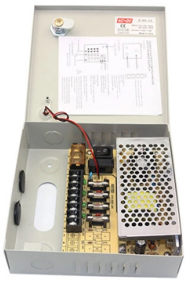
Energy Big Data Center Operation



Overview

The Commission''s energy efficiency package for data centres will complement existing EU rules for data centres under the Energy Efficiency Directive.

Key Takeaways

Energy-intensive operations in big data centers, especially AI-focused facilities, are rapidly increasing electricity demand, driving efficiency innovations and reshaping power infrastructure planning.

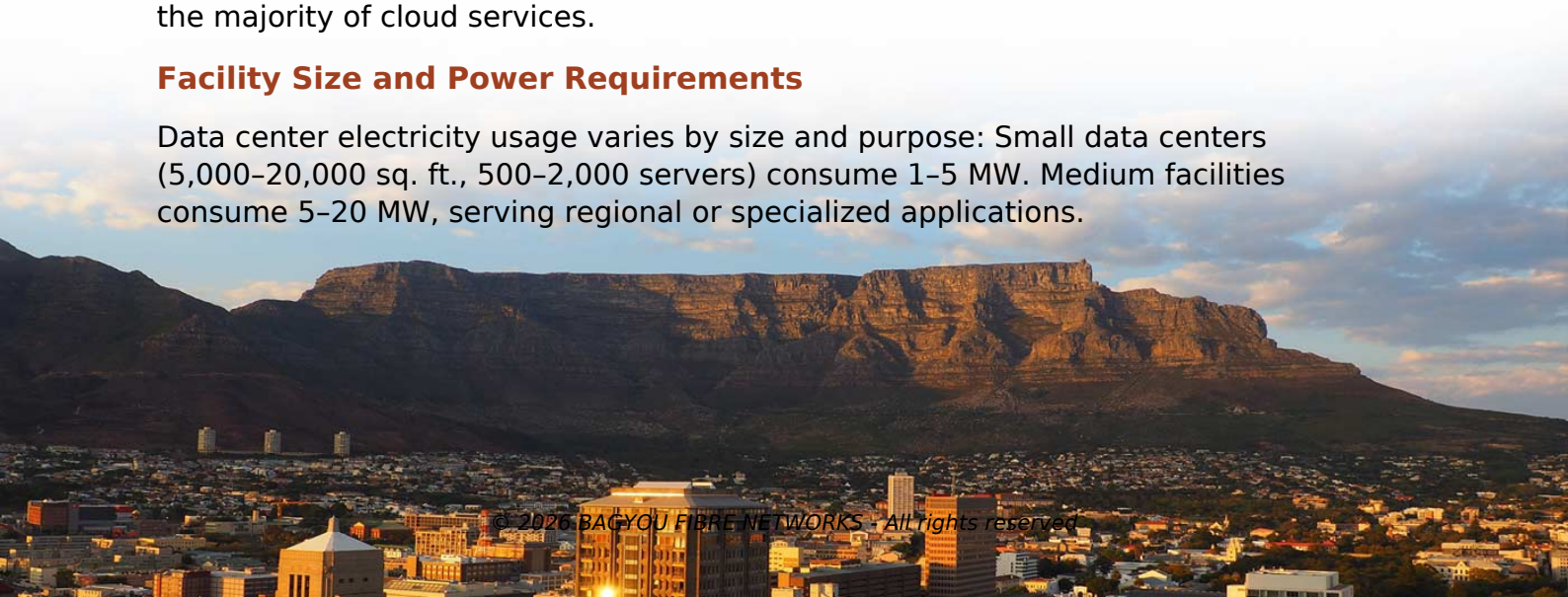
Current Energy Consumption Trends

Data centers globally are projected to consume 650–1,050 TWh by 2026, representing roughly 1. 5% of global electricity consumption in 2024, with AI workloads accelerating growth even faster than general data center demand. In 2025, electricity demand from AI-focused data centers surged, outpacing global electricity growth, and is expected to triple by 2030 due to the proliferation of AI training and inference tasks.

Hyperscale facilities, operated by companies like AWS, Microsoft Azure, and Google Cloud, account for 40–45% of global data center energy consumption while delivering the majority of cloud services.

Facility Size and Power Requirements

Data center electricity usage varies by size and purpose: Small data centers (5,000–20,000 sq. ft., 500–2,000 servers) consume 1–5 MW. Medium facilities consume 5–20 MW, serving regional or specialized applications.



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Hyperscale A

I campuses can exceed gigawatt-scale, with one in five expected to surpass 1 GW by 2030 and one in three by 2035.

A

I model training, such as GPT-4, can consume 50 GWh per training run, equivalent to the annual electricity use of tens of thousands of households. Inference workloads, which power real-time AI services, are projected to become the dominant driver of AI-related energy consumption by 2030.

Operational Challenges

Energy availability is now a primary constraint on data center growth. Key operational challenges include: Grid limitations: Interconnection timelines and local grid capacity can delay expansion. Cooling and water supply: High-density AI workloads require advanced cooling systems and sufficient water resources.

Permitting and regulatory complexity: Approvals for new facilities are increasingly bottlenecked. Supply chain constraints: Shortages of transformers, gas turbines, and advanced chips affect deployment speed.

Strategies for Energy Efficiency

To manage energy demand, operators are adopting multiple strategies: Onsite generation: Incorporating fuel cells, solar, and other distributed energy resources to reduce grid dependency. Geographic optimization: Concentrating new data centers in power-advantaged regions, such as Texas, while legacy markets like California and Oregon lose relative share. Hardware and software optimization: Improving server utilization, AI task efficiency, and cooling technologies to reduce power per computation.

Renewable integration: Procuring renewable energy to meet sustainability goals and mitigate carbon emissions.

Implications

The rapid growth of AI and big data operations is reshaping electricity markets, grid planning, and climate strategies. Data centers are no longer just IT facilities—they are critical energy infrastructure, influencing local and national energy policies, renewable energy adoption, and long-term power system planning. In summary, big data center operations are increasingly energy-intensive, with AI workloads driving unprecedented electricity demand.

Operators must balance efficiency, sustainability, and grid constraints while scaling facilities to meet the growing computational needs of the digital economy.

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Article Content

Data centre electricity use surged in 2025, even with tightening ...

Data centre electricity use surged in 2025, even with tightening bottlenecks driving a scramble for solutions - News from the International Energy Agency

Energy performance of data centres

The Commission''s energy efficiency package for data centres will complement existing EU rules for data centres under the Energy Efficiency Directive.

Data centres as a source of flexibility for power systems

Data centres present a unique opportunity to enhance power system flexibility due to their substantial yet controllable energy consumption and advanced technological capabilities. This paper

How Data Centers Redefined Energy and Power in 2025

In 2025, data centers evolved from passive utility customers to active energy planners, investing in on-site generation, battery storage, and flexible demand to serve AI compute and hit

Data Center Power Demand | MIT Energy Initiative

A single hyperscale data center can consume as much electricity as 50,000 homes. To address this complex challenge, the MIT Energy Initiative brings together MIT faculty members and scientists to

Data Centre Energy Use: Critical Review of Models and Results

The most comprehensive bottom-up analyses of United States (US) data centre energy use have been led by researchers at the Department of Energy''s Lawrence Berkeley National Laboratory (LBNL).

In focus: Data centres – an energy-hungry challenge

Data centres are a vital infrastructure supporting our ever-growing use of cloud storage, social media, AI, streaming services and more. They''re also an increasingly hot topic of the clean

Review of energy efficiency and technological advancements in data ...

The research, which draws from case studies of effective energy supply systems in data centers, offers useful suggestions and best practices for planning, executing, and overseeing data

Data centers: Catalyzing innovation in energy

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Data centers are reshaping the energy sector, straining power systems but also sparking innovation across generation, grid design, and business models.

Data center sustainability | Deloitte insights

AI-driven data center power consumption will continue to surge, but data centers are not—in fact—that big a part of global energy demand. Deloitte predicts data centers will only make up about 2% of

We did the math on AI''s energy footprint. Here''s the story you haven''t ...

In 2017, AI began to change everything. Data centers started getting built with energy-intensive hardware designed for AI, which led them to double their electricity consumption by 2023.

Accelerating Federal Permitting of Data Center Infrastructure

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered: Section 1. Policy and

Inside Form Energy''s Big Google Data Center Deal

The Google deal represents a significant play for scale from the startup, which has raised about $1.2 billion to date. By comparison, Form''s first

PNNL/ASHRAE/NEMA AI Data Center Energy Performance Framework

The AI Data Center Framework is a collaborative initiative between ASHRAE, NEMA, and Pacific Northwest National Laboratory (PNNL) to guide the design, operation, and optimization of next

Energy demand from AI – Energy and AI – Analysis

Energy demand from AI What is a data centre? Artificial intelligence (AI) model training and deployment occur mainly in data centres. Understanding the role of data centres as actors in the energy system

Mark Zuckerberg says Meta is building a 5GW AI data center

Mark Zuckerberg says Meta is building out some massive data centers to power its AI ambitions and compete with OpenAI, Google, and Anthropic.

Tech company climate goals under pressure due to AI

Some analysts predict nationwide electricity use to rise as much as 20% in the next decade, with data centers a big reason. Meanwhile, a backlog of proposed

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