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Editorial

Recent Advances in Renewable Energy and Clean Energy

Aritra Ghosh

College of Engineering, Mathematical and Physical Sciences, University of Exeter, Exeter TR10 9FE, UK; a.ghosh@exeter.ac.uk

1. Introduction

Energy generation from conventional energy sources, such as oil, coal, and gas, produces adverse environmental pollutants, e.g., CO_2 and other toxic gases and elements. Replacing conventional energy with renewable energy sources is one of the most promising ways to sustain the green environment. Renewable energy (RE) sources include biofuels, geothermal, hydro, solar, tidal, waste, and wind. Uninterruptible energy generation is the major barrier for RE systems. Solar and wind are the most unpredictable, and their variability is high compared with other RE sources. The storage of electricity plays a key role in overcoming the challenges associated with renewable energy systems. The advancement of technology and forecasting of the energy generation from RE systems are now the prime areas of investigation. According to the IEA, in 2018, RE contributed 26% of the global electricity generation, but a 13% drop in generation is expected in 2020 due to the current COVID-19 scenario [1]. This Special Issue, therefore, sought to contribute to the advancement of renewable energy systems and future prospects after COVID-19. We invited the submission of original research articles, reviews, case studies, analyses, and assessments relevant to renewable energy and clean energy systems.

This Special Issue highlights a variety of topics related to advanced renewable energy technology. The sequence of articles included in this Special Issue is in line with the latest scientific trends. The latest developments in science, including artificial intelligence, were used. A total of 5 papers (from 10 submitted) were published. In this article, we provide a brief overview of the published papers.

2. Overview of Contribution

Accurate solar radiation prediction is noteworthy for most renewable energy work. Particularly for solar photovoltaic generation, the presence of solar radiation is essential. In addition, to understand and install solar farms, solar data collection is a prerequisite which involves numerous expensive instruments. Hence, it is of the utmost imperative to have accurate solar energy prediction using long-term meteorological data. A multi-task learning algorithm was employed. This new model was compared with the existing methodology and found to be suitable for application [2].

Energy storage is probably one of the most crucial components, which is indispensable while replacing the traditional sources with renewable energy. For thermal energy storage currently, phase change materials (PCMs) are one of the best choices. In one paper, a novel twisted fin array was proposed which can enhance the charging response of PCMs. Employing CFD analysis, the efficiency of the new structure with PCMs was compared with conventional longitudinal fins within the same design. The results indicated 42% less charging time and energy storage up to 63% higher than that of the reference case of straight longitudinal fins with the same PCM mass [3]. Because of PCMs' latent heat storage capacity, they also have wide applications in the solar field [4,5]. Solar PV, whose current global installed capacity is over 700 GW, suffers from low efficiency. Most of the installed PVs are the silicon or thin-film type which has negative temperature coefficients. Concentrated PV is another approach, which reduces the use of solar cell materials by

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using low-cost optical materials. However, due to the presence of a concentrator, the thermal impact is more prominent which needs a thermal regulation mechanism. For this purpose, a thermo-optoelectrical model for a concentrated PV-based system with PCMs was investigated for the Doha climate. After the investigation of a range of different PCMs, the S-Series salt type was found to be the best, which improved the overall efficiency by 54.4% [6].

Renewable energies are mostly intermittent; hence, the storage of energy is essential if we are to be fully dependent on renewable sources. Batteries are currently one of the most promising technologies for these purposes. However, an effective management system is essential to determine the battery's charging and discharging pattern, which can offer a cost-effective option for battery-integrated microgrid systems. For this, a long short-term memory was proposed which showed that the real-time strategy outperforms the offline optimisation strategy, reducing the operating cost by 3.3% [7].

Energy consumption reduction is also essential for the future. Buildings currently consume 40% of global energy and produce 30% of greenhouse gases [8]. Hence, efficient buildings that possess combined benefits for energy, the economy, and the environment are essential. A review was performed to analyse the 3E impact on buildings, particularly in developing countries such as India. A new framework was designed which will enable architects, designers, and researchers to develop highly efficient buildings [9].

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