# 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

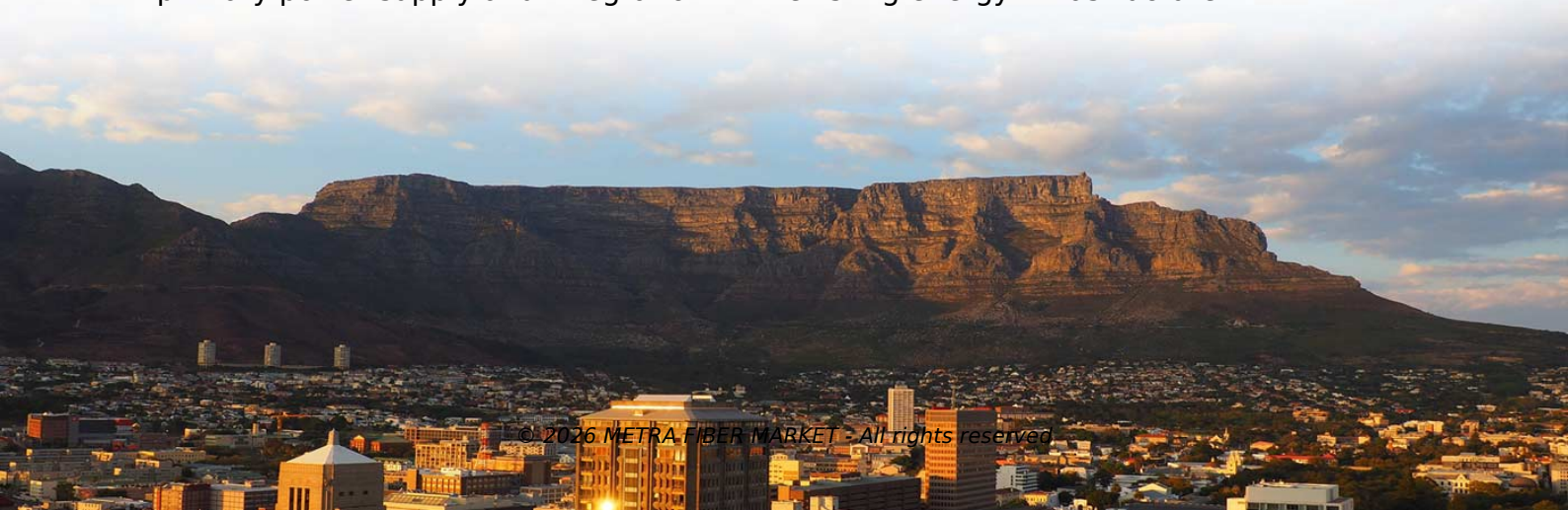
Hydrogen fuel cells offer a clean, reliable, and scalable energy solution for powering data centers, reducing carbon emissions while supporting continuous operation.

### 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.



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## 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.

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