

Article Overview

The growth of internet-driven big data is significantly increasing energy demand, particularly in data centers and networks, while advanced analytics and AI offer opportunities to optimize energy use and integrate renewable sources.

Energy Consumption of Internet and Data Centers

Data centers and data transmission networks are major consumers of electricity, accounting for roughly 1-1.5% of global electricity use in 2022, with data centers alone consuming 240-340 TWh and networks 260-360 TWh globally . In the U.S., data center electricity demand could double by 2030, potentially consuming up to 9% of national electricity generation, driven largely by AI and high-performance computing . AI queries, for example, require about 10 times more electricity than traditional internet searches, highlighting the energy intensity of modern big data applications . Despite efficiency improvements, the rapid growth of workloads in hyperscale data centers has led to annual energy growth of 20-40% in some segments .

Big Data Analytics for Energy Systems

Big data analytics plays a crucial role in modern power grids, enabling better forecasting, grid optimization, and renewable energy integration. Platforms using Hadoop, Spark, and data lake architectures allow utilities to analyze electricity prices, load demand, and consumption patterns, improving operational efficiency and reducing costs . AI-driven analytics can predict maintenance needs, optimize energy distribution, and support decision-making for both utilities and consumers .

Challenges and Opportunities

The massive volume, velocity, and variety of data generated by energy systems and internet services create scalability and storage challenges. Traditional databases often cannot handle these large-scale datasets, prompting the adoption of NoSQL databases, cloud platforms, and emerging technologies like blockchain and peer-to-peer data management . These solutions improve data accessibility, sharing, and regulatory compliance while enabling real-time energy monitoring and optimization.

Environmental and Policy Implications

While ICT energy use has grown moderately compared to data traffic increases, the sector still contributes to greenhouse gas emissions and energy demand. Data centers connected to grids with higher renewable energy shares produce fewer emissions, and efficiency improvements have helped limit growth . Policymakers and industry stakeholders must balance digital growth with sustainable energy practices, including renewable integration, energy-efficient hardware, and AI-driven optimization strategies .

Key Takeaways

- o Internet-driven big data significantly increases energy demand, especially in data centers and AI applications.
- o Big data analytics enables smarter energy management, forecasting, and renewable integration.
- o Efficiency improvements and emerging technologies are critical to managing energy consumption and environmental impact.
- o Future trends indicate continued growth in energy demand, requiring collaboration between ICT operators, utilities, and regulators to ensure sustainable digital infrastructure .

As a significant application of energy, smart grid is a complicated interconnected power grid that involves sensors, deployment

The review, in particular, explores the limitations of current storage and data integration solutions and examines how

Discover the power of Energy Internet Big Data in revolutionizing the energy industry. Explore its concept, characteristics, and

This has resulted in a system that is secure, efficient, and dependable. The significance and visibility of big data in the

Abstract Energy systems generate vast amounts of data in extremely short time intervals, creating challenges for

This paper discusses and provides recommendations and practices to be used in the future of smart grid and Internet

Over the coming decades, digital technologies are set to make energy systems around the world more connected, intelligent,

All the highlighted insights of this review collectively inspire advancements in the energy internet platform for future

The application of big data in the energy sector is considered as one of the main elements of Energy Internet. Crucial

We identify key trends in big data, particularly the data management needs and applications in energy

systems, and

In this paper, we present a new, innovative Big Data Reference Architecture for the secure exchange of data and

From the reviewed articles and patents, artificial intelligence, big data, Internet of Things, and blockchain all overlap

Big data technology can fully explore new energy vehicle operation data and fully grasp user demand, operation, and

Afterwards, the industrial development of big data-driven smart energy management is analyzed and discussed. Finally,

Abstract Energy Internet is deeply integrated by Internet concept, information technology and energy industry, and Energy Internet

Still, even these advanced solutions can encounter bottlenecks, which can impact the efficiency of data storage,

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