

Article Overview

Energy Internet load optimization schemes integrate advanced algorithms, hierarchical control, and multi-objective planning to enhance efficiency, reliability, and renewable energy utilization.

Overview

Energy Internet (EI) represents a modern energy system that combines renewable energy, distributed energy resources (DERs), and advanced information technology to create a reliable, efficient, and adaptive energy network. Load optimization within EI focuses on balancing energy supply and demand, integrating intermittent renewable sources, and managing flexible loads such as electric vehicles (EVs) while maintaining network stability and operational efficiency .

Key Optimization Approaches

1. Hierarchical and Layered Control Models Hierarchical optimization divides the EI into layers, allowing distributed devices to plan electricity, heat, gas, and cooling efficiently. Layered control-collaborative optimization enables regional systems to coordinate multi-energy scheduling, improving independence of distributed equipment and minimizing operational costs . 2. Multi-Objective Optimization Algorithms Algorithms like self-adaptive NSGA-III (SA-NSGA-III) optimize EI network topology for connectivity, robustness, and operational efficiency. These methods preserve scale-free network characteristics while dynamically adjusting reference points and population selection, achieving significant improvements in network performance and convergence efficiency . 3. Deep Learning and Reinforcement Learning Integration Advanced schemes leverage graph neural networks (GNNs) and spatiotemporal feature fusion to capture network dynamics. Coupled with Soft Actor-Critic reinforcement learning, these frameworks optimize access location, capacity, and timing decisions under uncertain renewable generation and load fluctuations, enhancing reliability and economic performance . 4. Integrated Planning and Co-Optimization Comprehensive EI planning involves co-optimizing generation, transmission, distribution, and DERs. Iterative feedback loops and least-cost optimization frameworks allow planners to evaluate DER contributions, flexible load performance, and bulk-grid interactions, ensuring cost-effective and feasible solutions .

Benefits

- o Enhanced Renewable Integration: Optimizes intermittent sources like solar and wind while mitigating voltage instability.
- o Load Flexibility Management: Efficiently schedules EV charging and other dynamic loads to reduce peak demand.
- o Operational Efficiency: Reduces energy costs and improves network robustness against failures or attacks.

o Scalability: Supports large-scale EI networks with multiple energy forms and distributed devices.

Practical Implementation

Successful EI load optimization requires granular data on resources, loads, and grid constraints, along with adaptive algorithms capable of real-time decision-making. Combining hierarchical control, multi-objective optimization, and AI-driven predictive models ensures that EI systems can meet growing energy demands while supporting carbon neutrality and sustainable energy goals .

The findings presented in this review serve as a valuable resource for researchers and practitioners seeking to

This article studies a power grid optimization partitioning method based on the improved K-means algorithm, aiming to solve the

Abstract Energy internet (EI) can alleviate the arduous challenges brought about by the energy crisis and global

Optimizing the configuration problem is the first problem that needs to be solved for regional energy Internet

To address these issues, we introduce a joint optimization framework for energy-efficient, secured computation

The growing depletion of fossil fuels has led to the use of distributed renewable energy sources. This shift has altered

Therefore, a distributed energy management scheme consisting of the proposed hybrid ADMM method and the

This paper introduces an interactive scheme within the SDN controller, employing the krill herd meta-heuristic algorithm

The energy Internet (EI) is an important infrastructure for effectively utilizing and intelligently managing renewable

By leveraging real-time data from IoT sensors and incorporating user preferences, the new algorithm dynamically

Energy internet is a multi-energy system with "source-network-load-storage" coordinated and optimized

operation, and

The development of the energy internet has become one of the key ways to solve the energy crisis. This paper

In this chapter, we will discuss an overview of the Energy Internet and its major characteristics, the key technologies,

As an activator of the energy market, IDR facilitates the optimization of multiple energy sources and the participation of

Abstract With the intensifying energy crisis and envi-ronmental pollution, the Energy Internet and corresponding patterns of energy

Addressing this oversight, this article introduces an innovative equity-aware load-shedding optimisation model

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