Internet Design for New Energy



Overview

Future Sustainable Internet Energy-Defined NetworkingThis paper presents a comprehensive set of design methods for making future Internet networking fully.

Key Takeaways

The Energy Internet integrates digital technologies, renewable energy, and interconnected energy systems to enable efficient, low-carbon, and resilient energy management.

Core Concept and Architecture

The Energy Internet applies the Internet paradigm to energy systems, using standardized energy exchange units called Blocks of Energy Exchange (BEE), managed via Energy Internet Cards with unique identifiers for each participant. This allows decentralized peer-to-peer energy trading while system operators evolve into Energy Internet Service Providers (ISPs), managing centralized resources and ensuring reliable energy delivery without direct intervention in user behavior. The architecture is hierarchical: Energy LANs (Local Area Networks): Collections of proximate energy resources, enabling local P2P trading and forming virtual power plants.

Energy Intranets (Microgrids): Subsets of LANs capable of operating independently from the main grid.



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Energy WA

Ns (Wide Area Networks): Interconnected transmission grids linking multiple LANs, facilitating large-scale energy flow and coordination.

Key Technologies

The Energy Internet relies on digitalization and ICT integration, including: Smart grid situational awareness and AI-driven microgrid control for real-time decision-making. Cloud-based big data analytics and digital twins to optimize renewable integration and grid flexibility. Edge computing and IoT devices for predictive maintenance, demand-side management, and adaptive control.

Energy routers (ERs) to direct energy flows similarly to data packets in the Internet, ensuring efficient distribution and system reliability.

Planning and Scenario Design

For urban and new-type urbanization contexts, Energy Internet planning emphasizes: Interconnection: Linking distributed energy resources to improve efficiency and resilience. Efficiency and low-carbon operation: Maximizing renewable energy utilization and minimizing carbon intensity. Digitization: Integrating information technology for monitoring, control, and optimization.

Diversification: Supporting multiple energy types (electricity, gas, heat) and flexible energy storage solutions. Scenario-based planning, such as the 1+N method, allows cities to model diverse energy interconnection scenarios, allocating resources across supply, conversion, transmission, and storage layers. This approach supports differentiated strategies for urban, suburban, and rural energy ecosystems.

Benefits and Challenges

The Energy Internet promotes: Energy democracy and equity through peer-to-peer trading. Carbon emission reduction via optimized renewable integration. Resilience and reliability in energy supply through adaptive microgrids and predictive control.

Challenges include: Cyber-physical security risks due to increased digitalization. Complexity in multi-energy coordination. Scalability and interoperability across diverse urban and regional energy systems.

Future Directions

Emerging trends focus on: Hybrid AI frameworks for adaptive self-healing grids. Integration of electric vehicles and distributed storage into virtual power plants. Data-driven modeling for real-time optimization and scenario simulation.

Policy and market mechanisms to support decentralized energy trading and sustainable urban energy planning. The Energy Internet represents a transformative shift toward digitally interconnected, low-carbon, and resilient energy systems, aligning with global decarbonization and smart urbanization goals.

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Article Content

Future Sustainable Internet Energy-Defined Networking

This paper presents a comprehensive set of design methods for making future Internet networking fully energy-aware and sustainably minimizing and managing the energy footprint.

Internet of Energy (IoE): A Comprehensive Review of Design

This paper reviews the literature on the IoE design principles and architecture models comprehensively. it also explains IoE enabling technologies, including fog computing and various

Recent advancement of energy internet for emerging energy

Energy internet features are highlighted to enhance efficiency, security and reliability. Energy internet architectures and models are demonstrated for regulatory bodies. Challenges and

The Emerging Energy Internet: Architecture, Benefits, Challenges, and ...

The benefits of the energy Internet, along with the challenges of its implementation on a large-scale distributed architecture with the inclusion of renewable energy resources, is discussed.

A comprehensive overview of framework for developing sustainable

Energy Internet (EI) envisions a future energy system with sustainable concerns of efficiency, economy and environment by achieving flexibility of multi-energy-integrated physical

Energy Internet: Redefinition and categories

In this paper, we propose the redefinition of EI, based on a comprehensive literature review, some latest trends and driving forces in the global energy industry, as well as its

Energy Internet: A Standardization-Based Blueprint Design

To break through, we need not only new devices and algorithms, but structural reforms of our energy systems. Taking the Internet as a paradigm, a practicable design of the Energy Internet is presented

Energy Internet: Systems and Applications | Springer Nature Link

The book presents the basic principles of energy internet and emphasizes the current research trends in the field of energy Internet at an advanced level. It includes instructor materials, case-studies, and

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IE''s top 7: Must-read stories on wind power tech

These breakthroughs show how wind energy is evolving into a more flexible, intelligent, and decentralized power source. Here are the top 7 wind

Regulations: ecodesign of energy-consuming products

Link added to new guidance on enforcement actions and associated rights. List of energy-related products with the associated ecodesign regulations updated. Declaration of Conformity

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Welcome to Channel Dive | Channel Dive

Welcome to Channel Dive. We''re Informa TechTarget''s new publication, focused on delivering daily news and analysis for executives at North

What is Energy Internet? Concepts, Technologies, and Future Directions

To realize renewable-energy-based electrification goals, a new concept—the Energy Internet (EI)—has been proposed, inspired by the most recent advances in information and

The internet consumes extraordinary amounts of

How much energy does the internet use, and - given recent technological advances - could it ever run on renewable energy alone?

Digital technologies for net-zero energy transition: a preliminary ...

This paper reviews current progress and future challenges of digital technology applications for energy system transition in the context of net-zero. A list of case studies for such

The Potential of Digital Business Models in the New Energy Economy

The pace of digitalisation in the energy sector has accelerated rapidly in recent years, leading to a transformation of many traditional business models. Thanks to innovative technologies

Digitalization and Energy – Analysis

A new era in energy Digitalisation: A new era in energy? Over the coming decades, digital technologies are set to make energy systems around the world more connected, intelligent, efficient, reliable and

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Future Sustainable Internet Energy-Defined Networking

This section introduces the new design primitives underlying all the design methods envisaged for making future Internet networking fully energy-aware, including the energy

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