Short Communication

Renewable Energy Systems: Need, Challenges, and Research Scope

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Abstract

Concerning the growing economy, the energy source plays a significant role, and deriving the energy from renewable energy resources, which are available in plenty, will lead to developing an energy model, aid for proper allocation of the resources, and enhance power system performance. This article addresses the critical problem associated with renewable energy and the scope of research in the field of renewable energy systems. Therefore, this article aid in giving a novel contribution from students and researchers.

Keywords: Economy; Energy Sources; Renewable Energy

Need for renewable energy systems

Resources are non-renewable like petroleum, natural gas, and coal are harming economic growth, human lives, and the environment. As a result, the Kyoto Protocol seeks to stabilize and reduce greenhouse gas concentrations in the atmosphere in order to avoid hazardous greenhouse gas concentrations system. The aforementioned concerns can be remedied utilizing renewable energy systems, among which wind energy and solar energy are the most well-known and plentiful resources.

Challenges associated with renewable energy systems

Due to the meteorological influence, projecting future electricity power generation from intermitted resources (solar, wind, etc.) is a difficult and crucial procedure when compared to nonrenewable energy resources. The following are the issues related with renewable energy technologies incorporated into the energy system:

- Grid security and outage problem
- Power quality problem
- Scheduling and dispatch problem
- Requirement of ancillary services
- Issue related to energy balancing
- Operation and control problem
- Damaging high-cost power equipment
- Economical problem

Scope of research in renewable energy systems

With the increasing expansion of renewable energy systems, the majority of research is focused on creating novel power converters, control schemes, and forecasting models to achieve superior performance in terms of power quality, scheduling, economic dispatch, control, and planning. There are several research opportunities in the field of renewable energy, including:

- Modeling of wind and solar energy systems utilizing cutting-edge methodologies
- Perform research works to improve the battery life and efficiency because most of the renewable energy are not portable.

- Developing more efficient and cost-effective power converters to solve grid integration, power loss, and power quality concerns.

- Linked the Internet of Things to renewable smart cities.

- Maximum power point tracking technique based on artificial intelligence to extract maximum power from renewable energy.

- Using hybrid optimization methods, optimize the performance of renewable energy sources.

- Invest in fuel cell and hydro energy research to address energy needs.

- Develop new high-efficiency solar cell materials.

- Due to the volatile and erratic nature of renewable energy systems, which may not achieve feasible performance, forecasting of wind speed and solar irradiance is required to overcome limitations and improve performance in scheduling, dispatch, and planning for resource allocation economy.

Conclusion

One of the current hot research topics is the integration of renewable energy with artificial intelligence using cutting-edge methods. As a result, this article assists students and researchers in identifying the bridge gap in order to create the most competent forecasting model and design novel power converters, battery systems, and control schemes. Hence, overcome the challenges for renewable energy systems, which leverage enhanced power systems and improve the economy [1-6].

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