ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 7, 2022

ADVANCES RENEWABLE ENERGY TECHNOLOGY: A REVIEW

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Abstract:

Renewable Energy Technologies and their Impact on Sustainable Energy Generation, Climate Change Mitigation, and the Global Energy System. Renewable energy sources such as solar energy, wind energy, hydro power and geothermal energy are attracting more attention and investment as they have the potential to reduce GHG emissions and replace fossil fuels. In this research paper, we look at recent advances in renewable technologies, their impact on the environment, their economic feasibility and the challenges associated with widespread adoption. We also look at how renewable energy can help address the increasing demand for energy and combat climate change.

Keywords:

Greenhouse gases, Co_2 mitigation, Sustainable development, Renewable energy sources

I. Introduction:

Renewable energy technologies have emerged as a response to the environmental and energy challenges of the 21st century. They can significantly reduce greenhouse gas emissions, thereby reducing the impact of climate change on the global environment. Furthermore, by providing cost-effective and readily available energy solutions, renewable energy technologies can contribute to reducing energy poverty and promoting social equity. Current and future developments in renewable energy technologies: Over the past few decades, there has been a significant growth in the development and adoption of renewable energy technologies. The burning of fossil fuels for energy generation has led to increased greenhouse gas emissions, climate change, and the depletion of finite natural resources. They are significant because they mitigate the environmental impact of energy production, reduce greenhouse gas emissions, enhance energy security, and contribute to sustainable economic development. Examine the most recent

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developments in biomass, geothermal, hydropower, solar, wind, and other renewable energy sources. Examine the advantages and difficulties these technologies have for the environment.

Examine the effects of government regulations and incentives as well as the viability of renewable energy sources economically. Examine how energy storage technologies fit into current energy systems and how renewable energy is integrated into them. Examine the industry's socioeconomic effects as well as the possibilities for sustainable growth and community involvement in the field of renewable energy.

Solar Energy:

- Advances in photovoltaic cell technology
- Concentrated solar power systems
- Integration of solar energy with energy storage solutions
- Environmental benefits and challenges

Wind Energy:

- Development of more efficient wind turbines
- Offshore wind farms and their potential
- Grid integration and energy storage for wind power
- Environmental and ecological considerations

Hydropower:

- Innovations in hydropower technology
- Small-scale and run-of-river hydropower systems
- Impact on aquatic ecosystems and mitigation measures

Geothermal Energy:

- Enhanced geothermal systems
- Geothermal heat pumps for heating and cooling
- Geothermal energy's role in reducing carbon emissions

Biomass and Bioenergy:

- Advanced biofuel production techniques
- Biomass co-firing in conventional power plants

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- Sustainable sourcing of biomass feedstocks

Integration and Energy Storage:

- Smart grids and demand-side management
- Energy storage solutions, such as batteries and pumped hydro
- Grid interconnectivity and balancing renewable energy sources

Economic Feasibility and Policy Support:

- Analysis of the cost of renewable energy technologies
- Government incentives and subsidies
- Market dynamics and investment trends

9. Environmental and Social Impacts:

- Lifecycle assessment of renewable energy technologies
- Socio-economic implications of the renewable energy industry
- Community engagement and sustainable development

Fig 1: Technology Advances in Eco Friendly

II. Previous Research:

Research has focused on next generation photovoltaic (PV) materials, like perovskite, which promise higher efficiency and lower production costs. Numerous studies have shown that concentrated solar power systems (CSP) have the potential to provide reliable and dispatchable solar power. Research has also shown that solar intermittency issues can be solved by combining solar with energy storage technologies such as lithium-ion batteries or molten salt

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storage. While environmental evaluations have highlighted the benefits of using solar to reduce carbon emissions, they have also raised concerns about the environmental impacts of producing and disposing of solar panels. Policymakers, corporations, and the general public face a number of possibilities and difficulties as a result of the rapidly expanding and innovative field of renewable energy technology. Through ongoing investigation and examination, interested parties can acquire important knowledge on the most effective approaches to utilizing renewable energy sources, resolving intermittent difficulties, and reducing their ecological footprints. Life Cycle Assessments (LCAs) have been carried out to evaluate how renewable energy technologies impact the environment throughout their entire life cycle, from production to disposal. Socio-economic studies have explored the potential for job creation in the renewable energy sector and its effects on local communities. These studies have emphasized the significance of community involvement and sustainable development in the progress of renewable energy projects, aiming to foster social acceptance and minimize conflicts. To summarize, prior research in the realm of Renewable Energy Technologies (RE) has furnished valuable insights into the rapid advancement of renewable energy sources, their environmental and economic implications, and their role in mitigating climate change and transitioning towards a more sustainable energy landscape. This information has been utilized to shape policy, industry practices, and ongoing research endeavors.

Graph 1: Renewable Energy

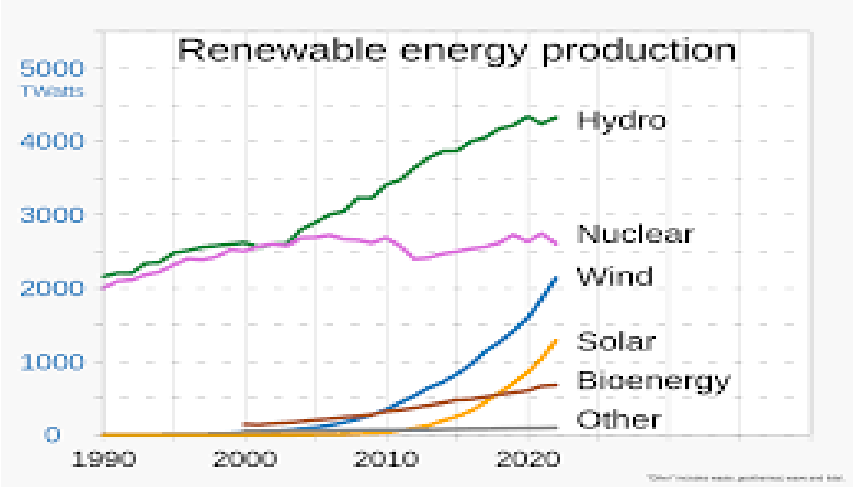

Fig : Renewable Energy Production

III. **Future Scope**:

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The future potential of research on Advances in Renewable Energy Technologies is promising and diverse. As the world continues to grapple with the challenges of climate change, energy security, and sustainable development, renewable energy technologies are expected to play a crucial role. Here are some areas of future research and development within this field. Investigate and report on the latest breakthroughs and emerging technologies in the renewable energy sector, such as perovskite solar cells, advanced wind turbine designs, next-generation energy storage solutions, and innovative bioenergy conversion techniques. Explore the evolution of energy storage technologies, including improvements in battery technology, grid-scale storage solutions, and the integration of artificial intelligence for optimized energy storage and distribution. Research the development and deployment of hybrid renewable energy systems that combine multiple energy sources (e.g., wind and solar) to enhance reliability and energy yield. Investigate smart grid solutions that efficiently integrate renewable energy into the existing energy infrastructure. Study how renewable energy technologies can contribute to climate resilience and adaptation. Assess the role of decentralized energy systems, microgrids, and renewable-powered desalination for water security in the face of climate change. Explore advancements in offshore wind energy, wave energy, and tidal energy. Investigate the technical, environmental, and economic challenges associated with harnessing energy from the ocean. Develop improved resource assessment and forecasting techniques for renewable energy sources, including advanced tools for predicting solar and wind energy generation. This will enhance grid integration and energy system planning.

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