460 kWh data center energy storage

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On average, a ChatGPT query needs nearly 10 times as much electricity to process as a Google search. In that difference lies a coming sea change in how the US, Europe, and the world at large will consume power -- and how much that will cost.

For years, data centers displayed a remarkably stable appetite for power, even as their workloads mounted. Now, as the pace of efficiency gains in electricity use slows and the AI revolution gathers steam, Goldman Sachs Research estimates that data center power demand will grow 160% by 2030.

At present, data centers worldwide consume 1-2% of overall power, but this percentage will likely rise to 3-4% by the end of the decade. In the US and Europe, this increased demand will help drive the kind of electricity growth that hasn"t been seen in a generation. Along the way, the carbon dioxide emissions of data centers may more than double between 2022 and 2030.

Over the last decade, US power demand growth has been roughly zero, even though the population and its economic activity have increased. Efficiencies have helped; one example is the LED light, which drives lower power use. But that is set to change. Between 2022 and 2030, the demand for power will rise roughly 2.4%, Goldman Sachs Research estimates -- and around 0.9 percent points of that figure will be tied to data centers.

That kind of spike in power demand hasn"t been seen in the US since the early years of this century. It will be stoked partly by electrification and industrial reshoring, but also by AI. Data centers will use 8% of US power by 2030, compared with 3% in 2022.

US utilities will need to invest around $50 billion in new generation capacity just to support data centers alone. In addition, our analysts expect incremental data center power consumption in the US will drive around 3.3 billion cubic feet per day of new natural gas demand by 2030, which will require new pipeline capacity to be built.

Over the past 15 years, Europe"s power demand has been severely hit by a sequence of shocks: the global financial crisis, the covid pandemic, and the energy crisis triggered by the war in Ukraine. But it has also suffered due to a slower-than-expected pick up in electrification and the ongoing de-industrialization of the European economy. As a result, since a 2008 peak, electricity demand has cumulatively declined by nearly 10%.

Going forward, between 2023 and 2033, thanks to both the expansion of data centers and an acceleration of electrification, Europe"s power demand could grow by 40% and perhaps even 50%, according to Goldman Sachs Research. At the moment, around 15% of the world"s data centers are located in Europe. By 2030, the power needs of these data centers will match the current total consumption of Portugal, Greece, and the

Netherlands combined.

Data center power demand will rise in two kinds of European countries, our analysts write. The first sort is those with cheap and abundant power from nuclear, hydro, wind, or solar sources, such as the Nordic nations, Spain and France. The second kind will include countries with large financial services and tech companies, which offer tax breaks or other incentives to attract data centers. The latter category includes Germany, the UK, and Ireland.

Europe has the oldest power grid in the world, so keeping new data centers electrified will require more investment. Our analysts expect nearly EUR800 billion ($861 billion) in spending on transmission and distribution over the coming decade, as well as nearly EUR850 billion in investment on solar, onshore wind, and offshore wind energy.

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