

## Article Overview

Data centers are powered by a mix of fossil fuels, renewables, and nuclear energy, with renewables growing fastest but fossil fuels still dominating in many regions.

## Global Energy Consumption

Data centers currently consume about 1.5% of global electricity, equivalent to roughly 415 TWh in 2024, and this is projected to more than double to 945 TWh by 2030 due to AI and cloud computing growth . Globally, the electricity mix for data centers is dominated by coal (30%), natural gas (26%), and nuclear (15%), while renewables--primarily wind, solar PV, and hydro--supply about 27% of current demand . The share of renewables is the fastest-growing segment, projected to meet nearly 50% of the growth in electricity demand for data centers between 2024 and 2030 .

## Regional Differences

- o United States: Natural gas is the largest source at over 40%, followed by renewables (24%), nuclear (20%), and coal (15%). Renewables and small modular reactors (SMRs) are expected to reduce reliance on fossil fuels after 2030 .
- o China: Coal remains the dominant source, contributing the highest share globally, though renewables are increasing .
- o European Union: Data centers consumed about 70 TWh in 2024, projected to rise to 115 TWh by 2030. The EU emphasizes energy efficiency and renewable integration, guided by initiatives like the EU Code of Conduct for Data Centres .

## Onsite Generation and Backup

By 2030, approximately 30% of data centers are expected to use onsite power as a primary or supplemental source, including fuel cells, solar, and battery storage . Backup energy storage is common to ensure high uptime, allowing data centers to respond flexibly to grid conditions .

## Trends and Strategic Implications

- o Renewable PPAs and co-located generation: Many operators invest directly in wind and solar to secure low-emission electricity .
- o Nuclear adoption: SMRs are expected to play a growing role in the U.S., reducing fossil fuel dependence .
- o Grid challenges: Rapid growth in data center demand, especially in AI-heavy regions like Northern Virginia, strains local grids and increases lead times for new power connections .
- o Energy efficiency: EU and global initiatives aim to double energy efficiency improvements and expand

renewable capacity to meet rising demand sustainably .

## Summary

Data centers rely on a diverse energy mix, with fossil fuels still significant but renewables and nuclear increasingly important. Regional differences are pronounced, with the U.S. and China leading in consumption. The fastest growth is in renewable energy, supported by corporate investments and policy incentives, while onsite generation and storage enhance reliability. As AI and cloud computing expand, energy planning, efficiency measures, and low-emission sourcing will be critical to sustainable data center operations.

With data centers become increasingly complex and diverse, energy management systems that can effectively

In summary, this review paper seeks to offer an exhaustive overview of cutting-edge research related to electricity

Executive Summary One year ago, Bloom Energy's inaugural Data Center Power Report documented an emerging reality: AI-driven

AI-driven data center power consumption will continue to surge, but data centers are not--in fact--that big a part of global energy

NEWS 10 April 2025 Data centres will use twice as much energy by 2030 -- driven by AI These facilities

His research interests include data center power and energy management, sustainable computing, and computer architecture.

The extent to which data-centre growth increases emissions depends on which energy

In 2025, AI demand drove data centers toward on-site power, BESS, and nuclear options, while grid delays

In the Annual Energy Outlook 2026 (AEO2026), our long-term outlook, we project electricity consumed by data center

Renewables - primarily wind, solar PV and hydro - currently supply about 27% of the electricity consumed by data centres globally.

Chapter 3 summarises the critical review of data centre energy estimates from a range of available sources, including government



# Data Center Energy Source Analysis

The Commission's energy efficiency package for data centres will complement existing EU rules for data

The Commission will regularly assesses the energy efficiency and sustainability of EU data centres that have reported their data and

Bloom Energy, a leader in power solutions, explains in this 2025 Data Center Power Report how data center leaders are shifting

This mid-year update builds on the 2026 Data Center Power Report, revealing how conditions have shifted and what leading

US data center power demand is forecast to surge from 31 GW in 2025 to 66 GW by 2027, driven by AI expansion,

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