Intelligent decision-making in energy storage management systems

What is Intelligent Energy Management?

1. Introduction Over the last few years, the term intelligent energy management, also called smart energy management, has emerged as a growing idea in the power systems literature. This is due to the rapid increase in energy consumption in today's applications, ranging from industrial to commercial (Ni?eti? et al., 2020).

Can energy management systems make dynamic decisions in real-time?

Designing an energy management system that can make dynamic decisions in real-time based on its current status is still a complicated challenge(Hossain et al.,2019b). In the existing literature (Hossain et al.,2019c) decisions are inferred by setting some rules or IF-THEN conditions.

What are the challenges in implementing intelligent energy management systems?

Challenges in implementation of intelligent energy management systems. The output of an energy management systems is dynamic in nature and difficult to predictbecause of the dynamic behaviors of consumers and utilities (Yu et al.,2020).

Can intelligent energy management systems save energy?

Forecasts show that, over the next two decades, the world's electricity production is expected to increase by over 40 per cent and its demand by approximately 85 per cent (Newell and Raimi, 2020). This has prompted the researchers and vendors to develop various intelligent energy management systems (IEMSs) for saving energy.

Why are energy management systems difficult to predict?

The output of an energy management systems is dynamic in nature and difficult to predict because of the dynamic behaviors of consumers and utilities(Yu et al.,2020). Designing an energy management system that can make dynamic decisions in real-time based on its current status is still a complicated challenge (Hossain et al.,2019b).

What is the future of smart energy management?

Also, artificial intelligence techniques, such as deep learning, and evolving approaches, such as context-aware systems, will be major drivers for future smart energy management systems (Himeur et al., 2021).

Energy management in HES and traditional energy resources is usually done by using some software like MATLAB, Simulink, HOMER and TRNSYS, or artificial intelligence such as differential evolution algorithm, fuzzy logic quasi-steady-state time-series model, particle swarm optimization, genetic algorithm and artificial neural networks [6]. In this work, the ...

Abstract: This paper deals with an intelligent decision-making strategy of energy management for a smart grid within an element storage in order to reduce the system cost and improve its ...

Intelligent decision-making in energy storage management systems

The Home Energy Management System (HEMS) is an important part of the smart grid that enables the residential customers to execute demand response programs autonomously. ... A multi-agent intelligent decision making support system for home energy management in smart grid: a fuzzy TOPSIS approach ... SPICE modelling and experiments on a complete ...

Transactive Energy (TE) is an autonomous and decentralised decision-making system that combines economic and control techniques to improve grid reliability and efficiency [20]. All these terminologies converge to the same concept, encompassing energy management systems based on the Cloud and smart devices, although they use different terminologies.

In the second part, a robust energy management strategy (EMS) is proposed for two smart grid configurations (grid-battery, grid-PVP-battery). This strategy is based on Fuzzy Logic Control (FLC) thanks to its non-linear ...

Strategic planning and management: Decision making, real-time decisions in the energy industry: Supervised learning: ... On the energy storage side, artificial intelligence technology is used to explore more efficient energy storage technology, and the appropriate energy storage system can be automatically selected according to the geographical ...

The study proposed a decision-making model based on energy storage devices" decisions of an actor-critic agent for microgrid energy management systems. The decisions of the agent are the current aggregated charging and discharging energy of the microgrid heat and electrical storage devices minimizing the overall reward associated with the ...

Intelligent Energy Dispatch: A futuristic control room where a digital AI conductor orchestrates electric currents flowing from stacked batteries to a distant skyline, ensuring ...

The IFE and MWWO algorithms significantly enhance the accuracy, efficiency, and speed of decision-making in intelligent energy management, leading to reduced costs and improved system quality. In this article, a nature-inspired MWWO and machine learning IFE, have been primarily applied for energy management systems and power quality enhancement.

Energy management systems (EMS) in smart grid (SG) are complex and dynamic systems that require intelligent decision-making to optimize energy usage and reduce costs. Integrating renewable energy sources, energy storage ...

The challenges facing any organization in business intelligence and decision-making include plan failure, lack of preparation, resource failure, and risk-taking capability.This paper proposes a framework of Optimized Data Management using Big Data Analytics (ODM-BDA) to increase the intelligent organizational

effectiveness and decision-making ...

Responding to this, our research introduces an advanced energy management framework, synergistically combining quantum computing advancements with a robust trust ...

The intelligent energy management system for an all-electric ship power system based on ANFIS is a powerful technique to develop the capability of the smart grid ship power system. Moreover, it gives flexibility to the power system in management, controls the energy generated, and shows how clean energy is necessary for navy ship applications.

In the context of Battery Energy Storage Systems (BESS) an EMS plays a pivotal role; It manages the charging and discharging of the battery storage units, ensuring optimal performance and longevity of the batteries ...

Energy management systems (EMSs) are regarded as essential components within smart grids. In pursuit of efficiency, reliability, stability, and sustainability, an integrated EMS empowered by machine learning (ML) has ...

This combination is completed in a generic system design model for users with power storage services shown in Figure 10, which is constituted by an energy management system, a load, the electrical network and a battery. ...

Several decision-making models, including power flexibility tools [10] and renewable sources from classic optimization methods to modern artificial intelligence-based approaches for microgrid energy management systems, are encountered in the literature [11] om these approaches, the myopic models in the field of power systems lead to the ...

o The Smart Home Energy Management System (HEMS) o The Home Energy Storage System through the use of energy storage technologies. ... Energy suppliers, grid administrators, and consumers all rely heavily on this capability as it facilitates proactive decision-making and load management [30]. Energy forecasting serves a dual purpose: it ...

Artificial intelligence (AI) and machine learning (ML) can assist in the effective development of the power system by improving reliability and resilience. The rapid advancement of AI and ML is fundamentally transforming ...

The future of smart grids will likely include a shift towards more autonomous and decentralized energy management systems. AI will enable distributed energy resources (DERs) to operate independently, making real-time decisions about energy generation, storage, and consumption based on current grid conditions and market signals.

Intelligent decision-making in energy storage management systems

In this review, we study intelligent systems for energy management in residential, commercial and educational buildings, classifying them in two major categories depending on ...

This innovative study addresses the urgent need for sustainable energy management by using multi-criteria decision-making techniques to optimise building energy ...

Intelligent Energy Management System. July 2009 ... an autonomous agent able to interact and with it owns decision making mechanism. ... distribution generation systems, energy storage devices ...

Intelligent Decision Support Systems have the potential to transform human decision making by combining research in artificial intelligence, information technology, and systems engineering.

This paper presents a novel development methodology for artificial intelligence (AI) analytics in energy management that focuses on tailored explainability to overcome the "black box" issue associated with AI analytics. ...

In the last decade, there have been significant developments in the field of intelligent energy management systems (IEMSs), with various methods and new solutions proposed for managing the energy resources intelligently. An important issue related to finding the desired outcomes remains unexplored, i.e., how to determine key insights from the sparse ...

Previous research has focused on energy storage and management systems to enhance energy performance. The thermodynamic properties of various materials are used to design energy storage devices. ... (AI) techniques in BAS, such as data mining, ANN, and intelligent decision-making. Furthermore, ABM is crucial for accomplishing multiple goals in ...

As the energy management undergoes rapid transformations, there"s an imperative need for innovative energy management frameworks. Responding to this, our research introduces an advanced energy management framework, synergistically combining quantum computing advancements with a robust trust management system. At the core of our proposition is the ...

The intelligent decision-making systems built on machine learning and deep learning, along with multi-source data fusion and real-time monitoring systems based on big data, significantly...

Integrating RL with smart home technologies creates an intelligent energy management system, optimizing usage and enhancing comfort. ... MARL-based approaches for coordinated decision-making among devices and storage systems in interconnected homes should be further explored. Thus, addressing these research directions can optimize SHEMSs ...

Intelligent decision-making in energy storage management systems

The focus on the AI forecast allows to make accurate decisions in real time in the storage system, choosing the best option to meet energy demands in buildings. Interpretation ...

Optimizing energy storage systems for multiple value streams and maximizing the value of storage assets depends on intelligent operating systems that analyze large datasets ...

Web: https://www.fitness-barbara.wroclaw.pl