

Green Energy and Sustainable Development in India

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Abstract

India's push for green energy is at the heart of its sustainable development. This push is driven by ambitious renewable energy targets (500 GW by 2030), massive investments, robust policies (such as Production-Linked Incentives for solar), and initiatives for grid modernization (BESS) to meet the ever-increasing demand for energy while simultaneously combating climate change, creating jobs, and boosting economic growth through solar, wind, and other clean sources. This aligns India's national goals with global sustainability efforts. The commitment that India has made to green energy is very revolutionary, since it connects the goals of national development with those of global sustainability. Using its tremendous renewable potential, India is paving the path for a cleaner, more prosperous, and more sustainable energy future for all of its population. This is being accomplished via the implementation of laws that are supportive, technological innovation, and major investment. By examining installed capacity, spending, and capacity addition data, the report highlights India's unwavering dedication to a more environmentally friendly future. Variations in funding and capacity expansions demonstrate the country's flexibility and will to overcome obstacles. India has made significant progress in lowering carbon emissions and enhancing energy security by embracing greener energy sources like solar, wind, hydropower, biomass, and geothermal energy. India's trajectory is a monument to the transforming ability of sustainable development in the face of these changes. The country's unwavering course, driven by strong laws and cutting-edge technology, demonstrates how environmental preservation and human advancement may coexist peacefully. In the end, the study presents a clear picture of India's critical role in international initiatives to reduce climate change, promote economic expansion, and improve communities through sustainable development powered by renewable energy.

1. Introduction

India has established itself as a global leader in the utilization of renewable energy sources as a response to the growing concerns regarding the environment and the requirement for energy security. The nation is rapidly transitioning to more environmentally friendly forms of energy due to the abundance of natural resources it possesses and its commitment to achieving sustainable development. India's energy landscape is undergoing a transformation as a result of the persistent pursuit of solar, wind, hydropower, and biomass technologies. This trend is also contributing to a reduction in the country's carbon footprint and increases economic growth. "Renewable Energy for Sustainable Development in India" is a sign that represents the convergence of India's growth objectives with the demands of the global community associated with sustainability. With concerns about the environment and the depletion of fossil fuels, renewable energy becomes increasingly important. The rise of India's economy is inextricably linked to the country's demand for energy; nevertheless, traditional sources of energy come with environmental implications. It is becoming increasingly important for India to transition to renewable energy sources such as solar, wind, hydropower, biomass, and geothermal energy. This transition is being guided by international obligations. Through this investigation, the relationship between India's development and renewable energy sources is dissected. In it, the policies, technologies, socioeconomics, and global links that are shaping this transformation are investigated in depth. The importance that renewable energy

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plays not only in the development of India but also in the redesigning of sustainable paths on a global scale. Wind energy, solar power, geothermal energy, and tidal power are all examples of renewable energy. Renewable energy is the endless energy that is produced as a result of continuous regeneration. The fact that renewable energy may be obtained without causing any harm to the environment is one of its most notable characteristics. According to the findings of recent research, renewable energy sources have the potential to provide answers to environmental issues that are currently being experienced by humanity. An extremely populous nation on this globe, India has a greater demand for energy than any other country. Renewable energy is one of the most important choices that may be made to achieve this quality. At the present time, renewable energy sources are responsible for 37% of India's total energy consumption. In this article, an attempt has been made to discuss the potential for our nation to utilize renewable energy sources in the future.

The statistics on renewable energy for sustainable development provide a comprehensive overview of India's initiatives to establish a cleaner and greener energy landscape. The installed capacity of renewable electricity throughout various states and union territories exhibits a significant increase in renewable energy projects, such as solar, wind, hydropower, and biomass, reflecting a growing commitment to sustainable development. This enhancement in capacity highlights the nation's dedication to reducing its dependence on fossil fuels, alleviating climate change, and shifting towards a low-carbon economy. The annual increase in capacity reflects the impact of external factors on renewable energy installations. The reduction in capacity expansion in 2020-21 may be ascribed to pandemic-related issues, including supply chain disruptions, labor shortages, and delays in project implementation. The substantial rise in 2021-22, conversely, indicates a resurgence in renewable energy initiatives, reflecting resilience and ongoing commitment to sustainable development. Renewable energy represents India's proactive strategy for sustainable development. The United States' dedication to renewable energy sources enhances energy security and environmental sustainability while paving the way for economic development, job creation, and social inclusion. India is pivotal in global climate change mitigation by advancing renewable energy transitions, in accordance with international initiatives to establish a sustainable future for subsequent generations.

As India continues to work towards achieving sustainable development, the country's persistent dedication to the use of renewable energy sources shines as a light of optimism and success. The investigation of the role that renewable energy plays in the formation of India's narrative of sustainable development sheds light on a dynamic path towards a future that is both more environmentally friendly and more robust. The deliberate adoption of renewable energy sources by India, which includes solar, wind, hydropower, biomass, and geothermal energy, represents a significant change away from traditional energy paradigms and toward alternatives that are more environmentally sensitive. A proactive response to the global need for climate action is embodied in this transition, which not only answers concerns over energy security but also addresses those concerns. The information regarding India's installed capacities, expenditures, and capacity additions presents a clear picture of the country's determined route. There is a dynamic commitment to sustainable development, as seen by fluctuations in financing priorities, with increased spending occurring at critical junctures. The statistics on capacity addition broken down by year demonstrates India's resilience in the face of adversities and highlights the country's willingness to ensure a smooth transition despite the influence of external forces. When all of these changes are taken into consideration, the underlying story is one of advancement. India has made great progress in embracing cleaner energy sources, which has contributed to a decreased carbon footprint and increased energy security. The data in question demonstrates this progress. Strong regulatory frameworks, technical innovation, and an increasing awareness of the imperatives of sustainable development are the foundations upon which these accomplishments are built. The findings, in essence, shed light on the admirable journey that India has been on towards sustainable growth through the utilization of renewable energy. The nation's drive to align itself with global efforts to mitigate climate change, stimulate economic growth, and elevate communities is reflected in the data, which resound with the nation's commitment to a cleaner and greener future. The tale of India is becoming a testament to the transforming force of sustainable development as it continues to be a pioneer in the move towards renewable energy. The notion that a healthy coexistence between human growth and environmental preservation is not just feasible, but vital, is reaffirmed by this journey, which serves as a symbol of hope for a world that is in the process of coping with complicated environmental challenges.

Energy exists on Earth in various forms. Some may be utilized instantly, while others necessitate a transformation procedure. All developmental activities are contingent upon energy. Energy production and use are the definitive indicators of a nation's advancement. Renewable energy sources are becoming increasingly significant for both environmental and economic reasons in all nations. Currently, energy consumption is escalating across all sectors. Energy is fundamentally essential for economic, social, and cultural advancement. Sustainable development is described as engaging in living, production, and consumption practices that fulfil the requirements of the current generation without jeopardizing the capacity of future generations to satisfy their own needs. It has emerged as a fundamental guiding principle for policy in the 21st century. Consequently, India is pursuing renewable energy and technologies. Energy is considered the fundamental element that drives the sustained growth of any nation. A dependable energy supply is crucial for all economies, facilitating lighting, heating, communications, computing, industrial machinery, and transportation. Over the past few decades, energy demands have consistently risen throughout nations. India's per capita energy usage constitutes 37% of the global average. India's energy infrastructure predominantly relies on coal for electricity generation and oil for transportation and industrial use.

India is committed to achieving its goal of becoming one of the major producers of sustainable energy in the world. As of right now, the government of India has already formed a large number of agencies and made a number of rules that will assist it in accomplishing its objective. The use of renewable energy presents an opportunity for our world to lower its carbon emissions. Given the negative impact that burning fossil fuels has on the environment, it is clear that the existing patterns of consumption are not sustainable over the course of a longer period of time. Specifically, the emissions of carbon dioxide (CO₂) that result from the combustion of fossil fuels have led to a considerable increase in the concentration of CO₂ in the atmosphere. This will have the consequence of amplifying the greenhouse effect and causing major climate change. In a nutshell, renewable energy sources are more compatible with sustainable development than fossil fuels are, both in terms of the constraints of resources and the impacts they have on the environment.

India has seen a significant increase in the amount of energy that it consumes in recent years, which may be attributed to the world's rapidly expanding economy and its expanding population. India has set ambitious aims to expand the amount of renewable energy in its energy mix, with the goal of generating 450 GW of renewable energy capacity by the year 2030. These targets are important for India because they will allow the country to meet this demand and strike a balance between the two pillars of profitability and sustainability. Between the years 2014 and 2021, India's capacity for renewable energy expanded by 250 percent. Additionally, the non-conventional energy sector received foreign direct investment (FDI) totalling 12.57 billion US dollars between April 2000 and June 2022. Businesses and investors that are interested in capitalizing on the growing demand for green energy solutions in India have been presented with huge investment opportunities as a result of the emergence of green energy. The concept of sustainability as a way of life is deeply ingrained in the cultural character of India. India, a global partner that is environmentally concerned and is on track to reach the \$10 trillion mark by the year 2035, is committed to developing a future that is both sustainable and inclusive. The implementation of renewable energy sources in India is largely focused at promoting economic development, boosting energy security, making energy more accessible, and reducing the negative effects of climate change. India has a natural location along the equator, which gives it a strategic edge in the production of solar energy. Certain regions of the country receive more than 300 days of sunshine each year. Considering that India has a coastline that is 8,000 kilometres long, this advantage applies to wind energy projects. Furthermore, it is projected that India's considerable hydropower potential is greater than 100,000 megawatts. With the help of these natural resources, India has been given a one-of-a-kind opportunity to establish itself as a pioneer in the generation of renewable energy and to establish a green economy. There are a total of 408.71 gigawatts (GW) of installed generation capacity in India, with 42.26 percent of that capacity coming from renewable sources of energy. There are 119.09 GW of renewable energy capacity, 46.85 GW of large hydro capacity, and 6.78 GW of nuclear power capacity among the 172.72 GW of capacity from non-fossil fuel sources that have been installed in the country.

The Institute for Energy Economics and Financial Analysis recently published a research that revealed India had a record-high investment in renewable energy in the fiscal year 22 (FY22). The analysis found that India invested a staggering \$14.5 billion in renewable energy, which represents a tremendous rise of 125 percent from the previous year. Moreover, this constitutes a 72 percent increase in comparison to the time before to the pandemic

that includes the fiscal year 2019-20. In the year 2023 alone, the nation is well positioned to attract investments totalling more than twenty billion dollars in the field of renewable energy. Indian power producers are shifting towards carbon neutrality and making substantial investments in renewable energy. Tata Power has committed to refraining from the construction of new coal-fired projects, whereas JSW Energy is allocating resources towards solar, wind, and hydropower facilities to achieve carbon neutrality by 2050. Reliance has purchased REC Group of Norway and invested in the German solar wafer maker NetWare GmbH to enhance its solar capabilities. Private enterprises like Greenko and Renew Power are providing on-demand energy solutions and storage services. Independent power producers (IPPs) are collaborating with technologically adept enterprises to provide decarbonisation solutions, offering chances for global strategic investors to engage with and invest in local entities. The innovation industry has emerged as a significant participant in the area. As of November 2022, the Government of India has acknowledged more than 4,600 start-ups in the sustainability sector. These start-ups operate in the fields of nuclear energy, solar energy, clean technology, and electric cars. India has acknowledged more than 2,212 firms in the renewable energy industry, 1,903 start-ups in the green technology sector, and 504 start-ups in the waste management area.

2. Conclusion

The protection of the environment, economic progress, and energy security are all vital components of sustainable development, which aims to provide a cleaner, greener, and safer environment for the generation that will come after us in any country. India has experienced a growing awareness of the importance of recognizing and appreciating the efforts that are being made to advance sustainable development and promote renewable energy sources. In conclusion, renewable energy presents a world of immense opportunities for the future. There is a significant amount of potential for renewable energy in India, which can help bridge the gap between supply and demand. When it comes to pushing on with progress, the most appropriate options are vehicles that run on hydrogen and electric power. Should this be accomplished, then the constraints that are associated with the clean energy sources can be readily circumvented. India's dedication to sustainable development is shown in its ambitious objectives to enhance green energy capacity and reduce greenhouse gas emissions. The nation's ample natural resources, encompassing sun, wind, and hydroelectric potential, present a distinctive opportunity for India to spearhead renewable energy production and establish a green economy. The government's policies and actions exemplify India's steadfast commitment to advancing decarbonisation and fostering green energy. The recent 125 percent rise in renewable energy investment in India highlights the escalating need for green energy solutions in the nation. India aspires to attain energy independence via clean technology by 2047, prioritizing sustainability and equality.

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