

## AWS Data Center Energy



### Overview

Data Centers AWS data centers use a more efficient cooling system that is expected to reduce mechanical energy consumption by up to 50% AWS Cloud By contin.

### Key Takeaways

AWS data centers are designed for high energy efficiency, using advanced cooling, purpose-built chips, and renewable energy to reduce carbon emissions and optimize resource use. Energy Efficiency and Power Usage

AWS data centers are up to 4.1 times more energy efficient than typical on-premises data centers, with optimized workloads reducing carbon footprints by up to 99% . In 2024, AWS reported a global Power Usage Effectiveness (PUE) of 1.15, outperforming the public cloud industry average of 1.25 and on-premises enterprise data centers at 1.63 . PUE measures the ratio of total facility energy to IT equipment energy, with lower values indicating higher efficiency.

### Cooling Innovations

AWS employs advanced cooling technologies to minimize energy use. These include single-sided and liquid-to-chip cooling systems, In-Row Heat Exchangers (IRHX) for high-density AI hardware, and configurable air and liquid cooling integration for AI supercomputing workloads . These innovations reduce mechanical energy consumption by up to 50% during peak cooling without increasing water usage, and are expected to cut water use by 9% compared to traditional evaporative air-cooled data centers once fully operational .

## Hardware and Compute Efficiency

AWS leverages purpose-built silicon chips like Graviton-based EC2 instances, which use up to 60% less energy than comparable instances while maintaining performance . These chips, combined with optimized rack placement and AI-driven energy management, reduce stranded power and improve overall energy utilization.

## Renewable Energy and Carbon Reduction

AWS matches 100% of electricity consumption with renewable energy, achieving this milestone consecutively in 2024 and 2025 . Investments include solar photovoltaic systems paired with battery energy storage, and advanced nuclear reactors (SMRs) to provide scalable, carbon-free energy . These initiatives contribute to Amazon's goal of net-zero carbon emissions by 2040.

## Water and Circular Economy

AWS tracks Water Usage Effectiveness (WUE), achieving 0.12 liters per kWh of IT load, over seven times better than the industry average . The company also promotes a circular economy by reusing hardware, extending server lifetimes, and using recycled materials in components .

## Summary

AWS data centers combine energy-efficient design, advanced cooling, purpose-built hardware, renewable energy, and water stewardship to minimize environmental impact while supporting high-performance workloads, including AI. These efforts make AWS infrastructure significantly more sustainable than traditional on-premises data centers, aligning with long-term carbon reduction and resource efficiency goals .

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In 2024, we continued to match 100% of electricity consumed in all data center regions with renewable energy sources and worked

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Amazon's 2024 Sustainability Report highlights energy and emissions performance across its global operations, with

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Amazon says all of its operations – including its data centers – are now powered by renewable energy. Amazon set a

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AWS Cloud

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"Talen is well-positioned to support Amazon's energy needs as it invests further in the Commonwealth of

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AWS' renewable energy is sourced from utility-scale wind and solar, with parent company

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AWS commitment to sustainability In addition to addressing environmental risks, we also invest and innovate to incorporate

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## How Much Energy Do Amazon Data Centers

Amazon built a data center empire in northern Virginia. Exclusive filings reveal it's using as

## 2023 Amazon Sustainability Report

AWS's scale allows for higher resource utilization and energy efficiency than the typical on-premises data center. From the

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## Energy-Efficient Data Centers: A Conversation with Amazon Web Services

For Amazon Web Services (AWS), Amazon's cloud computing business, everything is on the table as far as adoption

AWS rolls out liquid cooling in data centers

The shift, happening across parts of the AWS portfolio, matters because there's actually a fourth thing a data center

Water stewardship

We also have the most data center locations using reclaimed water according to Koomey Analytics. To do this, AWS works with local

How Data Centers Like Amazon's Can Lower Electricity Bills

Data centers — like the ones Amazon uses for cloud computing and artificial intelligence — use a lot of electricity.

Amazon joins White House Ratepayer Protection Pledge with energy

Amazon joins White House energy pledge to strengthen the grid and protect ratepayers. We fully pay our data center

Talen, Amazon Launch \$18B Nuclear PPA—A Grid-Connected IPP

Talen Energy has restructured and significantly expanded its nuclear energy agreement with Amazon Web Services

AWS acquires Talen's nuclear data center campus in Pennsylvania

Amazon Web Services (AWS) has acquired Talen Energy's data center campus at a nuclear power station in

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Sustainable Cloud Computing

AWS brings highly scalable, elastic, and secure cloud services to sustainability innovation. Using AWS, organizations can use the

Amazon Charges Ahead With Green Data Center Efficiency: Q&A

Customer demand for low-carbon data storage is a key driver of improved energy efficiency and innovation at Amazon

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How Amazon is powering the next era of carbon-free energy

We sat down with Mandy Ulrich, senior manager of energy and water for AWS Data Center Global Services in the

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