

DEVELOPMENT OF RENEWABLE ENERGY IS THE CORE OF ENERGY TRANSITION

Abstract

The global energy ecosystem is undergoing a transformative shift towards renewable sources, driven by the imperative to combat climate change and ensure sustainable energy access. This paper offers a thorough rundown of the renewable energy ecosystem, specifically focusing on India's ambitious targets, key developments in the clean energy sector, global trends, and the roles played by financing institutions, developers, and generation companies. Emphasis is placed on the core capabilities essential for successful renewable energy developers and GENCOs, highlighting the crucial part of renewable energy in bolstering energy security and expanding access. The paper concludes with actionable points tailored for developers addressing emerging challenges, along with suggestions for stakeholders, financial institutions, and legislators to expedite the adoption of renewable energy on a global scale, fostering a sustainable and resilient energy future.

Keywords: Development, Renewable energy, Key clean energy,

Authors

Satyam Gupta

Senior Associate

Ernst & Young LLP

Aerocity, New Delhi, India

Deepali Bansal

Assistant Professor

School of legal studies

K.R. Mangalam University

Gurugram, Haryana, India

deepalibansal2391@gmail.com

I. RENEWABLE ENERGY LANDSCAPE IN INDIA

India's energy demand is expected to grow by **5.16% CAGR from 2021-22 to 2041-42¹**. Therefore, it is imperative that most of this new energy demand is met by low-carbon, renewable sources. India's announcement that it intends to achieve **net zero carbon emissions by 2070** and **to meet 50% of its electricity needs from renewable sources by 2030** marks a historic point in the global effort to combat climate change. Rajasthan would play major role in achieving this target being a Renewable Energy Capital of the World.

India's market for renewable energy ranks fourth globally in terms of attractiveness.. India is the market with the fastest growth in renewable electricity, and by 2026, new capacity additions are expected to double.

As mentioned by PM Modi in his speech dated 23rd Feb 2023 on Green Growth, India has achieved the contribution of Renewable sources (including Hydro) more than 40% in its power generation portfolio. India has total installed capacity of more than 410 GW² (dated 31.01.2023) with RE sources contributing around 168 GW (including 64 GW³ Solar power).

II. KEY CLEAN ENERGY DEVELOPMENTS TO WATCH OUT FOR IN FY-24⁴

- 1. Solar Energy:** The solar energy industry in India has had rapid growth in recent years and is anticipated to continue growing in FY24. The rate of renewable energy adoption in rooftop solar will be influenced by elements such as solar module costs, ALMM, supply chain reliability, and net-metering policy. To encourage growth in Open Access, stable regulations in accordance with the Center's Green Energy Open Access principles will be essential. Solar energy will account for about 50% of the increase in capacity needed to reach the nation's ambitious goal of creating 500 GW of renewable energy capacity by 2030, which will require an expenditure of at least 2.44 lakh crore.
- 2. Wind Energy:** Despite the Ministry of New and Renewable Energy's goal of installing 60 GW of wind power capacity by 2022, the wind energy sector has had slower development in recent years compared to solar energy adoption. However, the government is offering financial incentives including faster depreciation, reduced customs duties, and tax vacations to hasten the expansion of the use of wind energy. According to the Indian Wind Turbine Manufacturers Association, the industry will develop by up to 30% in FY24.
- 3. Green Hydrogen:** In FY24, major investments in green hydrogen infrastructure and technology are expected. If successful, these initiatives might considerably reduce India's reliance on fossil fuels. In order to produce green hydrogen from renewable sources,

1 "20th Electric Power Survey of India by CEA", Report On Twentieth Electric Power Survey Of India Volume-I, Nov-2022, https://cea.nic.in/Wp-Content/Uploads/Ps_Lf/2022/11/20th_Eps_Report_Final_16.11.2022.Pdf.

2 "All India Installed Capacity (In Mw) Of Power Stations", Central Electricity Authority, Jun.30,2023 <https://cea.nic.in/installed-capacity-report/?lang=en>.

3 Ministry of New & Renewable Energy, *Programme/Scheme wise Cumulative Physical Progress as on June, 2023*, <https://mnre.gov.in/the-ministry/physical-progress>, Jul.31, 2023

4 Fourth Partner Energy, *India's Renewable Energy Landscape For FY24*, <https://www.fourthpartner.co/Indias-re-landscape-fy24.html>, Jul.31, 2023

India's National Hydrogen Mission aims to build green hydrogen plants with a combined capacity of 10 GW by 2030.

- 4. Energy Storage:** In order to integrate variable renewable energy sources like wind and solar, energy storage is a critical part of the renewable energy mix. In FY24, the energy storage market in India is anticipated to expand rapidly, with a focus on grid-scale technologies including pumped hydro, batteries, and compressed air storage. The India Energy Storage Alliance (IESA) estimates that at least 160GWh of energy storage would be required to integrate 500GW of non-fossil fuel energy by 2030.
- 5. Electric Vehicles:** Although the EV market is expanding quickly, issues including infrastructure, range anxiety, and lack of awareness must be resolved. In FY21, EV sales in India increased by 138%. Increased EV infrastructure investments and commercial vehicle usage are both anticipated for FY24. This may have a big impact on India's transportation industry and lessen the country's reliance on fossil fuels.

III. GLOBAL RENEWABLE ENERGY LANDSCAPE

Globally, it is anticipated that by 2030, renewable energy sources will make up 50% of the power mix and 85% by 2050. In 2021, renewable energy accounted for 28.3% of the world's electricity mix, up from 20.4% in 2011 and on par with 2020 levels (28.5%). Due to a number of causes, including falling prices, government incentives, and a rising understanding of the need to switch to clean energy sources, the usage of solar energy is expanding quickly. With new capacity installations totaling 175 GW in 2021, the solar PV sector continued its record-breaking streak. Over the past ten years, the total installed solar PV capacity has increased to 942 GW. Some of the major contributions to the worldwide solar PV capacity have come from nations like China, the USA, India, and Japan.

IV. GLOBAL INVESTMENT SCENARIO FOR ENERGY TRANSITION INCLUDING RENEWABLES

In 2022, global investment in energy-related technologies—including those connected to energy efficiency—amounted to USD 1.3 trillion. In 2022, worldwide investments in renewable energy surpassed USD 0.5 trillion, setting a new record. Annual investments in renewable energy maintained a good trend in spite of numerous economic, social, and geopolitical concerns. Investments in renewable energy reached \$348 billion in 2020, grew to \$340 billion in 2021 (a 24 percent rise from 2020), and then increased by 16 percent in 2022 to \$499 billion. The growth of investments in renewable energy is still ongoing, but it is not happening quickly enough to meet the 2030 targets for socioeconomic development, energy access, security, and the climate. It will take an average of USD 5.7 trillion in annual investments between 2021 and 2030 and USD trillion 3.7 trillion between 2031 and 2050 to keep the globe on target towards accomplishing the energy transition that's compatible with the 1.5°C Scenario outlined in IRENA's World energy transitions forecast 2022.⁵

Investments have been increasingly concentrated in a few technologies, and in order to facilitate the energy transition as much as possible, more money must go into less

⁵ *Global landscape of Renewable Energy Finance 2023*, International Renewable Energy Agency IRENA, Feb.2023, <https://www.irena.org/Publications/2023/Feb/Global-landscape-of-renewable-energy-finance-2023>

developed technologies and industries outside of the power industry. Investments in solar and wind technology are consistently the highest percentage. 2020 saw 43% of the total come from solar photovoltaic (PV), with onshore and offshore wind coming in second and third, respectively, at 35% and 12%. The majority of worldwide investment in renewable energy is still directed towards the East Asia and Pacific area. Based on preliminary statistics for 2021 and 2022, the East Asia and Pacific region received more than 50% of global investments in 2021, and by 2022, it accounted for two thirds of all investments, with North America and Europe coming in second and third.

V. GREEN FINANCING

Since the Paris Agreement, the field of green finance has grown rapidly and is positioned at the nexus of financial, socioeconomic, and environmental issues. It is hybrid in nature because it uses financial instruments, emphasises environmental issues, and falls under the larger category of so-called "sustainable" finance, which adopts a broader perspective by taking socio-economic and governance issues into account.

India is firmly on the path to a revolutionary transformation to renewable energy as a worldwide leader and active participant in the Paris Agreement. India is also demonstrating a strong interest in the use of green hydrogen in the petroleum sector. In order to increase investments in this industry, the GoI is exploring novel financing instruments including green banks and introducing financing requirements for renewable energy for financial institutions. The Indian Renewable Energy Development Agency ("IREDA") and the Tata Cleantech Capital Limited ("TCCL") are India's two existing clean energy finance organisations. The GoI has included Rs 19,500 Crore for Solar PV modules in the Budget 2022-2023 in accordance with new production linked incentive (PLI) schemes to assist the switch to green energy and the made in India ethos.

Green Banks: A green bank is a governmental or quasi-governmental financial organisation that works with the private sector to deploy cutting-edge finance strategies and market tools to hasten the adoption of sustainable energy technologies. The mobilisation of private investments in green initiatives depends on the involvement of green banks in financing the transition to a green economy. Green banks' objectives include achieving emission targets, reducing the cost of capital, and expanding the market for green technologies. Green banks can organise their investment schemes in accordance with GoI requirements.

VI. ROLE OF FINANCING INSTITUTIONS

Banks, NBFCs, and other financial institutions have historically provided support for infrastructure financing. However, new financing methods and creative financial instruments that may draw on a larger pool of investors are required in order to reach the clean energy targets. Some of the examples would be pension funds, sovereign wealth funds, green bonds and blue bonds (focusses on various sustainable aspects of blue economy such as sustainable fishing, Coral degradation, offshore wind plants etc). Financial Institutions will also play important role in countries just transition as there will be requirement of public debt at concession rate as well as private debt (Example Vietnam JETP)

Financing institutions play a crucial role in scaling renewable energy initiatives globally. Their involvement is instrumental in overcoming the financial barriers and challenges that often hinder the widespread adoption of renewable energy technologies. Here are some key roles that financing institutions fulfill in promoting renewable energy:

- 1. Capital Investment:** Financing institutions, such as banks, venture capital firms, and development banks, provide the necessary funds for renewable energy projects. These projects often require significant upfront investments, and these institutions help bridge the financial gap, making them feasible for developers and investors.
- 2. Risk Mitigation:** Renewable energy projects can be perceived as risky due to various factors, including technology uncertainty, regulatory changes, and market fluctuations. Financing institutions employ risk assessment techniques and financial instruments to mitigate these risks, making projects more attractive to investors.
- 3. Project Development Support:** Financing institutions may offer technical expertise and assistance during the project development phase. They can help identify suitable project sites, conduct feasibility studies, and ensure that projects meet the required standards and regulations.
- 4. Structured Financing Solutions:** Financing institutions tailor financial products and solutions to meet the specific needs of renewable energy projects. These may include project finance, green bonds, asset-backed securities, and other innovative financial instruments that align with the unique characteristics of renewable energy investments.
- 5. Market Development:** By investing in renewable energy projects, financing institutions contribute to the growth of the renewable energy market. As more projects are funded and become operational, economies of scale are achieved, leading to cost reductions and increased competitiveness of renewable technologies.
- 6. Knowledge Sharing and Capacity Building:** Financing institutions often have extensive expertise in the renewable energy sector. They share knowledge and best practices with project developers, governments, and other stakeholders to improve project implementation and drive sustainable development.
- 7. Policy Advocacy:** Supportive laws and regulations that promote the expansion of renewable energy sources can be promoted by financing organisations. Through the implementation of feed-in tariffs, tax breaks, and renewable energy objectives, they collaborate with governments and policymakers to establish favourable conditions for investments in renewable energy.
- 8. International Cooperation:** Many financing institutions operate globally and collaborate with international organizations, governments, and private sector partners to promote renewable energy on a global scale. They support projects in developing countries, fostering technology transfer and knowledge exchange. Carbon finance and emissions reduction: Some financing institutions engage in carbon finance, where they invest in projects that reduce greenhouse gas emissions. This includes projects related to renewable energy, energy efficiency, and other sustainable practices. Overall, financing institutions

play a critical role in scaling renewable energy initiatives globally by providing financial support, risk management, and expertise, which are essential for accelerating the transition towards a more sustainable and low-carbon energy future.

VII. ROLE OF DEVELOPERS

Can developer locate adequate land, protect the supply chain, and hire workers while yet being profitable?

Because to the increase in the price of commodities, energy, and shipping, the cost of producing and exporting solar PV modules, wind turbines, and biofuels has increased globally. In 2019, the anticipated costs of investment for onshore wind and utility-scale solar PV are 25% higher than the prices of commodities. In significant markets such as the US, India, and the EU, trade restrictions have also raised the price of solar PV modules and wind turbines.

Different developers are handling cost rises in different ways; smaller businesses are more vulnerable due to their tighter budgets. For developers that emerged victorious in competitive auctions with the expectation of ongoing equipment price reductions, the higher costs associated with solar PV and wind facilities provide a unique problem. To create an equal amount of capacity, the rising expenses would necessitate an extra expenditure of almost USD 100 billion.

To fill the gap of need and demand of the energy transition undoubtedly Developers and GENCOS will also play critical roles in facilitating the energy transition apart from the financial institutions. An overview of their roles is highlighted below in the article.

- 1. Developers:** Energy developers are responsible for identifying and developing new renewable energy projects such as wind farms, solar parks and hydroelectric plants. They work to bring these projects to fruition by securing land right, conducting feasibility studies, securing permits, designing and constructing the energy infrastructure, and negotiating power purchase agreements with the utilities and other off takers. Developers play a crucial role in driving the growth of renewable energy and expanding the use of clean energy sources.
- 2. Generation Companies:** GENCOS are responsible for operating and maintaining energy infrastructure such as power plants and transmission systems. They generate and distribute energy to end-users, including commercial, industrial, and residential customers. Generation companies can play a crucial role in the energy transition by investing in cleaner and more efficient energy technologies, such as renewable energy sources.

VIII. CORE CAPABILITIES FOR RE DEVELOPERS/GENCOS

The drive to expand solar and wind power capacity puts more pressure on developers to work quickly and effectively while ratcheting up competition for limited resources. However, Value chain excellence, Economies of scale and skill, and Agile operating model are the three winning competencies that are crucial for developing or growing a renewables

business. Successful renewables developers must navigate a marketplace that is getting more complicated and competitive while building on these capabilities as a solid foundation.

IX. ROLE OF RENEWABLE ENERGY IN ENERGY SECURITY & ENERGY ACCESS

Renewable energy plays a vital role in enhancing energy security for nations and communities. Energy security refers to the uninterrupted availability of reliable and affordable energy sources to meet the energy needs of society.

1. Energy Security: The Russian-Ukraine conflict has increased geopolitical tensions between Russia and Western countries which is creating implications in global energy markets. Energy costs skyrocketed with natural gas impacted the most as prices reached the equivalent of USD 250 for a barrel of oil followed by coal with the equivalent of USD 100 per barrel of oil. As a result, consumers across many regions are exposed to high energy bills and supply shortages.⁶ Estimates indicate 70 million people who have newly acquired access to electricity may not be able to maintain that access due to financial constraints. Additionally, it is expected that approximately 100 million people may discontinue using clean fuels for cooking.⁹

Here are some keyways in which renewable energy contributes to energy security:

- **Diversification of Energy Sources:** Relying on a diverse mix of renewable energy sources, such as solar, wind, hydro, geothermal, and biomass, reduces dependence on a single energy resource. This diversification helps mitigate the risks associated with supply disruptions, price volatility, and geopolitical tensions related to fossil fuel imports.
- **Decentralization and Grid Resilience:** Renewable energy projects can be decentralized and distributed, reducing the vulnerability of energy systems to large-scale disruptions. Localized renewable energy systems, such as rooftop solar and community wind farms, can supply power directly to consumers, making the grid more resilient to natural disasters or cyber-attacks.
- **Indigenous Resource Utilization:** Many renewable energy sources are widely available within a country's borders, reducing reliance on imported energy resources. Utilizing domestic renewable energy potential can enhance a nation's energy independence and reduce exposure to international energy market fluctuations.
- **Infinite and Sustainable Resources:** Unlike fossil fuels, which are finite and depletable, renewable energy sources are virtually inexhaustible and can be harnessed indefinitely. This inherent sustainability ensures a long-term and stable energy supply for generations to come.

⁶ World Energy Outlook 2022 Executive Summary, International Energy Agency, Oct. 2022, <https://www.iea.org/reports/world-energy-outlook-2022>.

- **Reduced Greenhouse Gas Emissions:** Transitioning to renewable energy helps mitigate climate change by reducing greenhouse gas emissions. By avoiding the burning of fossil fuels, which release carbon dioxide and other pollutants, renewable energy contributes to global efforts to limit global warming and its potential impacts on energy systems.
- **Energy Access for Remote Areas:** Renewable energy technologies, especially off-grid and mini-grid solutions, offer opportunities to provide electricity to remote and underserved areas where conventional grid extension is challenging or economically unviable. This enhances energy security by extending access to electricity to more people.
- **Technological Advancements and Job Creation:** Investing in renewable energy technologies drives innovation and creates jobs in various sectors, including manufacturing, installation, maintenance, and research. A robust renewable energy industry strengthens the overall economy and contributes to long-term energy security.
- **Energy Efficiency and Demand Management:** Integrating renewable energy with energy efficiency measures and demand-side management can optimize energy use and reduce overall energy consumption. This approach helps to maintain a stable and sustainable energy supply, especially during periods of high demand.
- **Global Energy Stability and Geopolitics:** As renewable energy technologies become more prevalent worldwide, nations may be less reliant on fossil fuel exports and international energy markets, reducing geopolitical tensions related to energy resources.

In summary, the widespread adoption of renewable energy sources is a crucial component of ensuring energy security. By diversifying energy sources, reducing dependence on imports, and promoting sustainability, renewable energy contributes to a more resilient, reliable, and stable energy supply for communities and nations, while also addressing climate change and fostering economic growth.

2. **Energy Access:** The population with electricity access reached 91% in 2020 from 83% in 2010. However, 733 million households still don't have electricity in 2020 with ~81% of the share lying in the countries of the African region.⁷ COVID-19 and the increasing complexity of reaching more remote and poorer unserved populations and has reduced the annual pace of electrification to 0.5% in 2018-20 from 1.0% between 2010-18⁸. Out of 113 countries without universal access, 54 have targets for electricity, of which 25 have targets to reach universal access before or by 2030. If these targets are met, population

⁷The Energy Progress Report 2022, The Energy Progress Report 2022, 2022, https://trackingsdg7.esmap.org/data/files/download-documents/sdg7-report2022-ch1-access_to_electricity.pdf

⁸UNEP, Emissions Gap Report 2022, Oct. 27, 2022, <https://www.unep.org/resources/emissions-gap-report-2022>

without electricity in 2030 will come down to 290 million from 660 million (current projection for 2030)⁹

X. CHALLENGES AND OPPORTUNITIES

Scaling up renewable energy presents both challenges and opportunities. While the benefits of transitioning to renewable energy are significant, several obstacles must be overcome to achieve widespread adoption. Here are some of the key challenges and opportunities for scaling up renewable energy:

- 1. Intermittency and Grid Integration:** Renewable energy sources like solar and wind are intermittent, meaning their output varies based on weather conditions. Integrating these variable sources into the grid requires advanced energy storage technologies and smart grid management to ensure a stable and reliable power supply.
- 2. Energy Storage:** The development of cost-effective and efficient energy storage solutions is essential for storing excess renewable energy generated during peak periods and supplying electricity during low production times. Current energy storage technologies, such as batteries, need further advancements to meet the demands of a renewable energy-dominated grid.
- 3. Infrastructure and Transmission:** Building the necessary infrastructure for renewable energy projects, including transmission lines and grid upgrades, can be challenging due to permitting issues, land acquisition, and public acceptance. Long-distance transmission lines are needed to transport energy from resource-rich areas to population centers.
- 4. Financing and Investment:** While the cost of renewable energy technologies has significantly decreased, upfront investment remains a barrier for many projects. Access to affordable financing and investment incentives are crucial to attracting more capital and speeding up deployment.
- 5. Policy and Regulatory Uncertainty:** Stable and supportive policies are vital for encouraging renewable energy development. Frequent changes in policies or a lack of clear regulations can deter investors and slow down the growth of the renewable energy sector.
- 6. Skills and Workforce Development:** Scaling up renewable energy requires a skilled workforce capable of designing, building, operating, and maintaining these systems. Ensuring an adequately trained workforce is essential to meet the growing demand for renewable energy professionals.
- 7. Cost Competitiveness:** The declining costs of renewable energy technologies, such as solar photovoltaics and wind turbines, make them increasingly competitive with fossil fuels. Continued technological advancements and economies of scale offer opportunities for further cost reductions.

⁹ International Energy Agency, *Supra* note 9 at 5

8. **Job Creation and Economic Growth:** Scaling up renewable energy projects creates jobs across various sectors, including manufacturing, construction, and maintenance. This can stimulate economic growth and contribute to local development.
9. **Energy Access in Remote Areas:** Renewable energy provides an opportunity to bring electricity to remote and underserved regions, where traditional grid extension may not be feasible. Off-grid and mini-grid solutions can empower communities with access to clean and sustainable energy.
10. **Decentralization and Community Ownership:** Renewable energy projects can be designed as decentralized systems, allowing individuals and communities to become energy producers, thereby fostering energy independence and local economic benefits.
11. **Environmental Benefits:** Shifting from fossil fuels to renewable energy sources significantly reduces greenhouse gas emissions, mitigates climate change, and helps improve air and water quality.
12. **Technological Innovation:** The pursuit of scaling up renewable energy drives technological innovation, leading to advancements in energy storage, grid integration, and other related fields.
13. **Sustainable Development:** Renewable energy supports sustainable development goals, such as poverty reduction, improved health outcomes, and environmental conservation.

Overall, while there are challenges to overcome in scaling up renewable energy, the opportunities for a cleaner, more sustainable, and economically viable energy future make it a compelling path to pursue. Addressing the challenges requires collaboration between governments, the private sector, and civil society to create supportive policies, invest in research and development, and mobilize financing for renewable energy projects.

XI. KEY ACTIONABLE POINTS

Renewable's developers will need to act decisively to prepare for the upcoming challenges. Specifically, they will have to focus on and address four emerging challenges¹⁰:

1. **A Scarcity of Top-Quality Land:** The rate at which developers must find new sites is constantly accelerating.
2. **A Blue-Collar and White-Collar Labour Shortage:** The "Great Attrition" is affecting economies worldwide, making it challenging for businesses to hire and retain employees.
3. **Supply Chain Pressures:** Due to the escalating price of steel, the interruptions caused by lengthy lockdowns in China, and transportation backlogs at ports, it is already difficult for

10 F.Heineke, N.Janecke, H.Klärner, F.Kühn, H.Tai, & R.Winter, *Renewable-energy development in a net-zero world*, McKinsey & co., , Oct. 28, 2022 <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/renewable-energy-development-in-a-net-zero-world>

wind and solar developers to complete projects in their pipeline on time and within budget.

- 4. Pressure on Profits and Volatility of Returns in the Short Term:** Returns are under pressure as more competitors enter the field of renewable energy production, government funding is being cut back, and materials, technology, and financing prices are rising.

XII. CONCLUSION & SUGGESTIONS

Scaling up renewable energy requires a comprehensive approach that involves various stakeholders, supportive policies, and innovative strategies. Here are some key recommendations to accelerate the adoption of renewable energy:

- 1. Implement Supportive Policies and Regulations:** Governments should establish clear and stable policies that incentivize the development and deployment of renewable energy technologies. This may include feed-in tariffs, tax incentives, renewable portfolio standards, and carbon pricing mechanisms to level the playing field with fossil fuels.
- 2. Encourage Investment and Financing:** Governments and financial institutions should work together to provide favorable financing conditions, low-interest loans, and grants to attract private investments in renewable energy projects. Promoting green bonds and sustainable investment funds can also mobilize additional capital.
- 3. Remove Fossil Fuel Subsidies:** Redirecting subsidies from fossil fuels to renewable energy can level the playing field and make renewables more economically competitive. This would create a more conducive environment for renewable energy deployment.
- 4. Invest in Research and Development:** Governments and private sectors should invest in research and development to drive technological advancements and cost reductions in renewable energy technologies. Supporting research institutions and innovation hubs can foster breakthroughs in energy storage, grid integration, and other critical areas.
- 5. Promote Energy Storage and Grid Modernization:** Develop and deploy energy storage technologies to address intermittency challenges and enhance grid stability. Modernizing the grid to accommodate a higher share of renewable energy and smart grid management systems will also be crucial.
- 6. Facilitate International Cooperation:** Foster international partnerships and collaboration to promote knowledge sharing, technology transfer, and joint investment in renewable energy projects. Global cooperation can accelerate the adoption of renewable energy on a larger scale.
- 7. Empower Local Communities:** Encourage community participation and ownership in renewable energy projects, such as community solar and wind farms. This involvement can enhance local acceptance, create economic opportunities, and support sustainable development.

8. **Streamline Permitting and Licensing Processes:** Simplify and expedite the permitting and licensing procedures for renewable energy projects to reduce development timelines and associated costs.
9. **Raise Awareness and Promote Education:** Educate the public and stakeholders about the benefits of renewable energy and its role in mitigating climate change. Raising awareness can build public support and facilitate the transition to renewable energy.
10. **Set Ambitious Renewable Energy Targets:** Governments and organizations should set ambitious and achievable renewable energy targets to drive action and provide a clear roadmap for scaling up renewables.
11. **Promote Electrification and Energy Efficiency:** Encourage the electrification of sectors like transportation and heating and promote energy efficiency measures to reduce overall energy demand and make renewable energy integration more manageable.
12. **Address Barriers to Technology Transfer:** Facilitate the transfer of renewable energy technologies to developing countries by addressing intellectual property rights issues and providing technical assistance.

By implementing these recommendations, governments, businesses, and communities can work together to accelerate the scaling up of renewable energy, helping to combat climate change, improve energy security, and foster sustainable development.

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