Energy Internet with Multi-Energy Complementarity



Overview

The model aims to solve the coordination problem between multiple energy types and optimize the balance of energy supply and demand through a multi-objective optimization algorithm.

Key Takeaways

Energy Internet integrates renewable energy, smart grids, and ICT to enable multi-energy coordination and complementarity for efficient, flexible, and sustainable energy systems.

Energy Internet Overview

The Energy Internet is the application of internet technologies, big data, and artificial intelligence to the production, transmission, storage, and consumption of energy. It transforms traditional centralized energy systems into decentralized, interconnected networks that integrate electricity, natural gas, oil, transportation, and information systems into a unified energy-sharing platform. Key features include: Intelligent energy production: Using predictive analytics and big data to optimize power generation and energy distribution.

Distributed energy networks: Primarily based on renewable energy sources, enabling coordination and complementarity among multiple energy types. Smart consumption models: Incorporating electric vehicles, user-end intelligence, and carbon trading to enhance energy efficiency and sustainability. Core technologies: Modern communication networks, AI, and ICT applied across energy production, transmission, storage, and consumption to improve utilization and promote clean energy adoption.

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Multi-

Energy ComplementarityMulti-energy complementarity refers to the coordinated operation of diverse energy sources—such as electricity, natural gas, heating/cooling, hydrogen, wind, solar, and hydropower—to balance supply fluctuations and enhance system flexibility. Its main objectives are: Integration of intermittent renewables: Mitigating the variability of wind and solar power through complementary energy sources. Cross-energy optimization: Coordinating production, storage, conversion, and consumption across multiple energy systems.

Spatial and temporal coordination: Leveraging cross-regional energy sharing and multi-temporal planning to optimize long-term and short-term energy balance. Enhanced reliability and efficiency: Reducing renewable energy curtailment, improving resource utilization, and ensuring stable power supply.

Practical Applications

Integrated energy bases: Large-scale projects in China aim to combine wind, solar, hydro, thermal, and storage systems for coordinated operation across regions. Hierarchical optimization models: Multi-temporal and multi-spatial frameworks use advanced algorithms to optimize energy dispatch, cross-regional mutual aid, and renewable energy accommodation. Smart energy services: New market players and energy finance models emerge from the integration of Energy Internet technologies, supporting industrial upgrading and sustainable growth.

Benefits

Improved energy efficiency: Coordinated multi-energy operation reduces waste and enhances utilization. Increased renewable penetration: Complementary energy systems allow higher integration of intermittent renewable sources. System flexibility and resilience: Cross-regional and multi-energy coordination mitigates supply fluctuations and enhances reliability.

Support for sustainable development: Aligns with carbon reduction goals and promotes clean energy adoption. In summary, the Energy Internet provides the technological and operational framework for multi-energy complementarity, enabling a flexible, efficient, and sustainable energy ecosystem that integrates diverse energy sources, advanced ICT, and intelligent management systems.

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Article Content

Energy Internet Multi-Energy Complementary Trading Model and

The model aims to solve the coordination problem between multiple energy types and optimize the balance of energy supply and demand through a multi-objective optimization algorithm.

Status and prospects of research on multi-energy complementary ...

This paper begins by elucidating the background and significance of multi-energy complementarity. It then provides an overview of multi-energy complementary systems, covering

Multi-energy complementary integrated energy system optimization

On the other hand, this study focuses on the effects of EVs participation on the multi-energy complementary integrated energy system during the design and operation stages, including

IEC TMOP Multi-energy coupling:2023-04(en) Multi-energy coupling

Section 1 of this technology and market outlook paper provides an introduction to the technique and scope of the paper. Section 2 presents an analysis of the concept of multi-energy coupling systems

Research on complementarity of multi-energy power systems: A review

This paper makes a review of the research on complementarity of new energy high proportion multi-energy systems from uncertainty modeling, complementary characteristics, planning and operation.

Cost-efficient multi-energy management with flexible complementarity ...

Peer-to-peer (P2P) trading is essential in maximising the benefits of renewable integration. The paper proposes a novel framework for economic benefit through P2P trading among

Cost-efficient multi-energy management with flexible complementarity ...

In this paper, a novel multi-energy management strategy based on the complementarity of multi-energy demand was proposed to explore optimal energy scheduling problems of prosumers.

Multi-Energy Complementation Comprehensive Energy Optimal

From the perspective of parallel scheduling, Cheng et al. (2019) proposed an intelligent scheduling strategy for Energy Internet. This strategy has a complex cyber-physical social system

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Cooperative mechanisms for multi-energy complementarity in the ...

Promoting a diversified and sustainable energy mix in the electricity market necessitates the implementation of multi-energy complementarity. However,

Analysis Of Multi-energy Complementary Integration Optimization

In order to improve the renewable energy consumption capacity and the overall efficiency of energy system, adapt to the transition trend of energy supply mode to green, efficient and close to users,

Research on Multi-Energy Coordinated Intelligent Management

Integrated energy systems (IES) are an important physical carrier of the energy Internet, which undertakes the tasks of energy conversion, distribution, and storage of electricity, heat and

Multi-energy Complementarity Evaluation and Its Interaction with Wind ...

High penetration of renewable energy generation is an important trend in the development of power systems. However, the problem of wind and solar energy curtailment due to their inherent

Energy Internet Multi-Energy Complementary Trading Model and

This paper proposes a multi-energy complementary trading model for energy Internet based on multi-objective optimization. The model aims to solve the coordination problem between multiple energy

Optimal Scheduling Strategy of Multi-energy Complementary in New Energy ...

When constructing the optimal scheduling strategy of multi-energy complementarity in NEPS, this article implements several key principles. These include economy, reliability and

Cost-efficient multi-energy management with flexible complementarity ...

Request PDF | On Sep 26, 2018, Fangyuan Si and others published Cost-efficient multi-energy management with flexible complementarity strategy for energy internet | Find, read and cite all the ...

Cost-efficient multi-energy management with flexible complementarity ...

To solve the increasing complexities of energy internet integrated with distributed renewable energy resources, Si et al (2018) deployed a more effective multi-energy management method based on

Multi-energy complementary power systems based on solar energy: A ...

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For different kinds of multi-energy hybrid power systems using solar energy, varying research and development degrees have been achieved. To provide a useful reference for further

Cost-efficient multi-energy management with flexible complementarity ...

The increasing complexities of energy internet integrated with distributed renewable energy resources and multiple energy infrastructures require more effective multi-energy management method. The pro

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