Science and Technology for Energy Transition (STET)
Topical issue Emerging Advances in Hybrid Renewable Energy Systems and Integration

Abstract:

Recently, the whole world is concerned about meeting the future energy demands due to the limited amount of resources available and also since those resources cannot be replenished. In spite of the existence of renewable energy ideas over a long period of time, its importance and need has been felt with utmost attention over the past few decades only. Advancements in energy systems has led to the development of off-grid and hybrid renewable energy systems. One common form of hybrid energy source is the integration of wind energy source with Photo Voltaic (PV) cells in both on-grid and off-grids. But these hybrid energy systems pose various challenges in the setup, generation, and integration part. In spite of the abundance and renewable nature of wind energy, it is unpredictable and highly variable depending on the location. These challenges are often offset by the provision of backup generators and batteries. Hybrid energy systems are an excellent solution to solving intermittent supply and reliability issues by combining two parallel power architectures.

A hybrid renewable energy system will consist of the following sub components: renewable energy resource such as wind or solar, energy harvester, electrical systems, energy storage systems such as lead batteries, common interface or bus, and an electronic logic controller for energy system management operations. Redundancy standards are applied in each and every stage of the hybrid renewable energy system in order to reduce the probability of loss in power supply. Emerging research and technological advancements are focused on optimizing the renewable energy systems through various approaches. Algorithms based on numerical, probabilistic, and heuristic techniques have been implemented in the optimization processes. A popular metric used in such optimization problems is Localized Cost of Energy (LCOE) which calculates the average price of the total amount of electricity produced by the hybrid renewable energy systems over their operation lifecycle. Apart from wind and solar combination, a variety of possibilities can be implemented using biomass, thermal, piezoelectricity, and hydraulic energy. Future research must be focused on solving problems associated with design, optimization, operation, and testing of such energy systems. Also, efforts can be made in developing an efficient energy management system.

Instructions for authors:

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Timeline for this special issue:

- Manuscript Submission Date - 20.04.2024
- Author Notification Date - 25.07.2024
- Revised paper submission Date - 30.10.2024
- Final acceptance Date - 25.01.2025

List of topics to be covered in this special issue:

- Estimation of renewable energy demands at various sistes and matching them with potential hybrid renewable energy system solutions.
- Mapping potential zones for implementation of hybrid energy systems using remote sensing data and big data analysis.
- Methods to enable energy harvesting in hybrid mode through vehicles such as trains, cars etc.
- Techniques to develop a hybrid renewable energy system using piezoelectric and thermal energy resources.
- Design and optimization of hybrid renewable energy systems for industries and audit of carbon footprint.
- Methods to overcome installation and operation challenges involved in hybrid renewable energy systems.
- Smart renewable energy systems for isolated grids.
- Modelling a computerised model or tool for analysing the risks involved in a wind and diesel hybrid energy system.
- Innovative techniques for generating renewable energy harvesting systems for residential grids.
- Energy need assessment and management tool for hybrid energy systems for isolated grids

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