

Energy Security and Sustainable Development: Key Drivers of India's Transition towards Clean and Green Energy

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Abstract: India's transition towards clean and green energy is being shaped by the interaction of energy security, sustainable development, rising energy demand, environmental concerns, technological advancement, industrial development and international climate commitments. As a rapidly growing major energy-consuming economy, India faces the dual challenge of providing reliable and affordable energy for economic and social development while reducing its exposure to imported fossil fuels and environmental pressures. The International Energy Agency (IEA) reported that India's energy demand was expected to grow substantially through 2040 and that the country already imported around 40% of its primary energy. It also projected that net dependence on imported oil could rise above 90% by 2040 under its Stated Policies Scenario. India has consequently increased its emphasis on renewable energy as a means of diversifying its energy mix and strengthening long-term energy security. Ministry of New and Renewable Energy (MNRE) data show that solar-power capacity increased from 2.82 GW in March 2014 to approximately 63.15 GW in March 2023, while wind capacity increased from 21.04 GW to 42.63 GW during the same period. The National Green Hydrogen Mission, approved in January 2023 with an initial outlay of ₹19,744 crore, further connects renewable energy with industrial decarbonisation, technological development and reduction of fossil-fuel imports. India's updated Nationally Determined Contribution (NDC) also established a target of approximately 50% cumulative installed electric-power capacity from non-fossil sources by 2030 and a 45% reduction in GDP emissions intensity from the 2005 level. This paper examines the principal drivers of India's clean-energy transition through a qualitative and descriptive analysis of secondary data, government documents, international institutional reports and academic literature. The study finds that India's transition cannot be explained by climate policy alone. Energy-security concerns, rising energy demand, sustainable development, renewable-technology cost reductions, industrial opportunities and policy interventions are closely interconnected. At the same time, challenges involving storage, transmission, distribution, financing, domestic manufacturing and social inclusion remain important.

Keywords: Energy Security, Sustainable Development, Clean and Green Energy, Renewable Energy, Energy Transition.

Introduction

Energy is a fundamental requirement for economic development, social welfare and national security. Agriculture, industry, transport, communication, healthcare, education and household activities all depend upon reliable access to energy. For a developing country such as India, the issue is particularly important because increasing energy consumption is closely connected with industrialisation, urbanisation, employment generation and improvements in living standards. The IEA observed that India's energy consumption had more than doubled since 2000 and that population growth, urbanisation, industrialisation and rising incomes would continue to increase energy demand.¹ India is therefore confronted with a distinctive challenge: it must expand energy availability while simultaneously making the energy system more secure, efficient and environmentally sustainable.

India's conventional energy structure creates significant vulnerabilities. Petroleum demand is substantially greater than domestic crude-oil production, making the economy sensitive to international prices and



geopolitical disruptions. The IEA estimated that India already imported approximately 40% of its primary energy and projected that the country's combined fossil-fuel import bill could triple between 2019 and 2040 under its Stated Policies Scenario. It further projected that net dependence on imported oil could rise above 90% by 2040. These circumstances make diversification of the energy mix an important component of long-term energy security.

Renewable energy provides an opportunity to address several of these challenges simultaneously. Solar radiation, wind, hydro resources and biomass are domestically available and can reduce the incremental requirement for imported fossil fuels. Renewable energy can also contribute to emissions reduction, local environmental improvement, technological innovation and employment. The scale of India's renewable-energy expansion since 2014 demonstrates the importance of this transition. According to MNRE's 2022–23 data, solar capacity rose from 2,821.91 MW in March 2014 to 63,145.91 MW in March 2023, while wind capacity increased from 21,042.58 MW to 42,633.13 MW.²

The transition is not restricted to electricity generation. India is also developing electric mobility, energy-efficiency programmes, battery storage and green hydrogen. The National Green Hydrogen Mission, approved on 4 January 2023, has an initial outlay of ₹19,744 crore and aims to develop at least 5 million metric tonnes of annual green-hydrogen production capacity by 2030.³ The Mission explicitly connects green hydrogen with reduced dependence on fossil-fuel imports, decarbonisation, indigenous manufacturing and technological leadership. India's updated NDC provides another important dimension. The country committed to reducing the emissions intensity of its GDP by 45% from the 2005 level by 2030 and achieving approximately 50% cumulative installed electric-power capacity from non-fossil sources by 2030.⁴ These commitments demonstrate that India's energy transformation is influenced by both domestic developmental priorities and international climate responsibilities.

The central argument of this article is that energy security and sustainable development constitute two closely interconnected drivers of India's transition towards clean and green energy. Renewable energy is increasingly being treated not merely as a climate instrument but as an element of India's long-term development and energy-security strategy.

Conceptual Framework

Energy Security

Energy security traditionally refers to the uninterrupted availability of adequate energy supplies at affordable and stable prices. Contemporary interpretations extend this concept beyond the physical availability of energy to include affordability, accessibility, reliability, resilience, efficiency, diversification and environmental sustainability. For India, energy security has historically been associated with securing supplies of coal, oil and natural gas. However, renewable resources and clean-energy technologies are increasingly becoming important components of the country's energy-security framework.⁵ India's dependence on imported hydrocarbons makes diversification particularly important, as international price fluctuations can influence transportation costs, inflation, industrial production and the balance of payments. Renewable energy can help reduce some of these vulnerabilities because solar and wind power do not require continuous fuel imports once generation infrastructure has been established. Nevertheless, renewable energy introduces additional system requirements. Solar and wind generation are variable and therefore require adequate transmission infrastructure, energy storage, accurate forecasting and grid flexibility to maintain reliable electricity supply. Consequently, energy security in the clean-energy era should be understood not merely as access to domestic resources but as the ability to maintain an affordable, reliable and resilient energy system based on diversified resources and technologies.⁶



Sustainable Development

Sustainable development requires economic growth, social welfare and environmental protection to be pursued together. Energy lies at the centre of this relationship. Economic development requires increasing energy availability, while environmental sustainability requires reducing the negative consequences of energy production and consumption. Sustainable Development Goal 7 calls for affordable, reliable, sustainable and modern energy for all.⁷ For India, this means that the energy transition must not simply reduce emissions; it must also support economic growth and improve the quality and affordability of energy services.

Literature Review

The literature on India's energy transition can broadly be organised around energy security, renewable energy, sustainable development and energy-policy transformation.

Mundaca, Busch and Schwer examined sustainable energy security in India through indicators covering availability, affordability, efficiency and environmental acceptability.⁸ Their work demonstrates that energy security should not be reduced to physical fuel availability and that environmental and efficiency dimensions are important components of a sustainable energy system.

The IEA's *India Energy Outlook 2021* provides an extensive assessment of India's future energy requirements. It identifies economic growth, urbanisation, industrialisation, rising appliance ownership and transport demand as important drivers of future energy consumption.⁹ The report also highlights the country's exposure to imported fossil fuels and the importance of clean-energy investment in reducing future vulnerabilities.

Kumar and Majid examined renewable energy as an instrument of sustainable development in India and identified benefits involving energy security, environmental protection, employment and investment.¹⁰ Their analysis also identifies challenges involving finance, infrastructure, technology and policy implementation.

Dey et al. similarly examined India's renewable-energy potential and concluded that renewable energy, technological innovation and appropriate policy support are essential to the country's long-term energy transformation.¹¹

Research has also highlighted the coexistence of renewable-energy expansion and continuing fossil-fuel dependence. Roy and Schaffartzik described India's energy transition as involving a paradox in which renewable energy expands while coal continues to play a significant role.¹² This observation is important because it demonstrates that India's transition is a gradual restructuring rather than an immediate replacement of the conventional energy system.

The existing literature therefore provides substantial evidence on individual aspects of India's energy transition, but there is scope for an integrated analysis linking energy security, sustainable development, renewable-energy expansion and industrial transformation. This study attempts to address that gap.

Research Questions

- What are the major factors driving India's transition towards clean and green energy?
- How does energy security influence India's renewable-energy policies?
- What role does sustainable development play in India's energy transition?

Objectives of the Study

The specific objectives are:

- To examine the relationship between energy security and clean-energy development in India.



- To analyse the contribution of sustainable development to India's energy policy.
- To assess the growth of renewable energy, particularly solar and wind, since 2014.

Methodology

The study uses a **qualitative, descriptive and analytical research design** based on secondary information. The empirical period primarily covers developments between 2014 and 2023, while the evidence used was restricted to material available on or before **December 2023**. The principal sources include reports and publications of the Ministry of New and Renewable Energy, Ministry of Power, Central Electricity Authority, Ministry of Finance, NITI Aayog, International Energy Agency, International Renewable Energy Agency, United Nations, UNFCCC and peer-reviewed academic journals.

The study employs documentary analysis, historical analysis, descriptive statistical interpretation and comparative policy analysis. Renewable-energy development is examined through installed capacity, policy targets and institutional initiatives. Energy security is analysed through energy-import dependence and diversification. Sustainable development is considered through energy access, environmental concerns, employment, technological development and economic opportunities.

Major Drivers of India's Clean-Energy Transition

• Rising Energy Demand

India's rapidly increasing energy demand is one of the most important structural drivers. The IEA projected that India would account for nearly one-quarter of global energy-demand growth between 2019 and 2040 in its Stated Policies Scenario. The expansion of cities, manufacturing, buildings, cooling, transportation and household consumption will continue to increase energy requirements. This makes the transition different from that of mature economies. India is not merely replacing an existing energy system; it is simultaneously building a larger one. Renewable energy and energy efficiency therefore provide opportunities to meet new demand without proportionally increasing fossil-fuel consumption.¹³

• Fossil-Fuel Import Dependence

Energy-import dependence is a major security concern. India's dependence on imported oil exposes the economy to international price cycles and geopolitical risks. The IEA projected that net dependence on imported oil could exceed 90% by 2040 under its Stated Policies Scenario. Renewable energy can reduce future exposure to imported fuels by increasing the domestic contribution of solar, wind, hydro and biomass. The strategic value of renewable energy therefore extends beyond emissions reduction to include diversification of energy supply.¹⁴

• Solar Energy

Solar energy has been the most rapidly expanding component of India's renewable-energy system. MNRE data show an increase in installed solar capacity from 2.82 GW in March 2014 to 63.15 GW in March 2023. This expansion was supported by the National Solar Mission, competitive procurement, solar parks, declining technology costs, transmission investment and private-sector participation. Solar energy also offers flexibility in scale, ranging from large utility projects to rooftop and decentralised installations. The growth of solar power demonstrates that renewable energy has become an important part of India's electricity strategy rather than a peripheral environmental programme.¹⁵

• Wind Energy

Wind power also expanded substantially, with capacity increasing from 21.04 GW in March 2014 to 42.63 GW in March 2023. Wind provides diversification within the renewable-energy portfolio and can complement solar generation. However, wind resources are geographically concentrated, making transmission investment



essential. The long-term contribution of wind power therefore depends upon resource assessment, project economics, grid connectivity and system integration.

- **Energy Efficiency**

Energy efficiency is a demand-side driver of energy security. Reducing energy consumption per unit of economic output can lower fuel requirements, reduce infrastructure pressure and decrease emissions. India's efficiency policies include appliance standards and labelling, industrial efficiency programmes and building-related measures. Energy efficiency is particularly important because the country's future energy demand is expected to increase. Greater efficiency can help meet a larger level of energy services without requiring equivalent increases in energy supply.¹⁶

- **Green Hydrogen**

Green hydrogen represents an important new dimension of India's clean-energy strategy. The National Green Hydrogen Mission has an initial outlay of ₹19,744 crore and seeks to establish at least 5 MMT of annual green-hydrogen production capacity by 2030, supported by approximately 125 GW of associated renewable capacity. The Mission projects more than ₹8 lakh crore in investment, over six lakh jobs and cumulative fossil-fuel import reductions of more than ₹1 lakh crore by 2030. These are policy projections rather than achieved outcomes as of 2023.

Green hydrogen is particularly relevant to industries where direct electrification may be difficult, including steel, fertilisers, refining, shipping and certain chemical processes. The Mission therefore links renewable electricity with industrial decarbonisation and energy security.

- **Climate Commitments**

Climate commitments provide another important driver. India's updated NDC established the targets of reducing GDP emissions intensity by 45% from the 2005 level and achieving approximately 50% cumulative installed electric-power capacity from non-fossil sources by 2030. These commitments encourage renewable deployment and energy efficiency while remaining embedded within India's broader development priorities. India's climate policy has therefore increasingly become interconnected with energy policy.

- **Technological Innovation and Manufacturing**

Technological change is reducing the cost and increasing the efficiency of renewable-energy technologies. Solar photovoltaics, batteries, electric vehicles, smart grids and electrolyzers are expanding the range of available clean-energy options. However, dependence on imported clean-energy equipment can create new vulnerabilities. Energy security therefore increasingly includes domestic manufacturing capabilities for solar modules, batteries, power electronics, electrolyzers and other strategic technologies. The National Green Hydrogen Mission specifically seeks to promote domestic electrolyser manufacturing and technological leadership.¹⁷

Grid Integration and Energy Storage

Renewable-energy expansion creates technical challenges because solar and wind generation varies with weather and time. Electricity demand, however, must be met continuously. The Central Electricity Authority's National Electricity Plan 2022–32, notified in 2023, recognises the increasing importance of battery energy storage systems and pumped-storage hydropower as renewable penetration grows. The plan also provides a trajectory for renewable-purchase and energy-storage obligations. This indicates that India's energy transition cannot be measured only by installed renewable capacity. Transmission, storage, forecasting, flexible generation and distribution reform are equally important.



Sustainable Development and Inclusive Energy Transition

Energy development must also address social welfare. Electricity is essential for education, healthcare, agriculture, communications and household welfare. The IEA reported that India achieved near-universal household electricity access by 2019, although differences in energy consumption and service quality remained. Renewable energy can support decentralised development through solar pumps, rooftop systems and other distributed applications. However, affordability and reliability must remain central to policy. The transition must also consider workers and communities associated with conventional energy sectors. Renewable-energy investment can create new employment, but skills development and regional economic diversification are necessary to ensure that benefits are widely distributed.

Findings of the Study

Energy security and rising energy demand together constitute a major foundation of India's transition towards clean and green energy. India's substantial dependence on imported fossil fuels, particularly petroleum, exposes the economy to international price fluctuations, geopolitical tensions and disruptions in global supply chains. At the same time, economic growth, industrialisation, urbanisation, population growth and improving living standards are increasing the country's demand for electricity and other forms of energy. India therefore needs to expand energy availability while reducing its exposure to external energy risks. Renewable resources such as solar, wind, hydropower and biomass provide an opportunity to diversify the energy mix and increase the contribution of domestic resources. In this context, renewable energy represents not only an environmental response but also a component of India's broader energy-security and development strategy. However, energy security in the emerging clean-energy system also requires domestic manufacturing of solar modules, batteries, electrolyzers and other strategic technologies, as excessive dependence on imported clean-energy equipment and critical minerals could create new supply-chain vulnerabilities.¹⁸

India's renewable-energy sector has undergone substantial expansion since 2014. According to Ministry of New and Renewable Energy data, installed solar capacity increased from approximately 2.82 GW in March 2014 to 63.15 GW in March 2023, while wind capacity increased from approximately 21.04 GW to 42.63 GW during the same period. This growth reflects the combined influence of government policies, competitive procurement, declining technology costs, private investment and infrastructure development. The expansion of renewable energy also contributes to sustainable development by supporting energy access, reducing environmental pressures, encouraging technological innovation and creating opportunities for employment and industrial development. Nevertheless, renewable-energy growth has occurred alongside continued dependence on coal and petroleum, indicating that India's transition remains a gradual restructuring of the energy system rather than an immediate replacement of fossil fuels.¹⁹

Green hydrogen has expanded the scope of this transition beyond electricity generation. The National Green Hydrogen Mission, approved in January 2023, provides a framework for linking renewable electricity with industrial decarbonisation, domestic manufacturing and reduced fossil-fuel dependence. Its significance is particularly evident in sectors such as steel, fertilisers, refining and shipping, where direct electrification may be technically difficult or economically challenging. The Mission also demonstrates the increasing integration of energy policy with industrial policy, technological development and new domestic value chains.

The rapid growth of variable renewable energy has simultaneously increased the importance of transmission, energy storage and grid flexibility. Solar and wind generation varies according to weather and time, whereas electricity demand must be continuously balanced. The National Electricity Plan therefore recognises the growing importance of battery energy-storage systems, pumped-storage hydropower, transmission infrastructure and flexible electricity-system operation. The effectiveness of renewable-energy expansion consequently



depends not only on installed generation capacity but also on the ability of the electricity system to integrate variable renewable resources while maintaining reliability and affordability.²⁰

The transition also presents significant economic and employment opportunities. Renewable-energy deployment creates demand for manufacturing, construction, installation, operation, maintenance, research and technical services, while emerging sectors such as batteries, electric mobility, green hydrogen and associated infrastructure can generate new industrial value chains. These benefits will depend, however, on domestic manufacturing capacity, skilled labour, research and development and greater domestic value addition. Renewable deployment alone cannot guarantee substantial employment gains if a significant proportion of equipment and technological inputs continues to be imported.

Finally, effective policy coordination is essential because India's energy transition extends across several interconnected sectors. Renewable-energy development requires transmission and storage; electric mobility requires charging infrastructure and electricity-system planning; green hydrogen requires renewable power and industrial demand; and domestic manufacturing requires finance, technology, skills and resilient supply chains. Energy, industry, finance, transport, environment and technology policies therefore need to operate within a coordinated framework. Overall, the evidence indicates that India's transition towards clean and green energy is a multidimensional process driven by the combined requirements of energy security, rising energy demand, sustainable development, environmental protection, technological innovation and industrial development. Its long-term success will depend on integrating these dimensions into an economically viable, technologically resilient and socially inclusive energy strategy.²¹

Policy Suggestions

India's transition towards clean and green energy requires a coordinated policy framework covering renewable-energy generation, transmission, storage, efficiency, manufacturing, finance, technology, environmental protection and social inclusion. Renewable-energy expansion should continue alongside investment in transmission infrastructure and energy-storage systems. The rapid growth of solar and wind power creates challenges for grid stability because these sources are variable and geographically concentrated. Therefore, battery storage, pumped-storage hydropower, smart grids, forecasting systems and inter-state transmission networks should develop alongside renewable-generation capacity to improve reliability and reduce curtailment. Greater attention should also be given to energy efficiency, as reducing energy intensity can lower energy costs, infrastructure requirements and dependence on imported fuels. Efficiency programmes should be strengthened across industry, buildings, transport, agriculture and households through energy-efficient appliances, improved building standards, efficient industrial technologies and better energy-management systems. Energy efficiency should therefore be treated as an essential component of India's energy-security and sustainability strategy.

India should strengthen domestic manufacturing of solar modules, batteries, electrolyzers, power electronics and other strategic clean-energy technologies. Excessive dependence on imported equipment could create new external vulnerabilities even while reducing dependence on imported fossil fuels. Domestic manufacturing can strengthen supply-chain resilience, generate employment, promote technological innovation and support industrial development. The financial and institutional sustainability of electricity distribution companies (DISCOMs) also requires continued reform. Financially weak distribution systems can affect electricity reliability, delay payments to generators and constrain investment in grid modernisation. Reducing technical and commercial losses, improving billing and collection, strengthening operational efficiency and using digital technologies can contribute to a more sustainable electricity sector.

Green hydrogen should be integrated with renewable-energy, industrial and transport policies. The National Green Hydrogen Mission provides a foundation for this development, particularly in sectors such as fertilisers, steel, refining, shipping and chemicals where direct electrification may be difficult. Research and development



should simultaneously focus on battery storage, hydrogen, advanced solar technologies, smart grids, recycling and critical-material recovery to strengthen technological capabilities. Renewable-energy development should incorporate environmental safeguards, transparent land processes and community participation because large projects can affect land, agriculture, forests, biodiversity and local communities. Finally, India's transition should adopt a just and inclusive approach by providing reskilling and alternative employment opportunities for workers and communities affected by the gradual transformation of conventional energy industries.

Overall, India's clean-energy transition should be treated as a system-wide transformation, integrating renewable energy, efficiency, storage, transmission, manufacturing, distribution reform, green hydrogen, innovation, environmental protection and social inclusion. Such an integrated approach can strengthen energy security while supporting sustainable economic development.

Conclusion

India's transition towards clean and green energy is driven by a combination of energy security, rising energy demand, sustainable development, climate commitments, technological change, industrial development and environmental concerns. These drivers are closely connected and cannot be adequately understood in isolation. Energy security is particularly important because India's dependence on imported fossil fuels creates exposure to international price fluctuations and geopolitical disruptions. Renewable energy provides an opportunity to increase the contribution of domestic resources and diversify the national energy mix.

At the same time, sustainable development requires India to provide increasing quantities of affordable and reliable energy while limiting environmental damage. The country's expanding population, urbanisation and industrialisation mean that future energy demand is likely to remain substantial. Renewable energy and energy efficiency therefore provide an opportunity to meet development needs without creating an equivalent increase in fossil-fuel dependence. The empirical evidence available up to December 2023 demonstrates considerable progress. Solar capacity increased from 2.82 GW in March 2014 to 63.15 GW in March 2023, while wind capacity increased from 21.04 GW to 42.63 GW. The establishment of the National Green Hydrogen Mission in 2023 further demonstrates the widening scope of the energy transition, connecting renewable electricity with industrial decarbonisation and energy-security objectives.

Nevertheless, India's transition remains a work in progress. Coal and petroleum continued to play important roles in the energy system through 2023. The expansion of renewable energy therefore does not imply an immediate replacement of fossil fuels. Instead, India is gradually restructuring its energy system. The central finding of this study is that energy security and sustainable development should be viewed as mutually reinforcing pillars of India's clean-energy transition. Renewable energy can contribute to energy diversification and reduced import exposure, while simultaneously supporting environmental sustainability and technological and industrial development.

The long-term success of this transition will depend not only on the number of gigawatts of renewable capacity installed but also on the development of transmission, storage, efficient distribution, domestic manufacturing, technological capabilities, financial sustainability and social inclusion. India's clean-energy transition is consequently best understood as a broad transformation of its energy-development model rather than merely a shift from one generation technology to another.

References:

- [1] India Energy Outlook 2021. Paris: International Energy Agency, pp. 17–35, 191–207.
- [2] Ministry of New and Renewable Energy, Government of India. (2023). Annual Report 2022–23. New Delhi: Government of India, pp. 20–30.



- [3] Ministry of New and Renewable Energy, Government of India. (2023). National Green Hydrogen Mission. New Delhi: Government of India, pp. 1–14.
- [4] Government of India. (2022). India's updated first nationally determined contribution under Paris Agreement (2021–2030). Ministry of Environment, Forest and Climate Change, New Delhi, pp. 1–4.
- [5] International Energy Agency. (2021). India energy outlook 2021. IEA, Paris
- [6] International Energy Agency. (2021). Renewables integration in India. IEA, Paris. <https://www.iea.org/reports/renewables-integration-in-india>
- [7] United Nations. (2023). The Sustainable Development Goals Report 2023. United Nations, New York, pp. 32–35.
- [8] Mundaca, L., Busch, H., & Schwer, S. (2017). Sustainable energy security for India: An assessment of energy demand sub-system. Applied Energy, 186, 126–139.
- [9] India Energy Outlook 2021. Paris: International Energy Agency, pp. 17–35, 191–207.
- [10] Kumar, C. R., & Majid, M. A. (2020). Renewable energy for sustainable development in India: Current status, future prospects, challenges, employment, and investment opportunities. Energy, Sustainability and Society, 10, 2, pp. 1–20.
- [11] Dey, S., Sreenivasulu, A., Veerendra, G. T. N., Rao, K. V., & Babu, P. S. A. (2022). Renewable energy present status and future potentials in India: An overview. Innovation and Green Development, 1(1), 100006, pp. 1–12.
- [12] Roy, B., & Schaffartzik, A. (2021). Talk renewables, walk coal: The paradox of India's energy transition. Ecological Economics, 180, 106871.
- [13] International Energy Agency (IEA), India Energy Outlook 2021.
- [14] International Energy Agency (2021), India Energy Outlook 2021.
- [15] Ministry of New and Renewable Energy (MNRE), Government of India (2023), Annual Report 2022–23.
- [16] Bureau of Energy Efficiency (BEE), Government of India, Impact of Energy Efficiency Measures for the Year 2022–23.
- [17] International Renewable Energy Agency (2023), World Energy Transitions Outlook 2023: 1.5°C Pathway.
- [18] International Energy Agency. (2021). India Energy Outlook 2021. Paris: IEA, pp. 17–35.
- [19] Roy, B., & Schaffartzik, A. (2021). Talk renewables, walk coal: The paradox of India's energy transition. Ecological Economics, 180, Article 106871.
- [20] Central Electricity Authority, Government of India. (2023). National Electricity Plan 2022–32: Volume I—Generation. Ministry of Power, Government of India, New Delhi.
- [21] United Nations. (2015). Transforming our world: The 2030 Agenda for Sustainable Development. United Nations.