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Editorial: Internet of energy for renewable energy-based decarbonized electrical energy systems

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Editorial on the Research Topic
Editorial for the research topic: Internet of energy for renewable energy-based decarbonized electrical energy systems

This research topic aims to highlight the current state-of-the-art technologies in digitalized smart grids, including renewable energy and others with the Internet of Energy (IoE) under the decarbonized electrical energy systems. These approaches will increase the overall efficiency of electrical power systems, along with emerging technologies and applications in the current system. IoE covers all digitalization processes with mobility, electronic devices, and energy network as seen in Figure 1.

The first article on the topic by Dynge et al. (2022) introduces a new pricing mechanism based on the Levelized Cost of Electricity (LCOE) to ensure profitability for prosumers and establish a transparent and fair price for all market participants. The mechanism utilizes a platform based on Distributed Ledger Technology (DLT) with a holistic perspective, considering market interactions as part of the Cyber-Physical-Social-System (CPSS). This study compares and analyzes fixed and variable contracts with the wholesale supplier to conventional Feed-in Tariffs (FiT) and its proposed replacement options. The results indicate a cost reduction for consumers and a minor decline in revenue for prosumers compared to the FiT scheme. However, the pricing mechanism proposed in the study provides a significant increase in benefits for both prosumers and consumers compared to the proposed replacements for FiT.

In Ali and Partal (2022), a wireless sensor network based on ZigBee and LoRa is proposed for integration into smart building energy management systems. The proposed system allows for automatic monitoring and control of room temperature, humidity, lighting systems, etc., in smart environments. Due to their scalability, many IoT applications can be implemented by customizing the embedded code. The system consists of an end device, a multiprotocol gateway, and a Central Data Collector (CDC) unit. It leverages the low-power and long-range capabilities of ZigBee and LoRa communication technologies. The end device collects temperature, humidity, and light intensity data using low-power sensors and transmits the data to the gateway *via* the LoRa wireless transceiver. The gateway serves as an intermediate device facilitating data exchange between the

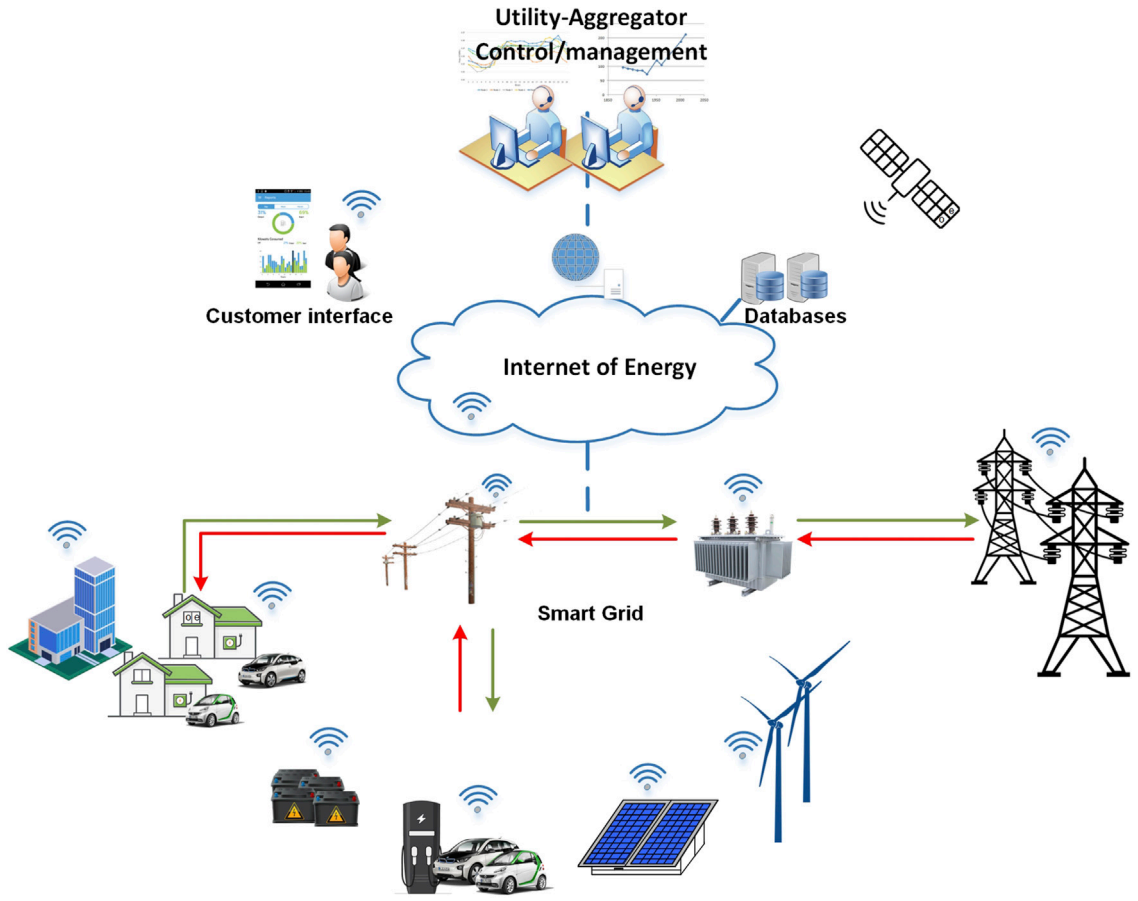

FIGURE 1
The structure of the Internet of Energy (IoE).

LoRa and ZigBee transceiver modules. The performance parameters were also evaluated, including communication range and throughput data wireless transceiver modules.

In Nkuriyingoma et al. (2022), a study on integrating renewable energy sources into the distribution system is conducted. This study presents a techno-economic analysis of a grid-connected solar photovoltaic (PV) system with a battery energy storage system (BESS) for a small community in Rwanda. The energy generated from the solar PV system is used to power home appliances and a water pumping system for agricultural purposes. The simulation results indicate an annual energy demand of 82.34 MWh and a peak load of 30.4 kW. The study shows that a 57.33 kWp solar PV system integrated with an 89.2 kWh BESS can supply the load with a self-sufficiency level of 64.38% and a performance ratio of 86.05% when the desired ratio is set to 110% with the year as the reference period. The financial analysis demonstrates a return on assets of 9.14% and an amortization period of 9.65 years. The results indicate that the proposed approach is a technically and economically feasible solution for addressing the issue of electrical power outages in developing countries.

In Tahir et al. (2022), a smart energy meter that incorporates blockchain and the internet of things (IoT) is proposed as a solution for energy conservation. The goal is to prevent energy loss and allow users to buy and sell excess electricity. Integrating IoT in smart grids plays a significant role in energy conservation, and adding blockchain technology can further improve its efficiency. The proposed system includes microgrids with their own blockchain, and users engage in energy transactions through smart contracts. The outcome of the design is a smart energy meter, a smart contract on the Ethereum blockchain, and an android app for monitoring and controlling transactions and energy trade through smart contracts with other consumers.

This research aims to provide readers with a comprehensive overview of the latest technologies that can help the transition of conventional electrical power grids into smart grids as part of the IoE, which will be a significant research area in power and energy systems.

Author contributions

OE: Conceptualization, Writing—original draft, supervision, MK: Writing—review & editing, validation. NZ: Resources, review, validation.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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