

Advancements in Renewable Energy: A Path to a Greener Tomorrow

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Abstract : Introduction: The urgent need to tackle climate change and environmental degradation highlights the significance of Renewable Energy Systems and Sources (RESSs). This paper explores the impactful roles of various RESSs—including wind, solar, hydropower, biomass, and geothermal energy—in mitigating greenhouse gas emissions and promoting sustainable development. It examines emerging technologies in energy storage and artificial intelligence to enhance renewable energy efficiency and reliability. The study also assesses essential policies for transitioning from conventional energy systems to renewables, focusing on grid interactivity and public awareness. Ultimately, this research aims to demonstrate how RESSs can drive climate resilience and contribute to a sustainable future. Objectives: The analysis aims to examine the contributions of various Renewable Energy Supply Systems (RESSs) in mitigating greenhouse gas emissions and promoting sustainable development while highlighting emerging trends and technologies such as advancements in energy storage, hybrid systems, and the integration of artificial intelligence and machine learning to enhance efficiency and reliability in renewable energy production. Additionally, it will assess the necessary policies and strategies for transitioning from conventional energy systems to renewable alternatives, focusing on aspects like grid interactivity, energy transformation, public awareness, and smart grid technologies. Methodology: This study employs a multi-faceted approach that includes a comprehensive literature review to gather insights on Renewable Energy Supply Systems (RESS) contributions to sustainability, quantitative data collection on energy production and greenhouse gas emissions from organizations like IRENA, and in-depth case studies of specific RESS projects across various geographical locations to illustrate practical applications. Additionally, it involves trend analysis through expert interviews and industry reports to identify emerging technologies, policy evaluation by analyzing existing policies with a focus on grid interactivity and public awareness, and the synthesis of findings by integrating insights from diverse sources to draw conclusions about the impact of RESSs. Contributions of the Paper: This research provides a comprehensive analysis of the impact of Renewable Energy Supply Systems (RESSs) in combating climate change while identifying emerging technologies, including current trends in energy storage and the integration of artificial intelligence in renewable energy systems. The paper offers actionable policy recommendations to facilitate the transition to renewable energy, illustrated through case studies that present best practices and real-world applications. Additionally, the findings highlight gaps in existing knowledge, encouraging further research into the sustainability impacts of RESSs. Overall, this study elucidates how RESSs can be instrumental in achieving climate resilience and environmental sustainability, ultimately contributing to a cleaner and greener future.

Keywords : renewable energy, sustainability, energy storage, artificial intelligence

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