Standard System for Energy Internet



Overview

To break through, we need not only new devices and algorithms, but structural reforms of our energy systems.

Key Takeaways

The Standard System for Energy Internet is a structured framework that integrates energy delivery with Internet-like communication using standardized protocols, enabling decentralized, efficient, and peer-to-peer energy management.

Overview

The Energy Internet applies the Internet paradigm to energy systems, combining electricity, heating, cooling, gas, and transportation networks into a unified, multi-energy ecosystem. It emphasizes decentralized intelligence, peer-to-peer energy trading, and integration of renewable energy sources, aiming to improve efficiency, resilience, and energy equity while reducing carbon emissions (CSEE, CEPRI).

Core Components

Energy LA

N (Local Area Network): A collection of proximate energy resources, often forming virtual power plants, enabling local P2P energy trading and interaction with the main grid or other Energy LANs. Energy Intranet (Microgrids): Specialized Energy LANs capable of operating independently from the main network, providing resilience and local energy autonomy.

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Energy WA

N (Wide Area Network): Interconnected transmission grids linking multiple Energy LANs, analogous to the Internet's WAN, sometimes including natural gas or other energy carriers. Energy Internet Card: Each participant is assigned a unique MAC address, allowing standardized communication of energy transactions via Blocks of Energy Exchange (BEE) without centralized intervention. Energy Internet Service Providers (ISPs): Traditional system operators evolve into ISPs, managing flow control, dispatching centralized resources, and providing reliable services while decoupling from individual user behavior.

Standardization Framework

The standard system relies on protocols and layered architecture similar to the Internet: Application Layer: Manages demand response, load control, distributed generation, and electric vehicle integration using TCP/IP-based communication. Transport and Internet Layers: Enable secure and reliable energy data exchange. Physical Layer: Supports multiple communication technologies (e.g., IEEE 802.

11™, IEEE 802. 15. 4™, IEEE 1901™) for energy system connectivity.

Cyber Layer: Implements cloud-edge computing, AI, IoT, and blockchain for smart energy management. Business Layer: Defines policies, markets, and business models for energy sharing, P2P trading, and carbon management.

Benefits

Decentralization: Reduces reliance on centralized power plants and enhances local energy autonomy. Energy Democracy: Promotes equitable access to energy resources and peer-to-peer trading. Carbon Reduction: Facilitates integration of renewables and efficient energy flow, lowering emissions.

Resilience: Microgrids and Energy LANs improve system robustness against failures or disruptions.

Implementation Considerations

Integration of multi-energy systems including electricity, gas, heat, and hydrogen. Deployment of energy routers, hubs, and storage for seamless energy flow. Adoption of plug-and-play technologies and standardized communication protocols.

Use of virtual power plants and digital twins for simulation, monitoring, and optimization. The Standard System for Energy Internet represents a comprehensive blueprint for transforming traditional centralized energy systems into a flexible, intelligent, and standardized network, leveraging Internet-like protocols to enable efficient, sustainable, and equitable energy management.

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Article Content

Energy Internet: A Standardization-Based Blueprint Design

Taking the TCP/IP model as a basis, energy exchange protocols are designed in this paper, which we believe will break through bottlenecks towards distributed energy exchange without any involvement

Energy internet

INTRODUCTION Energy Internet,sponsored by Chinese Society for Electrical Engineering (CSEE), and published by China Electric Power Research Institute (CEPRI) in cooperation with the Institution of

Construction of energy internet technology architecture based on ...

Based on general system structure theory, the technical system framework for the provincial power grid corporations to construct regional energy internet is constructed, and it

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

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

Recent advancement of energy internet for emerging energy

Key features of the energy internet such as energy sources, communication technologies, data computation, energy management systems and financial analysis are highlighted to enhance

Automated Standard Application for Payments

The Automated Standard Application for Payments (ASAP) is a completely electronic system that federal agencies use to quickly and securely transfer money to recipient

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EU Regulations for Battery Energy Storage Systems

The latest EU Regulations for Battery Energy Storage Systems (BESS). Learn about compliance, CE marking, Battery Passport, EPR, and

Energy Internet, the Future Electricity System: Overview, Concept ...

Energy Internet, a futuristic evolution of electricity system, is conceptualized as an energy sharing network. Its features, such as plug-and-play mechanism, real-time bidirectional flow of energy ...

smart energy

IEC runs four Conformity Assessment (CA) Systems whose members verify that devices and sytems fulfill the requirements in IEC Standards and specifications. IEC has set up a systems committee,

A comprehensive overview of framework for developing sustainable energy ...

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

(PDF) Smart Grid to Energy Internet: A Systematic

This paper has attempted to study the aptness of Energy Internet for a transitioning electricity system by focusing on national electricity systems

Building an "Energy Internet": Internet Protocols for the

Protocols, Standards, and "Requests for Consideration" Although most users and consumers know very little about how it works at its most

Recent advancement of energy internet for emerging energy

Furthermore, the present review focuses on the various issues and challenges of existing energy internet platforms related to safety, security, standards, protocols, costing and complexity as

A comprehensive review of Energy Internet: basic concept ...

With the intensifying energy crisis and environmental pollution, the Energy Internet and corresponding patterns of energy use have been attracting more and more attention. In this paper,

Energy System Architecture Incorporating the Internet of Energy ...

Thanks to digitalization, it is possible to reduce costs during the operation of the energy system and achieve its efficiency and stability. The purpose of this article is to analyze the

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

The climate change crisis, exacerbated by the global dependency of fossil fuels, has brought significant challenges. In the medium to long term, extensive renewable-energy-based

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