

Hydrogen Energy and Data Centers



Overview

Hydrogen-powered data centres: securing reliable and sustainable Given the significant benefits that AI and digitalisation offer for the energy transition.

Key Takeaways

Hydrogen fuel cells offer a clean, reliable, and scalable energy solution for powering data centers, reducing carbon emissions while supporting continuous operation.

How Hydrogen Powers Data Centers

Hydrogen energy is primarily harnessed through fuel cells, which generate electricity by combining hydrogen and oxygen in an electrochemical reaction, producing only water and heat as byproducts. Hydrogen can be stored in high-pressure tanks and fed into fuel cells, where it is split into protons and electrons. The electrons flow through an external circuit to generate electricity, while the protons combine with oxygen to form water, resulting in zero greenhouse gas emissions during operation.

Types of Fuel Cells

Proton Exchange Membrane Fuel Cells (PEMFCs): Quick start-up, high power density, ideal for backup power and managing fluctuating loads in data centers. Solid Oxide Fuel Cells (SOFCs): High efficiency and long-term stability, suitable for large-scale primary power supply and integration with existing energy infrastructure.



Benefits for Data Centers

Continuous and Reliable Power: Unlike batteries or intermittent renewables, hydrogen fuel cells can provide uninterrupted electricity, crucial for AI-driven and hyperscale data centers. **Carbon Footprint Reduction:** Hydrogen-powered systems produce only water, significantly lowering emissions compared to traditional gas or diesel generators. **Load Balancing:** Fuel cells efficiently handle variable loads, ensuring stable power for critical IT operations.

Energy Security: On-site hydrogen generation using renewable energy reduces dependency on external grids and mitigates risks from grid congestion or delays.

Industry Adoption and Initiatives

Companies like Equinix and EdgeCloudLink are actively exploring hydrogen-powered data centers. Equinix is researching green hydrogen to achieve 100% renewable energy in its facilities, while EdgeCloudLink operates a 1MW hydrogen-powered data center in California and plans a 1GW campus. In the U.

S., Bloom Energy reports that nearly one-third of data centers aim to go fully off-grid by 2030 using SOFCs, driven by AI energy demands and grid connection delays.

Hydrogen Production and Infrastructure

Hydrogen can be produced from natural gas, water electrolysis, or renewable energy, offering flexibility and sustainability. Countries like Japan and Germany are developing hydrogen hubs to support production, storage, and distribution, which is critical for scaling hydrogen-powered data centers. On-site generation further enhances energy independence and reduces logistical challenges associated with hydrogen delivery.

Future Outlook

Advancements in fuel cell efficiency, hydrogen production, and supportive government policies are accelerating adoption. Hydrogen-powered data centers are positioned to play a key role in decarbonizing IT infrastructure, supporting AI workloads, and ensuring reliable, continuous power in a sustainable manner. Hydrogen energy represents a strategic solution for data centers seeking to balance operational reliability, environmental responsibility, and energy security in the era of growing digitalization and AI-driven demand.

Article Content

Hydrogen-powered data centres: securing reliable and sustainable

Given the significant benefits that AI and digitalisation offer for the energy transition – as well as for Europe's broader resilience and strategic autonomy – it is essential that Europe adopts a balanced

The Outlook of Hydrogen Powered Data Centers

This blog explores how hydrogen power works, the benefits it provides over traditional energy sources, the current state of hydrogen-powered

A green revolution? Hydrogen fuel cells in the data center

In recent years, hydrogen has been increasingly posited as an alternative green energy source for the data center industry, though never one

Analysis of hydrogen infrastructure for the feasibility, economics, and ...

In this work, we describe a novel carbon-free hydrogen infrastructure that meets a data center's energy needs using integrated fuel cell computer racks, hydrogen storage, and renewable

Could hydrogen fuel cells be the right choice for data

As AI drives up global electricity demand, hydrogen fuel cells offer a clean, scalable power alternative for data centres. Discover how companies like

Hydrogen Fuel Cells in Data Centers: A Clean Energy

Explore the benefits and challenges of integrating hydrogen fuel cells in data centers for sustainable and efficient power solutions.

Hydrogen's Hurdles, Fuel Cells' Rise in Data Center Power

We examine hydrogen engines, fuel cells, and renewable fuels – and why behind-the-meter fuel cells may scale fastest to meet AI-era demand.

AI Energy Surge Spurs Hydrogen Powered Data Centers

AI's booming energy demands are straining grids and raising environmental concerns, prompting a shift to hydrogen-powered data centers. Startups like ECL and giants such as Oracle

Hydrogen-Powered Data Centers: A Sustainable Solution?

Hydrogen-powered data centers could revolutionize the industry by providing a clean, reliable energy source. Learn how they work and who's using them.

Microsoft's 2025 Hydrogen Plan: Powering AI Data Centers

Discover how Microsoft's 2025 hydrogen strategy powers its AI data centers with clean energy. Learn about its key pilot projects and partnerships now.

AI Data Center Powered by Green Hydrogen in Asia

InterContinental Energy launches P2(H2)Node for 100% green AI compute, 99.995% uptime, and low-cost power for data centers in Asia.

Data Center Power Solutions | Siemens Energy

Power up your data center with Siemens Energy! From boosting efficiency to hitting sustainability targets, we're here to help you navigate the digital world's energy demands and stay ahead of the

Microsoft announces pioneering green hydrogen pilot project with ESB

Microsoft's Hydrogen Fuel Cell pilot project, in collaboration with ESB, is aligned with the "Principles for Sustainable Data Centre Development" set out by Government in its 2022 policy

Duke's 2026 Hydrogen Strategy: A \$103B Bet on Data

Duke Energy's 2026 hydrogen strategy pivots to meet massive data center demand with a \$103B investment. Discover their plan to future-proof the grid today.

Bloom Energy signs \$5bn partnership with Brookfield to deploy fuel

US fuel cell developer Bloom Energy has signed a \$5 billion AI infrastructure partnership with global investment firm Brookfield. The partnership will see Brookfield invest up to \$5bn to

Alternative Fuels and Feedstocks Office

Infrastructure The Infrastructure R&D program advances infrastructure technologies to reduce the cost of transporting, storing, and dispensing alternative fuels and feedstocks. Cost-effective bulk hydrogen

Paraguay courts AI data centers and green hydrogen with discounted ...

Paraguay's government has rolled out a pair of decrees offering preferential electricity pricing to energy-hungry industries—ranging from AI-linked data centers and cloud computing to

Overcoming the Range Limitation: SpaceX Thinks Big, Siemens Energy ...

Siemens Energy Makes AI Data Centers Possible in the First Place Siemens Energy is a true heavyweight in the energy sector. The company is resolutely driving the scaling of global

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