

RIVO MULTITRADE OPTICAL SYSTEMS

Ai server energy saving



Overview

AI data centers use 20 MW to 1 GW of electricity — up to 10x more per rack than traditional facilities.

Key Takeaways

AI server energy efficiency is achieved through advanced power electronics, wide-bandgap semiconductors, intelligent controllers, and AI-driven workload optimization. Advanced Power Supply Units (PSUs)

Modern AI servers consume significantly more energy than traditional servers, with AI workloads potentially doubling energy use and accounting for 10–20% of total data center energy consumption . To address this, server PSUs now incorporate wide-bandgap semiconductors such as silicon-carbide (SiC) MOSFETs and gallium-nitride (GaN) FETs, which allow higher switching frequencies, reduce energy losses, and minimize the need for bulky magnetic components . Additionally, solid-state relays are replacing mechanical relays, offering smaller footprints, higher reliability, and better high-temperature performance .

Intelligent Controllers and DSP Integration

Microcontrollers (MCUs) with integrated Digital Signal Processing (DSP) capabilities, such as Microchip's dsPIC® Digital Signal Controllers (DSCs), play a pivotal role in energy efficiency. These controllers manage complex algorithms for power factor correction, synchronous rectification, and resonant converters, enabling precise real-time adjustments to fluctuating AI server power demands. High-speed PWM control, dual-core architectures, and advanced on-chip peripherals allow predictive maintenance, robust power monitoring, and reduced energy waste.

AI-Driven Energy Optimization

AI itself can be leveraged to optimize energy consumption in data centers. Techniques include agentic AI, digital twins, and automation to forecast task completion times, predict energy requirements, and schedule workloads based on energy availability, cost, and business priorities. This approach allows servers to dynamically align power demand with supply, reducing unnecessary energy use while maintaining performance.

Thermal Management and Cooling Innovations

AI servers generate substantial heat due to high GPU and TPU utilization. Advanced cooling strategies, including liquid cooling, modular infrastructure, and adaptive airflow management, are critical for reducing energy spent on temperature control. Efficient thermal management not only lowers electricity consumption but also extends hardware lifespan, reducing e-waste.

Sustainable AI Practices

Beyond hardware, energy savings can be achieved by optimizing AI models. Training smaller, domain-specific models or using pre-trained models reduces computational overhead and electricity usage. Additionally, employing neuromorphic chips or optical processors can further enhance energy efficiency by providing specialized, low-power computation for AI tasks.

Key Takeaways

- Wide-bandgap semiconductors and solid-state PSUs improve power conversion efficiency.
- DSP-enabled controllers allow precise, real-time power management.
- AI-driven workload scheduling optimizes energy use across servers and data centers.
- Advanced cooling and thermal management reduce energy spent on heat dissipation.
- Model optimization and specialized hardware minimize computational energy requirements. By combining these technologies, AI servers can achieve significant energy savings, reduce environmental impact, and maintain high computational performance.

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AI is a power-hungry endeavor. In this article, we explore the power consumption demands of AI and some ways to

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Explained: Generative AI's environmental impact

With traditional AI, the energy usage is split fairly evenly between data processing, model training, and inference,

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AI Energy Consumption Statistics

Explore the key statistics on AI energy consumption and best practices derived from leading AI researchers and

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Explore how innovations in power devices, gate drivers, and DSP-based controllers tackle AI servers' high energy

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