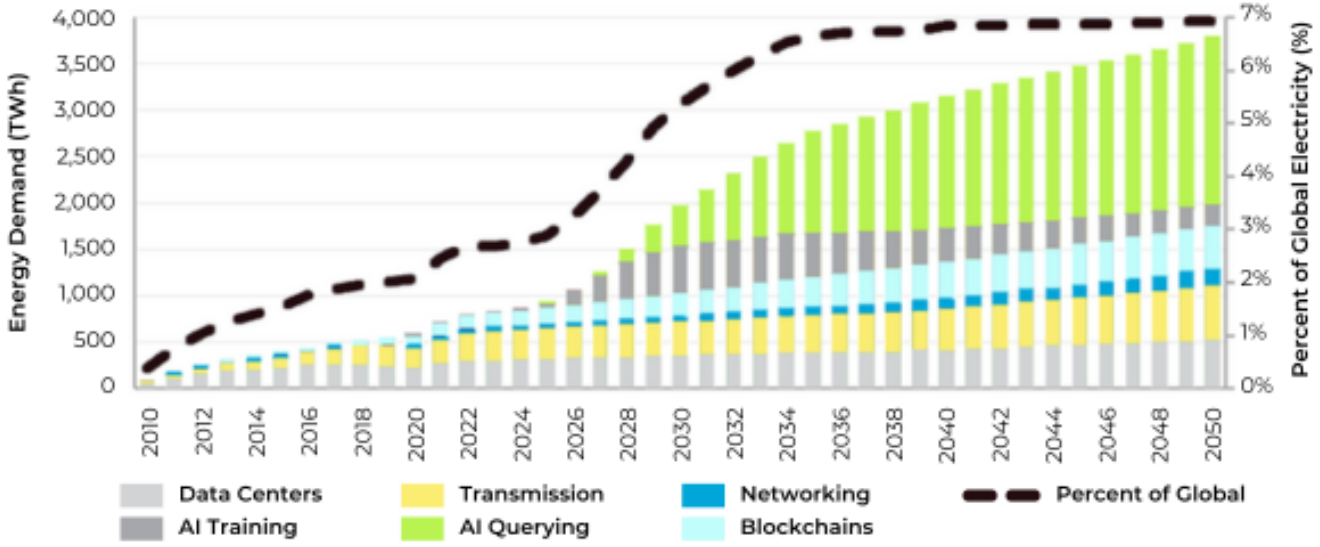
Considering that electricity is a data center's second largest expense (15-25% operating costs) after maintenance (40%), operators track energy efficiency very closely. Energy consumption within data centers largely comes from computing (40-60%), with cooling a close second (20-40%). Batteries, used for uninterruptible power supply (UPS), play an integral role in optimizing power usage by preventing downtime while helping to reduce electricity costs and environmental impact. Thanks to meaningful efficiency improvements in IT hardware, power equipment, and cooling, alongside a shift from smaller facilities towards more efficient hyperscale facilities, global data center energy usage has grown by only 20% since 2010.

The Impact of Artificial Intelligence on Power Demand

Despite a great deal of uncertainty in forecasts, with expectations of US data center capacity growth from 2023-2026 varying from 10% per annum (pa) (McKinsey) to an eye-watering 65% pa (SemiAnalysis), datacenters and the increasing popularity of artificial intelligence (AI) is widely expected to drive a step change in electricity demand growth. According to Bernstein, power demand for these data centers is poised to grow at 10% pa from 2023-2030, **increasing from 2.5% to 7.5% of total US electricity consumption**. Underpinning this expansion is the growing prevalence of AI servers which are 4-5x more power hungry than traditional servers. This, along with reshoring of manufacturing, electric vehicles, and the shift to renewables is set to accelerate US electricity demand growth from 0% pa for the past 20 years to 2% pa from 2023-2028, prompting a number of US utilities to hike their forecasts for demand growth.

The picture is similar at a global scale. Even with improvements to efficiency, "Thunder Said Energy" forecasts global internet related energy consumption to increase 12% pa from 800TWh in 2022 to 2,000TWh in 2030, driven primarily by AI Training and Querying. They see 2,000 AI models being trained per year in 2030, up from 200 in 2023, consuming 500TWh of electricity, pushing internet related power consumption from **2.5% of global demand in 2023 to 5.5% in 2030**.

Number of Internet Users by Year
(in millions)

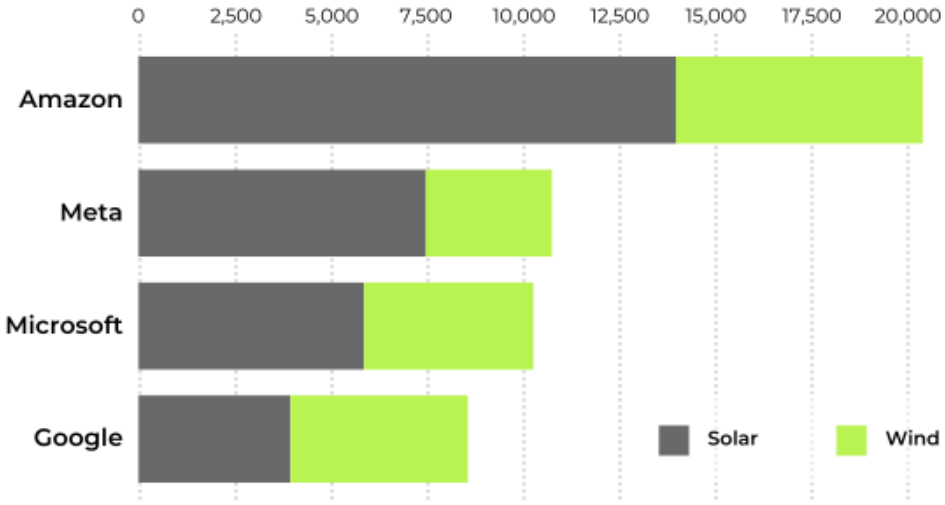


Source: Thunder Said Energy

The Role of Clean Energy PPAs

Growing hyperscaler energy needs combined with ambitious sustainability commitments and a need for predictable prices has underpinned recent growth in clean energy power purchase agreements (PPAs). Global PPA volumes have increased from 6GW (gigawatt) in 2017 to 46GW in 2023 and PPA prices in the US and Europe have increased at >20% pa from 2020-2023. Globally, technology companies are the largest purchasers of clean energy PPAs, accounting for around 40% of demand in 2023. Amazon, Microsoft, Meta, and Google are the four largest purchasers of corporate renewable energy PPAs, having contracted almost 50GW to date, equal to the generation capacity of Sweden.

Top Corporate Off-Takers of Renewable Energy PPAs
2010 - 2022 (MW)



Source: International Energy Agency

NVIDIA recently stated that "Generative AI has kicked off a whole new investment cycle to build the next trillion dollars of infrastructure of AI generation factories." This bullish outlook has been echoed by a number of our portfolio companies.

- **Schneider Electric**, **Eaton**, and **Legrand** provide medium voltage power equipment for data centers. We believe Schneider is especially well placed, offering full solutions that bring together power, cooling, racks and power and IT management systems. Schneider sees this end market growing at >10% pa to 2027, outpacing its group level organic growth target of 7-10% pa. At its Q1 2024 results, management called out "very strong" and broad-

based demand from data centers, confirming an acceleration in the market due to AI, led by North America, but also that they were starting to see the same type of exciting dynamics in Europe.

- **Trane Technologies** is a leader in specialist commercial cooling solutions, providing both liquid and air-cooled offerings. In our opinion, the company holds an attractive position in both data centers and complex industrial manufacturing where demand is ramping on the back of AI investment and US Reshoring tailwinds. At the end of 2023, management highlighted strength from data centers and was confident the vertical would remain robust through 2024-2025, given the pipeline of activity from major customers.

- **Iberdrola** & **NextEra Energy** provide clean energy and energy storage to hyperscalers and colocation companies. Both have highlighted data centers as a key driver electricity demand growth with NextEra expecting the vertical to grow at 15% pa to 2030. We believe both companies are well positioned to serve these needs due to their scale and experience in renewables.

Based on this information, we believe that SOLR is well positioned to benefit from this data center driven investment cycle.

Disclosure

For the fund's current holdings, click here or go to SmartETFs.com/SOLR.

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International investments may involve risk of capital loss from unfavorable fluctuation in currency values, from differences in generally accepted accounting principles or from social, economic, or political instability in other nations. Emerging markets involve heightened risks related to the same factors as well as increased volatility and lower trading volume.

Prices of energy, whether traditional or sustainable, may fluctuate or decline due to many factors, including international political or economic developments, real or perceived, demand for energy and sustainable energy, production and distribution policies of OPEC (Organization of Petroleum Exporting Countries) and other oil-producing countries, energy conservation projects, changes in governmental regulations affecting companies in the energy sector, including Sustainable Energy companies, changes in technology affecting Sustainable Energy, and changes in tax regulations relating to energy.

A decline in energy prices would likely have a negative effect on securities held by the ETF. The ETF's focus on the energy sector to the exclusion of other sectors exposes the ETF to greater market risk and potential monetary losses than if the ETF's assets were diversified among various sectors.

Foreside Fund Services, LLC, distributor.