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## Cementing Rajasthan's and Gujarat's Renewable Energy Leadership

*Policy initiatives that can help the states continue to play a critical role in India's energy transition*

- *Introducing an incremental green tariff in Rajasthan and lowering Gujarat's high incremental green tariff will attract consumers to renewable energy by providing a flexible and low-risk path to sustainable power while generating additional revenue for DISCOMs.*
- *Creating renewable infrastructure funds and adopting green budgeting in Rajasthan and Gujarat will secure capital for renewable projects, streamline fiscal strategies, and strengthen economic growth aligned with environmental goals.*
- *Scaling up distributed renewable energy (DRE) and advancing grid infrastructure will help Rajasthan and Gujarat boost renewable capacity, improve grid reliability, and reduce reliance on fossil fuels, driving a resilient transition to clean energy.*

### Introduction

India's rapid urbanisation and growing GDP will drive energy demand that will [likely surpass all other countries by 2050](#). In order to meet the rising energy demand and reduce dependence on fossil fuels, India had set a target at the 26th Conference of Parties (COP26) to achieve 500 gigawatts (GW) of non-fossil fuel energy capacity by 2030. India also aims to reach net-zero emissions by 2070, for which it needs [investments of over US\\$10 trillion](#) in infrastructure and clean energy.

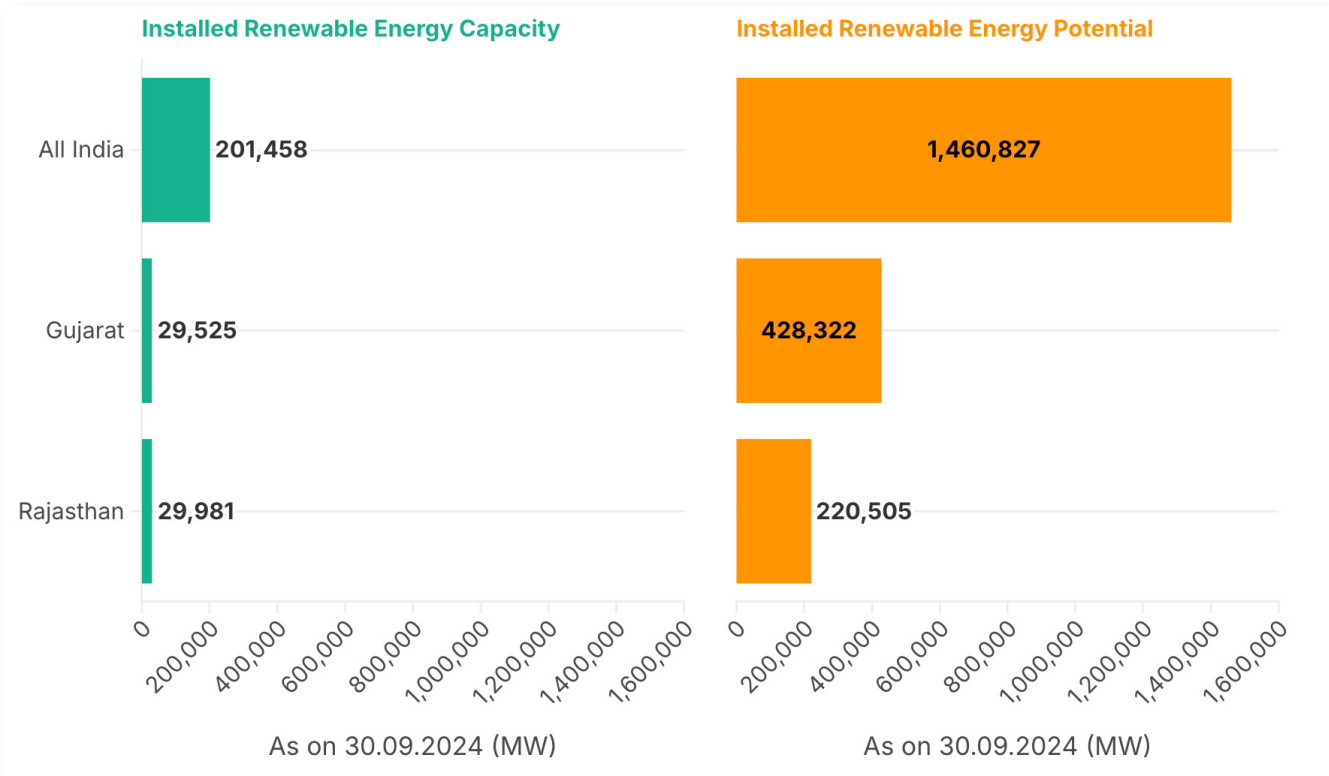
According to the International Energy Agency, India ranked [fourth worldwide](#) in total renewable energy installed capacity (including large hydro) in 2023, [fourth in wind power capacity](#) and [fifth in solar power capacity](#). As of 31 September 2024, India's total renewable energy capacity (including large hydro) reached [201,458 megawatts \(MW\)](#), 12.8% higher year-on-year.

In India's energy transition, states like Rajasthan, with the highest installed renewable energy capacity of 29,981MW, and Gujarat, with the second highest installed renewable energy capacity of 29,525MW, will play pivotal roles. Rajasthan's vast desert and Gujarat's long coastline make



them ideal for large-scale solar and wind energy development. Progressive government policies by the states have helped them become renewable energy powerhouses in the country. There is always room for improvement. Our analysis finds that steps like implementing a green tariff, integrating green budgeting practices, setting up dedicated infrastructure funds, promoting distributed renewable energy, modernising the grid and developing storage solutions will help both states continue to lead India’s energy transition.

**Figure 1: National Share of Renewable Energy Capacity and Potential in Gujarat and Rajasthan**



## Rajasthan

Rajasthan has emerged as a leader in renewable energy, particularly solar power, owing to its vast open spaces and abundant sunlight. The state’s renewable energy potential of 428,322 megawatts (MW) (including large hydro) accounts for [20.3%](#) of India’s total estimated renewable energy potential as of 31 March 2023, the highest among all states and union territories.

As of 30 September 2024, Rajasthan’s installed renewable energy capacity was [29,981MW](#) (including large hydro), representing approximately 7% of its total potential. The state generated [24,287.4 million units \(MUs\)](#) of renewable energy from April to August 2024, achieving an impressive 12% year-on-year growth.

This significant progress highlights Rajasthan’s pivotal role in advancing India’s clean energy transition. Our recent study, [Indian States’ Electricity Transition \(SET\) 2024](#), highlights that Rajasthan consumed 29,764 gigawatt-hours (GWh) (including large hydro) of renewable energy, representing 28% of its total electricity consumption (~104,830GWh) in the financial year (FY) 2023. In addition, from January 2020 to March 2024, the state has bolstered its renewable energy capacity by approximately 16 gigawatts (GW). Among the 21 states analysed in the SET 2024 report, Rajasthan represented about 31% of the total installed renewable energy capacity addition (excluding large hydro) from 2020 to March 2024, making it the foremost contributor.



## **Policy Landscape**

Rajasthan can significantly reduce its carbon footprint and pave the way for a sustainable future by harnessing just a fraction of its renewable energy potential. The state is working to harness the renewable energy potential, which can potentially decrease the state's power sector emissions intensity of its Gross State Domestic Product (GSDP), which reflects the emissions generated in the power sector relative to the GSDP. For FY2023, the emissions intensity stands at 9.3 million tonnes of CO<sub>2</sub> equivalent per trillion rupees of GSDP, as per the SET 2024 report.

### **State's Energy Policy**

The Rajasthan Energy Policy 2023 aims to achieve 90GW of renewable energy capacity by FY2030, which includes 65GW from solar and 15GW from wind-solar hybrid sources. Additionally, the policy targets developing 10GW of capacity from hydro, pumped storage and battery energy storage systems (BESS). The policy emphasises utilising Rajasthan's abundant natural resources and implementing technological innovations to facilitate the integration of renewable energy into the state's power grid.

### **Green Procurement Policy**

In order to achieve self-sufficiency in electricity, the state must also embrace more energy-efficient measures. The Rajasthan Commission has introduced its latest Green Procurement Policy, signalling a transformative shift in its purchasing and procurement strategies. This policy promotes sustainable practices and the reduction of environmental impact throughout all supply chain operations.

### **Green Open Access Rule**

Rajasthan has issued a draft of the Green Energy Open Access Regulations, 2024, to accelerate the adoption of renewable energy in the state, helping widen the consumer base, increasing demand and ensuring supply. The draft regulations propose that consumers with a minimum contract demand or sanctioned load of 100 kilowatts (kW) are eligible for green energy open access, while there is no load limit for captive consumers. The proposed rules will streamline green energy access and reduce costs, such as waiving cross-subsidy surcharges for captive plants, municipal solid waste-to-energy plants, and green hydrogen/ammonia production. The regulations also propose crediting surplus renewable energy purchased beyond obligated entities' Renewable Purchase Obligation (RPO) to the distribution licensee's RPO, ensuring compliance. We expect these measures to boost renewable energy adoption and align the state with India's clean energy targets.

### **Green Hydrogen Policy**

We expect Rajasthan's Green Hydrogen policy to play a pivotal role in advancing clean energy initiatives. The Rajasthan Green Hydrogen Policy aims to facilitate the production of green hydrogen by using the state's strong solar and wind energy resources. The policy focuses on several key areas: generating hydrogen and its by-products through renewable energy, developing Green Hydrogen Parks and promoting green tourism with hydrogen-powered mobility. It also supports green hydrogen fuel cells for transportation and aims to use hydrogen in homes, businesses and industries.



The policy targets to produce 2,000 kilotonnes of green hydrogen annually by 2030, creating at least one green hydrogen valley for fertiliser plants and refineries, and setting up a Gigafactory for making electrolysers. The state plans to export these electrolysers worldwide and blend up to 10% green hydrogen in natural gas pipelines by 2030. Additionally, the policy offers a 50% discount on transmission and distribution charges to encourage investment. Overall, the policy seeks to reduce carbon emissions, improve energy security and create jobs while attracting investments.

## ***Advancements in Renewable Energy Deployment and Market Integration***

### **Uptake of Distributed Solar**

Distributed solar energy in Rajasthan has seen a lower uptake, with only about 7% ([2,089MW](#)) of its total installed renewable energy capacity (including large hydro) as of September 2024. Despite being a solar-abundant state, this low percentage highlights a significant untapped market for distributed solar energy solutions. This sector has considerable growth potential, which could further enhance the state's renewable energy landscape, facilitating energy independence, flexibility, scalability and financial incentives.

### **Short-term Electricity Market Participation in Green Energy**

Rajasthan's participation in short-term electricity markets for acquiring renewable energy was minuscule in FY2023. According to the SET 2024 report, in FY2023, the latest available data for transactions through bilateral, Rajasthan acquired only 59MUs or 0.4% through the Green Day-Ahead Market (GDAM) of the total 15,072MUs it purchased or sold in the short-term electricity market. Rajasthan can further integrate renewable sources and enhance its energy transition efforts by actively engaging more in these markets.

### **Energy Efficiency**

The [State Energy Efficiency Index \(SEEI\)](#) 2023 categorises Rajasthan as an “aspirant” state with a score of 20.5, placing it in the lowest energy efficiency category. It experienced the most significant drop, a 46.5 point decrease, compared to 2022's index, largely due to a lack of reported data. Addressing data transparency through new initiatives can provide a clearer picture of Rajasthan's energy efficiency efforts and help improve its future performance.

### **Battery Storage**

Rajasthan is looking to ensure the quality of power supply. As outlined in its new Renewable Energy Policy 2023, to ensure electricity reliability, the state is prioritising the establishment of [hydro, pumped storage projects \(PSP\) and BESS projects totalling 10GW](#). This underscores their crucial role in efficient energy management, allowing for integrating renewable sources while ensuring a reliable power supply during peak demand or supply fluctuations.

### **Other Developments**

Recent developments in Rajasthan are significantly boosting the state's role in India's renewable energy landscape. Tata Power [has signed](#) a memorandum of understanding (MoU) with the state government to invest Rs1.2 trillion (US\$14.27 billion) over the next 10 years, aiming to make the state power surplus with 24/7 clean and reliable energy. The investment includes Rs750 billion (US\$8.9 billion) for 10,000MW of renewable energy, Rs20 billion (US\$237.8 million) for a solar module manufacturing facility and Rs10 billion (US\$118.9



million) for 100,000 electric vehicle (EV) charging points.

Similarly, NTPC Green Energy Limited (NGEL) [has partnered](#) with the government to develop 25GW of renewable energy projects, further solidifying Rajasthan's position as a key player in the nation's clean energy transition.

The state government has announced that it will present a separate green budget from next year. A green budget will empower the state to accelerate its energy transition by directing resources toward renewable energy development, energy efficiency and sustainable infrastructure.

## Gujarat

Gujarat has a renewable energy potential of 220,505MW, representing a 10.45% share of India's total renewable energy potential as of 31 March 2023, according to [Energy Statistics Report 2024](#). It ranks 3rd in India, following Rajasthan and Maharashtra. The state has utilised 13% of this potential by installing [29,524.53MW](#) of renewable energy capacity (including large hydro) as of 30 September 2024.

According to the Ministry of Power's latest data, Gujarat generated [23,341.13MU](#) from renewable energy sources from April to August 2024, a 13% YoY growth.

The SET 2024 report showed that Gujarat consumed 23,137GWh of renewable energy (including large hydro) in FY2023, which accounts for 17% of the state's total electricity consumption at 138,763GWh. Also, from January 2020 to March 2024, Gujarat increased its renewable energy capacity by about 12GW, making it the second-largest contributor among 21 states (excluding large hydro) analysed in the SET 2024 report. This addition represented roughly a quarter of the total renewable energy installed capacity by the 21 states analysed in the SET 2024 report during this period, representing a significant investment in renewable energy infrastructure and expenditure within the state.

### Policy Landscape

Gujarat's untapped renewable energy potential presents a golden opportunity for growth and innovation. By harnessing just a fraction of this potential, the state can significantly reduce its carbon footprint and pave the way for a sustainable future through greener policies and regulatory measures.

The Gujarat government is making significant strides in advancing renewable energy with its ambitious plans for FY2025. The state has announced a new initiative to install 48MW of solar rooftop systems across various state government buildings, supported by an allocation of Rs1.77 billion (US\$21.1 million) from the Climate Change Department. This investment builds on Gujarat's already notable achievements in solar energy, with over 3,000 government buildings equipped with solar rooftops, generating a combined capacity of 56.8MW as of March 2024. Additionally, this expansion will enhance the utilisation of distributed solar energy.

### Green Open Access Rules

The Gujarat Electricity Regulatory Commission (GERC) has issued the Green Energy Open Access Regulations, 2024, outlining banking rules and charges for green energy consumers. These regulations apply to entities with a contracted demand or sanctioned load of at least 100kW, including consumers, green energy generators, and licensees. It allows for open access to green energy, ensuring wider participation and smoother processes for renewable energy adoption. This will support Gujarat's clean energy goals and facilitate access to more





sustainable power sources for eligible users.

### **Incremental Green Tariff**

The state's incremental green tariff rate is the highest among the 21 states in the SET 2024 report, set at Rs1.5/kWh (US\$0.018/kWh), indicating an area which requires attention to make renewable energy less competitive and accessible for consumers. This higher cost could slow the adoption of green energy, making it more expensive than conventional power sources.

### **State's Energy Policy**

The Gujarat Energy Policy 2023, effective until 2028, aims to utilise approximately 400,000 acres of land for renewable energy projects, targeting the development of around 36GW of solar and 143GW of wind capacity.

### **Green Hydrogen Policy**

Gujarat is [working towards launching](#) its Green Hydrogen policy. The Gujarat Green Hydrogen Policy is encouraging the production of green hydrogen in the state, aiming to produce 3 million metric tonnes per annum (MMPTPA) by 2030. This ambitious goal represents over half of India's national target of 5MMPTPA. The state government is in the final stages of launching a new policy focused primarily on electrolyser manufacturing, ensuring that not only large companies but also micro, small, and medium enterprises (MSMEs) can benefit from this initiative.

## ***Advancements in Renewable Energy Deployment and Market Integration***

### **Uptake of Distributed Solar**

Gujarat has only 15% ([4,426MW](#)) of its total renewable energy capacity (including large hydro) as of September 2024 allocated to distributed solar, with substantial potential for expansion in this sector. Notably, Gujarat leads all states and union territories in distributed solar capacity, accounting for 24% of India's total installed capacity in this segment.

### **Short-term Electricity Market Participation in Green Energy**

Gujarat procured 406MUs from the GDAM or 1.8% of its total traded volume of 23,138.37MUs in the short-term electricity markets in FY2023, the latest available data for transactions through bilateral, according to the SET 2024 report. There is significant room for growth in leveraging these markets to better balance supply and demand, reduce costs and enhance grid efficiency, particularly as states like Rajasthan expand their renewable capacity.

### **Battery Storage**

Gujarat Urja Vikas Nigam Limited (GUVNL) [plans to establish three BESS projects](#) across the state. These sites will collectively provide 500MW of capacity, enhancing the integration of renewable energy sources and improving grid stability. This will support Gujarat's growing energy demands and facilitate a transition to cleaner energy by effectively managing power supply fluctuations. However, Gujarat's 2023 renewable energy policy does not explicitly mention a target for BESS. Including such a target would provide the required push to the sector, ensuring greater reliability in renewable energy supply.

### **Other Developments**

The Solar Energy Corporation of India (SECI) tender for [500MW offshore wind power](#) projects in Gujarat, issued in September 2024, marks a crucial step in the state's energy transition.



Using viability gap funding (VGF) and offering a fixed tariff of Rs4.5 per unit (US\$0.05 per unit), this initiative aims to harness Gujarat's offshore wind potential. By supporting large-scale wind energy development, the project will contribute significantly to Gujarat's shift towards renewable energy, further diversifying India's energy mix and aligning with the [National Offshore Wind Energy Policy, 2015](#).

With robust policy support and investor interest, the state government projects Gujarat's renewable energy capacity is likely to rise to [38,466MW by 2025 and 61,466MW by 2030](#). Major projects, including the massive 30,000MW hybrid park in Kutch, are central to these expansion plans.

## Challenges to Rajasthan and Gujarat's Energy Transition

Despite the significant progress towards the clean energy transition, Rajasthan and Gujarat still need to address certain challenges related to transmission infrastructure, improving the health of state electricity distribution companies (DISCOMs), accelerating rooftop solar and improving land acquisition. This section elaborates on the challenges the states are facing in accelerating the transition.

### *Insufficient Transmission Infrastructure*

Renewable energy projects in India are facing delays due to [insufficient transmission infrastructure](#), with the demand for grid connections outpacing development. The same is true for Rajasthan, where the need for High Voltage Direct Current (HVDC) systems exacerbates these delays, often extending commissioning timelines to around 48 months. Both central and state governments plan to expand transmission capacity significantly, but historical underinvestment and regulatory hurdles hinder progress. Effective long-range resource adequacy planning is essential to align transmission infrastructure development with renewable capacity growth.

### *Environmental Impacts*

A significant environmental challenge in expanding renewable energy in Gujarat and Rajasthan is the impact on local wildlife. One prominent example is that of the endangered Great Indian Bustard. Found in the desert regions of these states, this bird faces severe threats from the increasing renewable energy infrastructure, especially the risk of fatal collisions with overhead power lines. To address this, it is crucial for policymakers and energy developers to prioritise biodiversity by integrating bird-friendly designs, conducting thorough environmental impact assessments and creating protected wildlife areas. This balanced approach will allow the states to meet their clean energy goals while safeguarding their ecological heritage.

### *Poor Financial Health of DISCOMs*

The poor financial health of state discoms presents a significant challenge to India's electricity transition. DISCOMs struggle with widening financial gaps, limiting their ability to support the growing renewable energy sector. According to the Power Finance Corporation (PFC), in FY2023, the Average Cost of Supply (ACS) and Average Realisable Revenue (ARR) gap [widened to Rs0.55 per unit from Rs0.33 per unit in FY2022](#). This pushed the absolute cash gap to over Rs790 billion (US\$9.394 billion).

In Rajasthan, despite its leading role in solar energy production, the financial health of its DISCOMs remains a critical barrier to the state's electricity transition. The [poor performance](#) of its DISCOMs is evident in their low rankings in the PFC's 12th Integrated Report on Power



Distribution Utilities. Ajmer's DISCOM ranked 17th, Jaipur's 23rd and Jodhpur's 35th out of 53 utilities. Many of the state's solar parks fall under the Jodhpur DISCOM, further complicating renewable energy integration. Additionally, Rajasthan's DISCOMs have consistently struggled to meet their RPOs, largely due to delayed payments and poor financial management. This has eroded the confidence of power producers. These challenges limit the state's ability to fully harness its renewable energy potential and secure a stable supply of clean power.

In contrast, Gujarat's DISCOMs have shown more stability, reflected in their relatively positive ratings in PFC's report, supporting the state's proactive approach to renewable energy integration.

### ***Land Acquisition Challenges***

Land acquisition presents a significant challenge for renewable energy development in Rajasthan and Gujarat. Large-scale solar and wind projects require vast land tracts, but much of this land supports rural livelihoods or holds ecological importance. For example, in Rajasthan, solar parks like Bhadla span thousands of acres, leading to [concerns over](#) displacement, soil degradation, and local water shortages. While proactive in renewable energy expansion, Gujarat faces growing resistance from communities reliant on common land for agriculture and grazing, complicating land procurement efforts.

To overcome these hurdles, developers must engage in transparent negotiations that involve all stakeholders, ensuring fair compensation and addressing concerns about the social and environmental impact. Innovative land-use strategies, like agrivoltaics, can allow for dual-purpose land use, benefiting energy production and local livelihoods. Balancing developmental needs with community interests is key to unlocking the full potential of renewable energy in these states.

### ***Maintaining Momentum in Energy Storage Development***

India currently stands at a relatively modest [219.1MWh of installed energy storage capacity](#) (approximately 111.7MW) as of March 2024, the latest available data, lagging behind global trends. This capacity falls short of India's ambitious targets of 1.6GWh for standalone battery storage systems and 9.7GW for renewable energy projects by 2027. While the global [energy storage market is projected to grow](#) from US\$31.47 billion in 2023 to between US\$120 billion and US\$150 billion by 2030, India's pace underscores the need for accelerated development.

Gujarat and Rajasthan, with their abundant renewable energy potential, are already making good efforts in advancing energy storage. Their continued progress in this sector will be crucial for India to meet its national storage demand, helping to bridge the current gap.

### ***Investment Challenges***

Despite their vast potential for renewable energy, Gujarat and Rajasthan face significant investment challenges. In Rajasthan, the poor financial health of state DISCOMs creates uncertainty for investors, as delayed payments and unmet RPOs deter private sector participation. This financial instability undermines investor confidence, making securing the capital needed for large-scale solar and wind projects harder.

In Gujarat, although the state has shown more financial stability, investors still face hurdles like high land acquisition costs and the slow pace of regulatory approvals. Additionally, policy uncertainties around tariffs and grid infrastructure investment add to the risk, making long-





term investments in RE projects more complex. Both states need clear, consistent policies and better financial frameworks to attract and sustain investment in their growing renewable energy sectors.

### ***Slow Offshore Wind Power Development in Gujarat***

Despite Gujarat being a prominent player in India's wind energy sector, wind energy development has slowed in recent years. As per the National Institute of Wind Energy (NIWE), Gujarat's coastline offers a potential of [36GW of offshore wind energy](#), while India overall has a potential of 100GW. Despite Gujarat's significant potential for offshore wind energy, the state faces challenges that have hindered its rapid development. Key issues include [the need for advanced infrastructure](#) to support offshore platforms, the complexities of transmitting power to the onshore grid and navigating regulatory processes that can be cumbersome. Addressing these challenges will be crucial for unlocking Gujarat's offshore wind energy potential.

### **Way Forward**

A multifaceted approach is essential to accelerate the renewable energy transition in Gujarat and Rajasthan. This involves implementing strategic measures that enhance financial resources, improve market dynamics, and support effective governance. The recommendations in this section aim to provide a framework for achieving ambitious renewable energy targets.

#### ***Implementing Green Tariff***

Adopting lower incremental green tariffs in Rajasthan and Gujarat can accelerate the renewable energy transition by offering consumers a flexible, low-risk option to procure green power from DISCOMs, avoiding the complexities of open access and project financing. For DISCOMs, green tariffs also provide an additional revenue stream by attracting commercial & industrial (C&I) consumers committed to sustainability goals.

In Rajasthan, where an incremental green tariff is [currently absent](#), introducing such a tariff could stimulate a more robust green energy market. By enabling consumers to procure renewable power at a premium, Rajasthan can drive demand for renewable energy, encouraging further investments in renewable energy infrastructure without burdening consumers with high upfront costs.

Gujarat, where the incremental green tariff is the highest among 21 states analysed in the SET 2024 report, should focus on refining its regulatory framework to ensure this pricing does not deter potential consumers. Gujarat can maintain its role in advancing the renewable energy transition by balancing affordability and flexibility.

#### ***Establishing Dedicated Infrastructure Funds***

To further strengthen renewable energy initiatives, Rajasthan and Gujarat should establish dedicated infrastructure funds specifically designed to finance renewable energy projects. These funds would provide the necessary capital for large-scale investments, enabling states to implement ambitious renewable energy targets effectively. By ensuring a steady flow of resources for project development, states can accelerate the deployment of renewable technologies and improve their overall energy capabilities.

#### ***Integrating Green Budgeting Practices***

Rajasthan and Gujarat should integrate green budgeting practices into their fiscal planning.



This approach aligns financial strategies with environmental objectives, allowing the states to prioritise investments in renewable energy and green technologies. By adopting green budgeting, the states can create a sustainable financial framework that promotes economic growth while supporting environmental goals. The success seen in various states and Union Territories, such as Odisha, Bihar, Assam, Meghalaya, Uttar Pradesh, Maharashtra and Pondicherry, demonstrates the effectiveness of this strategy in driving energy transitions and fostering long-term sustainability.

### ***Promoting Distributed Renewable Energy***

Rajasthan and Gujarat should prioritise the expansion of distributed renewable energy (DRE), particularly through distributed solar rooftop installations, to enhance their transition to a renewable energy economy. As of 30 September 2024, Rajasthan and Gujarat only have about 7% (2,089MW) and 15%, respectively, of their total renewable energy capacity allocated to distributed solar, indicating substantial untapped potential. Promoting DRE can reduce pollution by decreasing reliance on centralised power plants, helping both states meet their renewable energy targets while creating jobs and stimulating economic growth. Additionally, DRE can foster energy independence by leveraging local renewable resources and reducing dependence on imported fossil fuels. Rajasthan and Gujarat can significantly enhance their sustainability goals and contribute to a cleaner energy future by investing in DRE.

### ***Grid Modernisation and Storage Development***

Rajasthan and Gujarat should prioritise grid modernisation as a crucial step toward enhancing the efficiency and reliability of their power systems. By incorporating advanced grid planning tools, state utilities can effectively manage the integration of new technologies and distributed energy resources. Implementing smart grid and smart metering solutions will further improve grid efficiency and empower consumers to better manage their energy consumption. Additionally, investing in BESS will provide the necessary flexibility and stability to the grid, enabling effective storage and management of renewable energy. Addressing critical challenges such as high transmission and distribution losses, along with curbing energy theft and improving grid maintenance, will significantly enhance overall grid performance. Rajasthan and Gujarat can create a more resilient and efficient energy landscape by focusing on these modernisation efforts.

## **Conclusion**

The path forward for states in India requires a concerted effort to strengthen renewable energy initiatives. While states that are slower in their transition to clean energy need to ramp up efforts, even leaders like Rajasthan and Gujarat must keep taking stock and corrective measures to ensure they do not lose momentum. By adopting the right strategies, states like Rajasthan and Gujarat can effectively navigate the transition to a sustainable energy future, achieving their renewable energy goals while fostering economic growth and environmental sustainability.



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