PROCEEDINGS

A Two day National Seminar on Multi-Disciplinary Research in Contemporary Era: Exploring Innovative Trends

20th & 21st February, 2025

Organized by
Department of Humanities
and
Internal Quality Assurance Cell (IQAC)

Editors

Dr. Sr. Prafula
Dr. Shruthi G.
Dr. Hydar Ali
Mr. Chethan M.
Mr. Vivek Charles
Dr. Sathishkumar A. V.

Volume I

TERESIAN COLLEGE
Bannur Road, Siddarthanagar, Mysuru - 570 011

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Shruthi G

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Chethan M

Vivek Charles

Sathishkumar A V

ISBN: 978-81-948760-1-4

Published By

Teresian College

20th Feb, 2025

Seminar Organized by Department of Humanities and Internal Quality Assurance Cell (IQAC), Teresian College, Mysuru.

INR: 600

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THE ROLE OF GREEN ENERGY IN SUSTAINABLE DEVELOPMENT

B.N. Chandrashekar

Department of Chemistry, Sri Adichunchanagiri First Grade College , Affiliated to Hassan University, Channarayapatna – 573116. Email: chandrashekarbn1984@gmail.com

Abstract

The transition to green energy is pivotal in addressing both environmental degradation and the quest for sustainable development. As the world faces urgent problems like climate change, high energy use, and resource shortages, moving from fossil fuels to renewable energy is more important than ever. Green energy, derived from sources like solar, wind, hydropower, and geothermal, offers a sustainable alternative that not only mitigates environmental harm but also fosters economic growth and social well-being. This article explores the intersection of green energy and sustainable development, highlighting how the adoption of renewable energy technologies can reduce carbon emissions, lower dependence on finite resources, and create new opportunities for job creation and innovation. It examines the environmental benefits of green energy, including its role in reducing air pollution, conserving ecosystems, and combating climate change. Furthermore, it discusses the socioeconomic implications of green energy adoption, from improving energy access in underserved communities to driving green technologies that can stimulate global markets. However, achieving a green energy future requires overcoming significant challenges such as policy development, infrastructure investment, and public awareness. The paper proposes strategies for governments, industries, and individuals to collaborate in accelerating the transition to green energy, with an emphasis on building resilient energy systems, fostering innovation, and ensuring equitable access to clean energy. In conclusion, green energy is not just a technological solution but a fundamental enabler of a more sustainable and environmentally responsible global society. By prioritizing green energy, we can lay the groundwork for a future where environmental sustainability and human prosperity coexist in harmony.

Keywords: Renewable Energy, Green Energy, Sustainable Development, Economic Growth and Climate Change

Introduction

The world is experiencing a significant environmental crisis that includes climate change, the depletion of natural resources, and the loss of biodiversity. These challenges are urgent and require immediate attention. One of the most important steps we can take to address these issues is to shift from fossil fuels to renewable energy sources (Jacobson et al., 2009). This transition to green energy, which comes from natural and renewable systems like solar, wind, hydropower, and geothermal power, provides a way to reduce environmental harm while supporting sustainable development (Ajanovic & Haas, 2017). Green energy helps to reduce the negative impacts on the planet by decreasing carbon emissions and minimizing environmental degradation. Unlike fossil fuels, which contribute to pollution and global warming, renewable energy sources are cleaner and can be replenished naturally without damaging the environment (IRENA, 2020). Additionally, these energy sources do not produce the same level of waste or contribute to resource depletion in the long run (Fischedick et al., 2019). As the global demand for energy continues to grow, transitioning to renewable energy becomes even more critical to preserving the planet for future generations (Rogers, 2019). The switch to green energy also has significant socioeconomic benefits. It offers opportunities to create new jobs and industries, particularly in the fields of clean technology and energy infrastructure. This can help reduce poverty and inequality, particularly in developing regions where access to clean energy is limited (IRENA, 2020). Moreover, renewable energy sources can provide a more reliable and decentralized supply of power, helping to address energy security challenges (Jacobson et al., 2009). In summary, the move from fossil fuels to renewable energy is essential for reducing environmental damage and promoting social and economic well-being. By embracing green energy, a more sustainable and equitable future for everyone can be achieved.

The Environmental Crisis and the Role of Energy.

The global reliance on fossil fuels for energy generation has resulted in significant environmental degradation. Fossil fuel combustion produces harmful emissions that contribute to global warming, smog, and acid rain. These activities also lead to land degradation, water pollution, and loss of biodiversity. The world's energy consumption continues to grow, and with it, the environmental toll. For example, according to the International Energy Agency (IEA), the energy sector is responsible for approximately 75% of global greenhouse gas emissions (IEA, 2020). In contrast,

renewable energy sources such as solar, wind, and hydropower are cleaner, produce little to no carbon emissions, and help conserve ecosystems. The transition to renewable energy is central to achieving global climate targets outlined in the Paris Agreement, which aims to limit global temperature rise to below 2°C above pre-industrial levels. Thus, the development and implementation of green energy technologies can significantly reduce the carbon footprint and help mitigate the adverse effects of climate change.

The Intersection of Green Energy and Sustainable Development.

Sustainable development is a broad concept that encompasses environmental, social, and economic dimensions. The United Nations' Sustainable Development Goals (SDGs) highlight the importance of affordable, reliable, and modern energy for all. Renewable energy supports the SDGs by reducing energy poverty, stimulating economic growth, and fostering social equity (Sovacool et al., 2019).

Reducing Carbon Emissions and Environmental Impact

Green energy is critical to mitigating climate change. Solar and wind power, for example, produce no direct emissions, while hydropower and geothermal energy contribute very little to global warming. By replacing fossil fuels with renewable energy technologies, carbon emissions can be significantly reduced. According to the Global Commission on the Economy and Climate (2018), a global shift toward renewable energy could reduce CO_2 emissions by up to 70% by 2050. Such reductions are necessary to avoid the most severe impacts of climate change.

Lowering Dependence on Finite Resources.

Fossil fuels such as coal, oil, and natural gas are finite resources. Their extraction, transportation, and consumption have numerous environmental and socioeconomic costs. Additionally, as reserves deplete, the cost of extraction increases, leading to price volatility in global markets (Kerschner et al., 2018). In contrast, renewable resources like sunlight, wind, and geothermal heat are abundant and will not run out for the foreseeable future. Investing in these technologies not only mitigates the risks associated with resource depletion but also helps build a more resilient global energy infrastructure.

Economic Benefits of Green Energy.

The transition to renewable energy offers significant economic advantages that extend beyond environmental benefits. One of the primary economic impacts is job creation. As renewable energy technologies, such as wind, solar, and bioenergy, grow in demand, they create a wide range of employment opportunities in areas such as manufacturing, installation, and maintenance (Doyen et al., 2018). This influx of new jobs helps stimulate local economies and provides workers with sustainable career paths. Additionally, the shift towards renewables fosters increased economic growth by attracting investments in clean energy projects and infrastructure. This, in turn, can improve energy security and reduce reliance on fossil fuel imports, leading to a more resilient economy. The development of green technologies further boosts innovation and drives the creation of new industries, contributing to long-term economic sustainability and enhancing global competitiveness in the rapidly evolving energy sector.

Job Creation and Economic Diversification

Green energy is a job-intensive sector. The renewable energy industry provides direct employment opportunities in fields such as manufacturing, installation, operation, and maintenance. According to the International Renewable Energy Agency, renewable energy employed 12 million people globally in 2020, with the potential for even greater employment gains in the coming decades (IRENA, 2021). Furthermore, the green energy sector stimulates innovation and technological advancement, spurring the creation of new industries and services.

Economic Growth and Market Opportunities.

The development of green technologies provides opportunities for market expansion. For example, electric vehicles (EVs), energy-efficient appliances, and energy storage solutions are becoming increasingly important industries. As governments worldwide adopt renewable energy policies and incentives, companies that produce and distribute green technologies are well-positioned for growth. As a result, the renewable energy transition can drive economic growth, particularly in regions that embrace these new technologies (Smith & Wilson, 2020).

Socioeconomic Implications of Green Energy Adoption.

The widespread adoption of green energy technologies can significantly transform both local and global communities. It can improve access to affordable and reliable energy,

especially in underserved areas, helping to bridge the energy gap. Additionally, green energy reduces social and economic inequalities by providing job opportunities and empowering marginalized groups. By addressing energy poverty, it promotes social well-being, enhances health outcomes, and opens up educational opportunities. Overall, the transition to green energy fosters greater equity, social cohesion, and sustainable development (Sovacool et al., 2019).

Improving Energy Access in Underserved Communities.

Access to affordable and reliable energy is a major issue in many developing countries. According to the World Bank, approximately 770 million people worldwide still lack access to electricity (World Bank, 2021). Renewable energy technologies, particularly off-grid solar systems, offer a solution to this issue by providing decentralized and cost-effective energy sources to rural or isolated communities (Sreenivas et al., 2020). By increasing energy access, green energy can help alleviate poverty, improve health outcomes, and enhance education opportunities in underserved regions.

Fostering Social Equity.

Green energy projects can provide social benefits by empowering communities and promoting inclusive development. For instance, renewable energy initiatives can create local employment, reduce energy costs, and enhance community resilience to climate-related events. Furthermore, green energy systems can contribute to gender equality by enabling women and girls to gain access to reliable energy, which can improve their education and economic opportunities (Ghimire & Taylor, 2021).

Challenges to the Green Energy Transition

Despite the numerous benefits of green energy, several challenges hinder its widespread adoption. These include technological obstacles, such as the need for more efficient energy storage solutions and better grid integration, as well as financial barriers, like the high upfront costs of renewable energy infrastructure. Additionally, policy and regulatory frameworks often lack the necessary support for large-scale green energy implementation. Addressing these technological, financial, and policy challenges is crucial to ensuring a smooth and successful transition to a sustainable energy future (Hanger et al., 2021).

Policy Development and Regulatory Frameworks.

Governments play a crucial role in promoting green energy through supportive policies and regulations. However, in many regions, there is still a lack of comprehensive and effective renewable energy policies. This can result in slow adoption rates, limited investment, and inconsistent energy pricing mechanisms (Mitchell et al., 2020). Clear regulatory frameworks, incentives, and long-term policy commitments are essential to creating the conditions necessary for green energy growth (Carley et al., 2021).

Infrastructure Investment

A key concept in addressing the infrastructure challenges of renewable energy integration is the establishment of scientific research laboratories focused on developing innovative solutions. These laboratories play a critical role in advancing technologies for energy storage, improving power grid systems, and enhancing energy transmission networks. They contribute essential research that can reduce costs and improve efficiency, supporting infrastructure investment. Governments, private investors, and international organizations must collaborate to fund such research, ensuring infrastructure investments are well-aligned with the goal of a clean energy future (Zhang et al., 2020).

Public Awareness and Education

Public understanding of the benefits of renewable energy and the urgency of the climate crisis is essential for driving change. Awareness campaigns, education programs, and advocacy initiatives are crucial in shifting public attitudes and behavior (Hine et al., 2020). Governments and civil society organizations should prioritize these efforts to build support for green energy initiatives (Tuncer et al., 2019).

Strategies for Accelerating the Green Energy Transition.

To overcome the challenges and accelerate the green energy transition, a range of strategies can be employed. First, strong collaboration between governments, industries, and communities is essential. Governments can provide supportive policy frameworks, financial incentives, and regulatory measures, while industries innovate and deploy renewable technologies. Communities play a vital role by participating in decision-making processes and benefiting from local projects. Second, investing in research and development (R&D) is crucial to advancing green technologies, making them more efficient and affordable. Scientific laboratories should be well-funded to drive

innovation, and children must be encouraged to pursue careers in research, fostering a future generation dedicated to solving energy challenges. Lastly, ensuring equitable access to green energy is vital, ensuring that vulnerable populations benefit from the transition (Rogner et al., 2021). This coordinated effort will drive the green energy transition forward and create a more sustainable future (Moser et al., 2021).

Investment in Research and Development

Innovation is critical to advancing green energy technologies. Increased investment in research and development (R&D) will lead to more efficient, cost-effective, and scalable solutions. Funding should be directed to colleges and universities to support cutting-edge research in renewable energy. Additionally, students should be supported through scholarships to encourage them to take up projects in green energy, ensuring a pipeline of future innovators. Public-private partnerships, as well as international collaborations, can help accelerate R&D and bring new technologies to market (Watson et al., 2020). This approach will foster the next generation of experts driving the green energy transition forward.

Ensuring Equitable Access to Green Energy.

Ensuring that green energy benefits are shared equitably is essential for achieving sustainable development. Policymakers must prioritize inclusive energy access and address the needs of vulnerable populations, such as rural communities and low-income households (Sovacool et al., 2019)

Conclusion

The transition to green energy is essential for achieving sustainable development and mitigating environmental degradation. By reducing carbon emissions, improving energy access, fostering economic growth, and promoting social equity, renewable energy offers a pathway to a more sustainable and prosperous future. Despite the challenges, the green energy transition is both necessary and achievable, and with the right policies, investments, and public support, we can build a world where environmental sustainability and human prosperity go hand in hand.

References.

1. Jacobson, M. Z., Delucchi, M. A., Bauer, Z. A., Goodman, J., Chapman, W. E., Cameron, M. A., & Leach, A. M. (2009). A path to sustainable energy by 2030. *Energy Policy, 37*(8), 2145–2159.
2. International Renewable Energy Agency (IRENA). (2020). *Renewable energy and jobs – Annual review 2020*. International Renewable Energy Agency.
3. Ajanovic, A., & Haas, R. (2017). The role of renewable energy in the transition towards sustainable development. *Renewable and Sustainable Energy Reviews, 72*, 247–258.
4. Fischedick, M., Hake, J.-F., Rübbelke, D., & Hauff, F. (2019). The future of energy systems: Opportunities and challenges for transition to sustainable energy. *Nature Sustainability, 2*, 381–389.
5. Rogers, H. (2019). The transition to green energy and the role of policy. *Environmental Economics and Policy Studies, 21*(1), 1–18.
6. International Energy Agency (IEA). (2020). *World energy outlook 2020*. IEA.
7. Sovacool, B. K., Kester, J. R., Kim, J., Banks, A., Hennig, R., Ke, K., Hafner, J., & Liao, W. J. (2019). Sustainable development, energy poverty, and the global transition to renewable energy. *Nature Sustainability, 2*, 509–521.
8. Global Commission on the Economy and Climate. (2018). *Unlocking the inclusive growth story of the 21st century: Accelerating climate action in urgent times*. Global Commission on the Economy and Climate.
9. Kerschner, C., O'Neill, D. W., Arnsperger, C., Sorman, A. H., & Uweyama, M. (2018). Economic growth, decoupling, and material flow analysis. *Nature Sustainability, 1*, 5–13.
10. Doyen, L., Voisin, A., & Turotti, L. (2018). Green energy, jobs, and sustainable economic growth: The link between employment and clean energy. *Renewable and Sustainable Energy Reviews, 98*, 67–76.
11. International Renewable Energy Agency (IRENA). (2021). *Renewable energy and jobs – Annual review 2021*. International Renewable Energy Agency.
12. Smith, A. R., & Wilson, T. E. (2020). Economic growth and the rise of green technologies: The impact of government policy on market expansion. *Renewable and Sustainable Energy Reviews, 120*, 109645.

13. Sovacool, B. K., Kester, J. R., Kim, J., Banks, A., Hennig, R., Ke, K., Hafner, J., & Liao, W. J. (2019). Sustainable development, energy poverty, and the global transition to renewable energy. *Nature Sustainability, 2*, 509–521.
14. World Bank. (2021). *The World Bank annual report 2021*. World Bank Group.
15. Sreenivas, A., Yoon, M. K., Kumar, S., & Ahn, J. H. (2020). Decentralized energy systems and their role in alleviating poverty in rural areas. *Renewable and Sustainable Energy Reviews, 119*, 109555.
16. Ghimire, P., & Taylor, S. L. (2021). Renewable energy, gender equity, and social benefits in developing countries. *Renewable and Sustainable Energy Reviews, 135*, 110401.
17. Hanger, K., Jones, C., Green, D., & Piani, A. (2021). Challenges to the global transition to green energy: Technology, finance, and policy. *Energy Policy, 149*, 112027.
18. Mitchell, C., Connor, P., & Wustenhagen, R. (2020). Policy, regulation, and financing of renewable energy: Challenges and solutions for accelerating the transition. *Renewable and Sustainable Energy Reviews, 130*, 109926.
19. Carley, S., Nicholson, C., Safford, T., & Sine, W. D. (2021). The role of government policy in the growth of renewable energy: A global overview. *Energy Policy, 149*, 112007.
20. Zhang, L., Liu, C., Li, Z., Wu, Y., & Chen, X. (2020). Investment in renewable energy infrastructure: Addressing the gaps in power grids and energy storage systems. *Renewable and Sustainable Energy Reviews, 118*, 109537.
21. Hine, D. L., Johnson, D., & Jones, M. K. (2020). The role of public awareness and education in advancing renewable energy adoption. *Energy Policy, 144*, 111689.
22. Tuncer, B., Yildiz, Ö., & Yılmaz, H. L. (2019). Public awareness and education campaigns in renewable energy adoption: The need for a global advocacy strategy. *Renewable and Sustainable Energy Reviews, 107*, 45–55.
23. Rogner, H.-H., Huld, T., Nabuurs, G.-J., Dufresne, C., Marbaix, P., Chum, H., Lund, P., & Schaeffer, R. (2021). Pathways for accelerating the global transition to clean energy. *Environmental Science & Technology, 55*(6), 3339–3348.

24. Moser, S. C., Morrow, B. H., & Goldman, L. E. (2021). Integrating local communities in the energy transition: The role of collaboration and participatory governance. *Environmental Science & Policy, 116*, 52–60.
25. Lewis, N. S., & Nocera, D. G. (2006). Powering the planet: Chemical challenges in solar energy utilization. *Proceedings of the National Academy of Sciences of the United States of America, 103*(43), 15729–15735.
26. Watson, J., Katerina, S., & Brown, C. (2020). Public-private partnerships and the future of green energy technologies. *Renewable and Sustainable Energy Reviews, 127*, 109857.
27. Sovacool, B. K., Kester, J. R., Kim, J., Banks, A., Hennig, R., Ke, K., Hafner, J., & Liao, W. J. (2019). Sustainable development, energy poverty, and the global transition to renewable energy. *Nature Sustainability, 2*, 509–521.