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King Abdullah Petroleum Studies and Research Center

Commentary

Insights from India's Journey to Over 100 Gigawatts of Renewable Energy

September 2022

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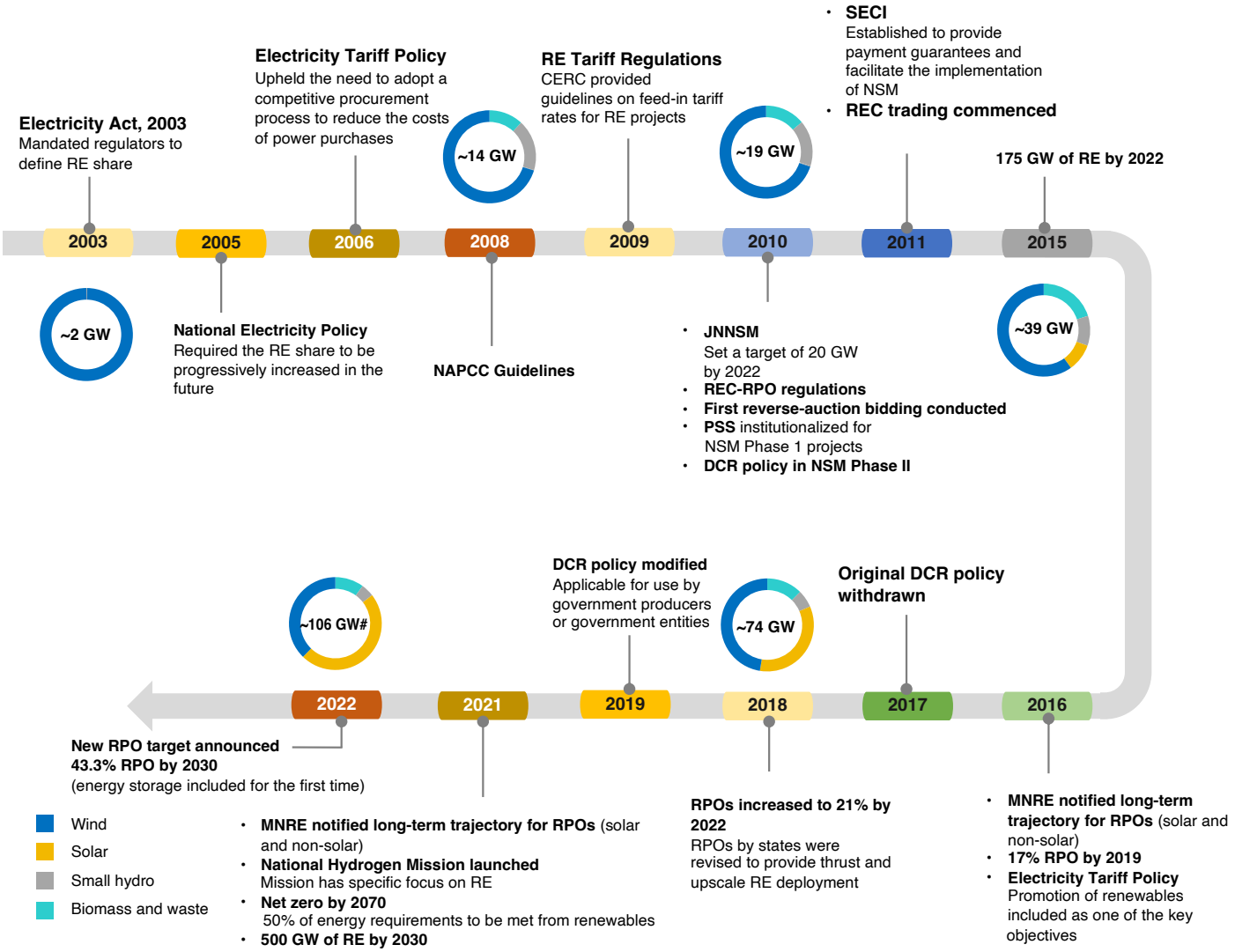
Timeline of India's Renewable Energy Journey



Source: Authors' illustration.

Notes: This chart is not a comprehensive representation of all the policies and regulations governing renewable energy development in India. Only key developments and the timelines of central (e.g., Government of India) initiatives are shown here. Several state-level policies specific to solar, wind or combined renewables have also contributed to India's renewable energy capacity additions over this time period.

RE = renewable energy; NAPCC = National Action Plan on Climate Change; CERC = Central Electricity Regulatory Commission; JNNSM = Jawaharlal Nehru National Solar Mission; REC = renewable energy certificate; RPO = renewable purchase obligation; PSS = payment security scheme; DCR = domestic content requirement; SECI = Solar Energy Corporation of India; NSM = National Solar Mission (a short form of JNNSM); MNRE = Ministry of New and Renewable Energy.

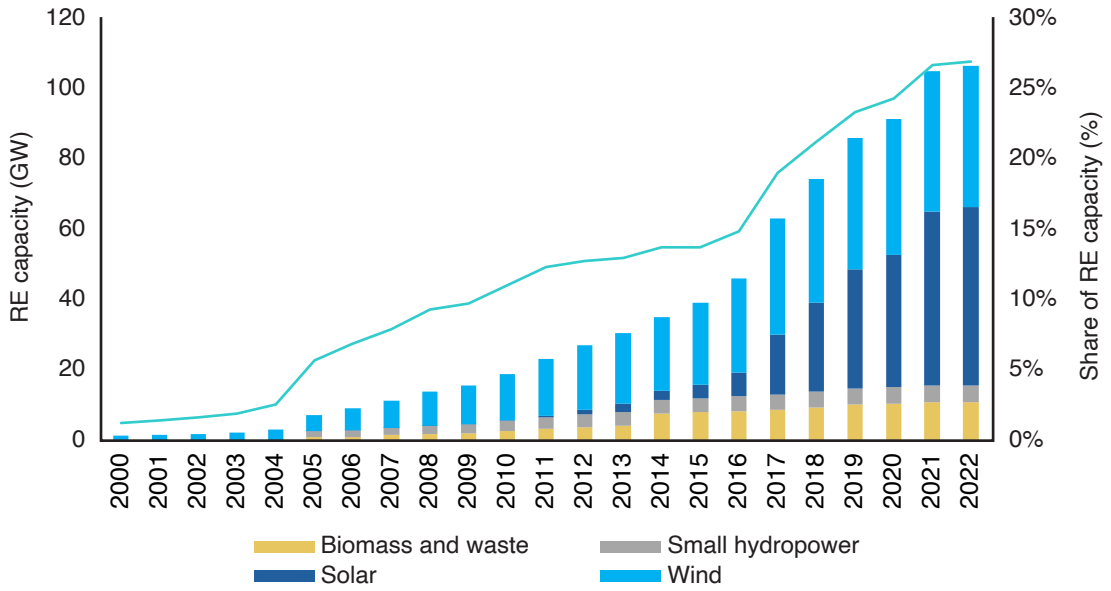
Introduction

This commentary analyzes the key industry developments, policy and regulatory features, prevailing circumstances and challenges related to renewable energy (RE) in India. It also highlights learnings for other countries. As electricity is a concurrent subject as per the Indian Constitution, its policies, planning and development are jointly governed by central and state authorities. Some Indian states realized the importance of RE technologies (RETs) in the mid-1990s and began taking advantage of these constitutional provisions. By taking the lead in promoting RETs, these states initiated India's RE deployment journey.

The first state-level RE policy initiatives were launched in 1994. At that time, the climate change policy development process had just begun India's adoption of the United Nations Framework Convention on Climate Change (UNFCC). The states of Maharashtra and Kerala released their policies for promoting RE in 1996 and 2002, respectively. Tamil Nadu started offering tax incentives to producers of wind power in 1998, particularly to improve the electricity supply during the summer. Textile manufacturers took advantage of these incentives and built several wind farms to supplement their energy requirements (Shukla and Sawyer 2013).

These early actions in India were largely taken to quickly supplement the electricity supply in the wake of prevailing shortages. Since then, however, supportive policies, regulations and institutional reforms have successfully increased India's RE capacity to about 106 gigawatts (GW) as of 2022 (Figure 1) (BNEF 2022; Central Electricity Authority 2022).

Figure 1. India's growing RE footprint.



Source: BNEF (2022), Central Electricity Authority (2022).

Review of India's RE Journey

1. Several Challenges in Early Years

India was one of the first countries to set up a separate ministry for promoting RE in the early 1990s

In 1980, the Government of India (GoI) established the Commission for Additional Sources of Energy, following the oil crisis of the 1970s. It was tasked with formulating and implementing policies and programs to develop new and renewable energy, alongside coordinating and intensifying research and development (R&D) efforts. Based on the commission's recommendation, a new department, the Department of Non-Conventional Energy Sources (DNES), was created within the Ministry of Energy in 1982. In 1992, the DNES was converted into a separate ministry, the Ministry of Non-Conventional Energy Sources (MNES). This change was intended to provide more focused attention to RE promotion in India. The MNES was renamed the Ministry of New and Renewable Energy (MNRE) in 2006.

In the early stages of India's RE deployment, achieving energy self-sufficiency was identified as the major motivation for promoting RE in India. The central government's MNRE, supplemented by state-level policy reforms, continued to promote RE in a piecemeal manner, but it achieved little success. Three main reasons for the low uptake of renewables emerged. First, the state-owned electricity utilities (then called State Electricity Boards) suffered from poor financial health. Second, the government lacked a clean energy policy. Third, renewables were expensive compared to other, conventional, sources of electricity.

2. Legislative Reforms of 2003 Put the Spotlight on Renewables

The new electricity act, EA 2003, enshrined support for renewable energy into law

To accelerate previous reform efforts and transform the functioning of the electricity sector, the GoI introduced new legislation in 2003. The Electricity Act 2003 (EA 2003) sought to promote competition, efficiency and sustainability within the electricity industry. Although several fiscal policies promoted electricity generation from RE sources, EA 2003 was the first law to include specific provisions concerning RE. This new law required each state electricity regulatory commission (hereafter, state regulator) to specify a definite RE percentage in distribution utilities' overall power procurement (MoP 2003). The National Electricity Policy of 2005 was issued under EA 2003. This rule further required that this share, as prescribed by state regulators, be progressively increased in the future (MoP 2005). These provisions supported RE promotion in an organized manner by creating demand for RE sources.

3. Feed-in-Tariffs (FiTs) Limited the Potential for Growth

FiTs initially acted as a catalyst for investments, but state-owned electricity distribution companies (DISCOMs) began worrying about the cost implications

India's renewables program, like those of many other countries, initially tended toward **feed-in-tariffs** (FiTs) as the most important stimulus tool for promoting renewables. However, levels of FiTs offered to developers varied significantly across India's states. Furthermore, state regulators did not adjust the FiTs periodically to reflect technological progress. This decision resulted in higher costs of policy support, returns on investment and impacts on ratepayers. In the short run, high FiTs acted as a catalyst to stimulate investment. However, they started to gradually lower utilities' appetites to absorb higher shares of renewables, thereby affecting the sustained growth of RE deployment in India.

4. Growing Aspirations for Renewables Created the Momentum for RE Growth

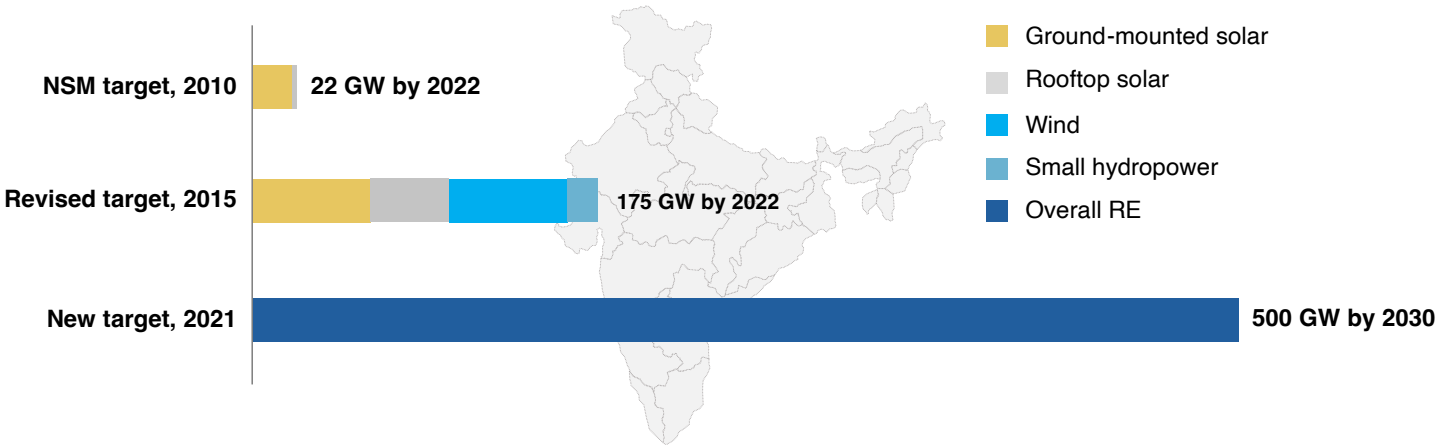
Until 2010, RE was promoted through various state and central government policies, with differing degrees of success. In January 2010, however, the Jawaharlal Nehru National Solar Mission (NSM) was launched. It intended to establish India as a global leader in solar energy by creating conditions for its planned and accelerated deployment in the country. The program set a target of 22 GW of solar capacity (20 GW of utility grid power and 2 GW of off-grid applications) by 2022 (SECI 2012). This goal was to be achieved in three phases from 2010 to 2022. The NSM expected to achieve grid parity in solar power through a predictable policy environment over the long term. It also emphasized the need to create the necessary environment to attract industry and project developers to invest in R&D and domestic manufacturing capabilities (SECI 2012).

India created a grand vision for renewables at a time when the energy industry was skeptical

Encouraged by its learning curve, the GoI revised its target by several orders of magnitude in 2015. Specifically, it aimed to reach 175 GW of RE capacity by 2022. This target included a goal of 100 GW of grid-connected solar capacity, a fivefold increase from the previous target of 20 GW. The remaining 75 GW of the target capacity included 60 GW of wind, 10 GW of biomass power and 5 GW of small hydropower. India initially lagged in achieving this goal, but creating 106 GW of RE capacity by February 2022 is a praiseworthy achievement. By establishing and increasing its long-term goals, India has created momentum for RE growth.

In November 2021, the prime minister of India announced another revision to India's goal. India plans to meet 50% of its energy requirements with RE by 2030. The MNRE is developing an action plan to achieve 450 GW of RE capacity by 2030 (Figure 2). Aggressive top-down target setting and policy cues characterize India's pursuit of its RE goals. Achieving these goals will require high-level political commitments.

Figure 2. India's growing RE ambitions.



Source: Authors' illustration.

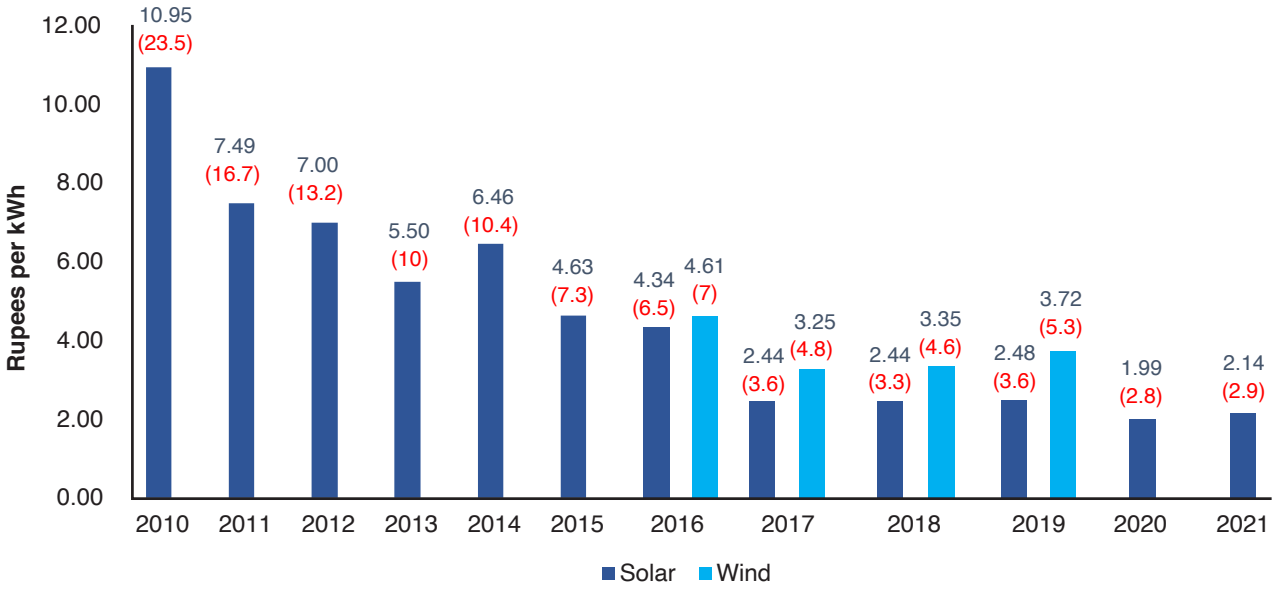
5. Competitive Auctions Paved the Way for a Transformative Future

The competitive selection of RE projects has reduced the cost of policy support significantly

In 2010, India used a reverse auction to award solar projects to qualified bidders under Phase 1 of the NSM. The central electricity regulator set a forbearance price of 17.91 rupees ($0.39) per kilowatthour (kWh) for solar PV in Batch I of Phase 1. The forbearance price was 15.39 rupees ($0.34) per kWh for the bidding round in Batch II of Phase 1. The first bidding round received a very enthusiastic response, with 343 proposals totaling 1,715 megawatts (MW) were received, against the allotted requirement for 30 projects with an aggregated 150 MW of capacity (EAI 2011). The fierce competition observed in Batch I also continued in the next round. This competitive selection resulted in 39% and 51% declines in the strike prices against the forbearance prices in the first and second bidding rounds, respectively. Investor response to the auction indicated a successful start and a major improvement over the previous FiT approach, which was administratively determined.

The states were encouraged by the national-level experience with competitive selection for solar energy, and their policies began to move toward auction-based approaches. State regulators began defining the maximum price cap for prospective investors. Considering the substantial savings over the economic lives of the projects, moving from FiTs to reverse auctions appeared to be successful (Basu 2011). Solar tariffs fell, and a pathway to achieving India's ambitious RE targets seemed clearer. The lowest solar price bid fell from 10.95 rupees per kWh in 2010 to 2.14 rupees per kWh in 2021. This change represents a decline of ~80% over the past 10 years (Figure 3).

Figure 3. Lowest solar and wind tariff bids under reverse auctioning.



Source: Collated from various reports from Ranjan (2021) and Sekar (2015).
Note: Figures in round brackets are the equivalent values in United States (U.S.) cents in nominal terms. We use the U.S. dollar to rupee conversion rate on January 1 in the corresponding year.

6. Payment Risks Were a Major Concern Among Investors

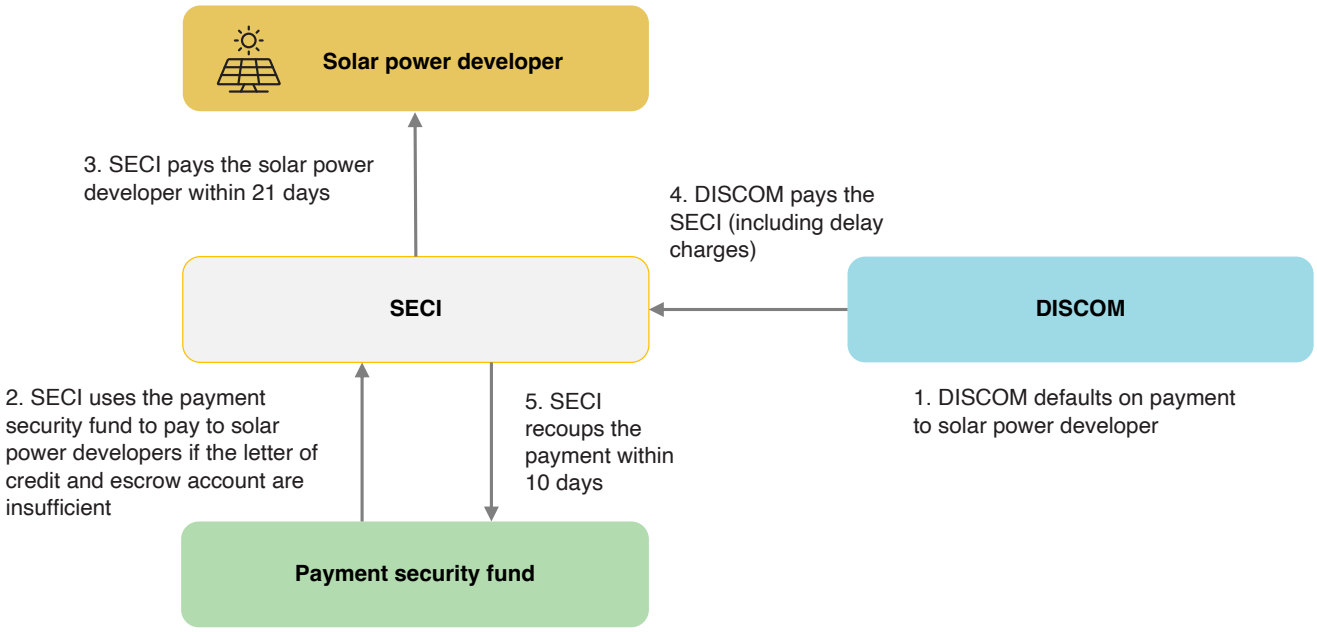
In India, DISCOMs are the largest off-takers of electricity, including RE, under long-term power purchase agreements (PPAs). However, despite earlier price reforms, DISCOMs' financial conditions have remained fragile. Several factors have contributed to the DISCOMs' poor financial health. They include inadequate tariff revisions, delays in transfers from states to compensate them for supplying electricity at concessional tariffs and large aggregate technical and commercial losses. In 2010, the total financial losses of power utilities was estimated to be around 400 billion rupees ($8.63 billion) (Sinha 2011).

Long-term structural fixes were needed to improve the sector's financial viability. However, the GoI attempted to mitigate RE developers' payment risks through short-term measures. It instituted a payment security scheme for solar projects to be set up in Phase 1 of the NSM. This payment security scheme was backed by a budget of 4.86 billion rupees (~$104 million) (Farooquee and Shrimali 2016) from the GoI. It helped to protect developers' interests against delays or defaults by the DISCOMs.

Institutionalizing a payment guarantee scheme was key to reducing the credit risks for RE lenders

For subsequent bidding rounds, the GoI established the Solar Energy Corporation of India (SECI), a public company, in 2011. This company was tasked with providing payment guarantees to solar producers and facilitating the implementation of the MNRE's RE initiatives. Under this arrangement, SECI, as an intermediatory procurer, signed PPAs directly with solar producers, thereby insulating them from payment-related risks (Figure 4). Initially, the GoI provided 15 billion rupees (~$226 million) to create a payment security fund. This fund was to be used by SECI if the DISCOMs defaulted on their payments. To further boost the RE sector, an additional 10 billion rupees (~$136 million) was provided in 2021, allowing SECI to support 15 GW tenders annually (MNRE 2021). As of 2021, RE capacity of ~44.2 GW (32.7 GW solar and 11.5 GW wind) has been set up through SECI. Undoubtedly, the payment security mechanism has been instrumental in reducing the lenders' credit risks.

Figure 4. SECI's payment security mechanism.

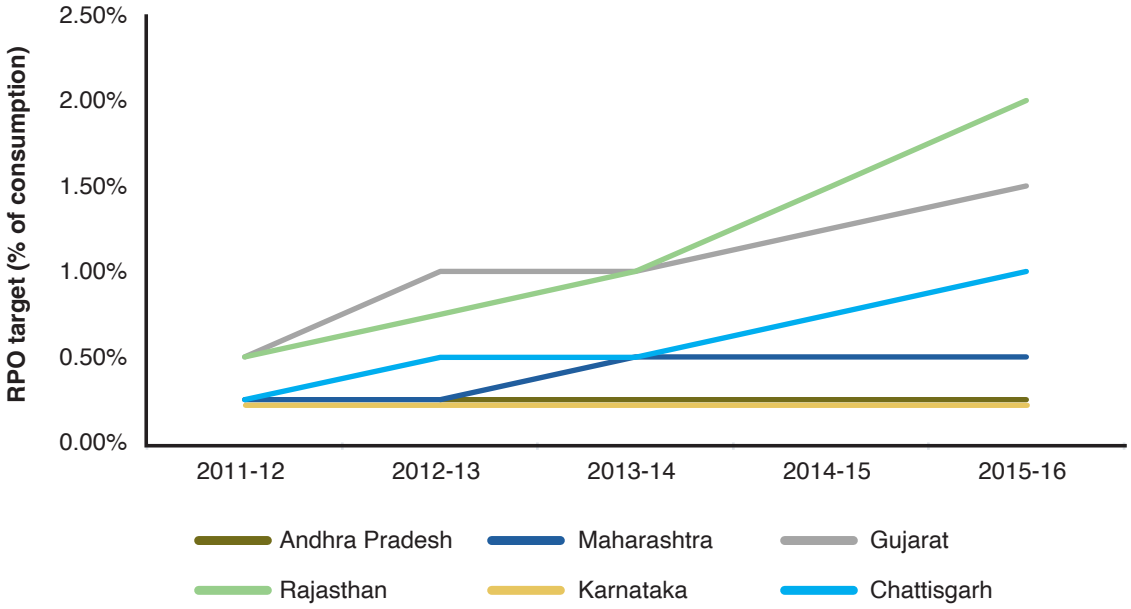


Source: CEEW (2019).

7. Renewable Purchase Obligations (RPOs) Facilitated RE Growth

EA 2003 required state regulators to define RPO targets for their states. However, until 2017, they set RPO targets very conservatively owing to the potential backlash from ratepayers, as rate design has social and political ramifications. For instance, the solar energy potential of the top six RE-rich states ranges from 18 GW to 142 GW. Nevertheless, those states set RPO targets below 2% (Figure 5). In some cases, DISCOMs easily achieved these low RPO targets. Thus, rather than a stimulus, the low RPO targets acted as a ceiling on RE deployment in Gujarat, Maharashtra and Rajasthan.

Figure 5. Low solar RPO targets in resource-rich states.



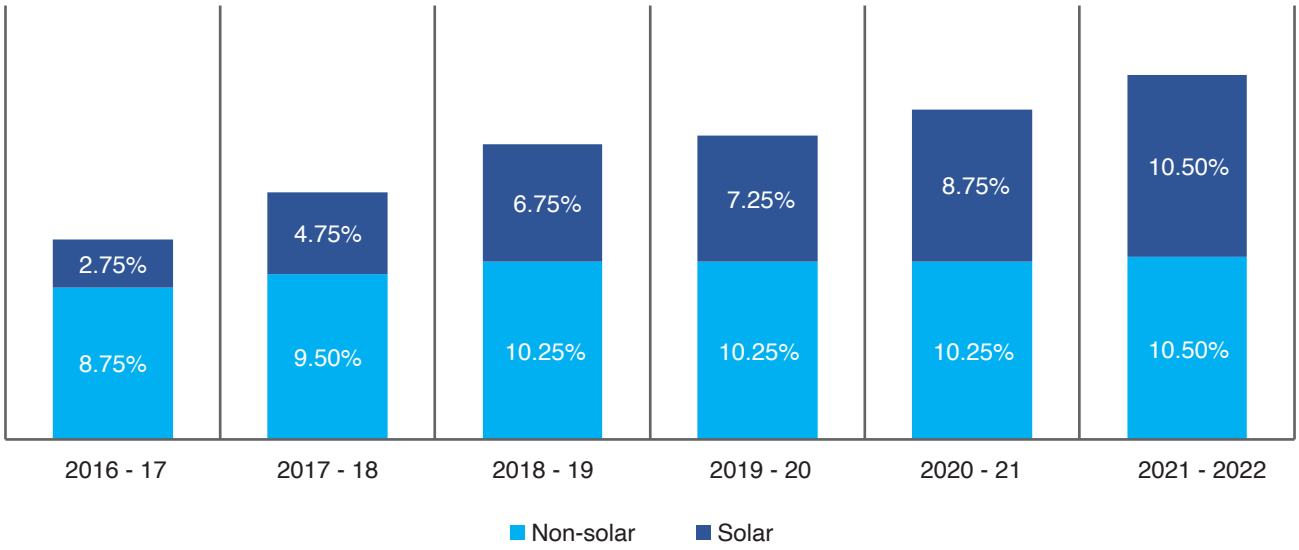
Source: RPO regulations issued by state electricity regulatory commissions.

RPOs have been the single most important policy driving RE installations in India

In 2015, India increased its RE target from 20 GW to 100 GW by 2022. The state-level approach therefore needed a serious realignment with national goals. The Ministry of Power (MoP) realized that states might continue to set conservative RPO targets. Thus, after consultation with the MNRE in July 2016, the MoP published a uniform long-term trajectory of solar and non-solar renewable purchase obligations (RPOs) for all states in India. This new requirement also compelled non-RE-rich states to contribute to achieving the national objectives by purchasing RE from other states. An initial RPO target of 17% of renewables in the energy mix (with a solar RPO target of 6.75%) was set for 2019. Encouraged by the increase in India's RE capacity to ~74 GW in 2018, the MoP revised its RPO target to 21% by 2022. This target included a 10.50% share of solar power in the energy mix (MoP 2018) (Figure 6). Additionally, the GoI has set a target of 30 GW of hydropower by 2029 to 2030. Iit has issued long-term hydropower purchase

obligations for projects commissioned after March 2019 (Ranjan 2021). Moreover, the GoI aims to boost green hydrogen production. Thus, if RE is used to produce green hydrogen or green ammonia, it also counts toward the RPO compliance of the consuming entity. On July 24, 2022, the GoI yet again increased its RPO target to 43% by the end of 2030. Besides solar and wind, it has set new state targets for energy storage for the first time. This new development comes in the wake of India committing an ambitious 500 GW of RE by 2030 at the Glasgow COP 26 climate summit in 2021 (Jay 2022).

Figure 6. Long-term trajectory of RPOs.



Source: MoP (2018).

Compliance with RPOs has been an issue, as few states strictly adhere to their RPO targets (Prateek 2018). In most cases, these targets are poorly enforced even if penalties are issued. The GoI has created the RPO Compliance Cell to monitor RPO compliance by all obligated entities. It also coordinates with states and central and state regulators on matters relating to RPO compliance and raises non-compliance issues with the appropriate authorities. Nonetheless, RPOs are the single most important policy driving RE installations in India. With India's new goal of 450 GW of RE by 2030, the importance of effective enforcement is greater than ever.

The monitoring of and effective compliance with RPO targets are important for achieving goals

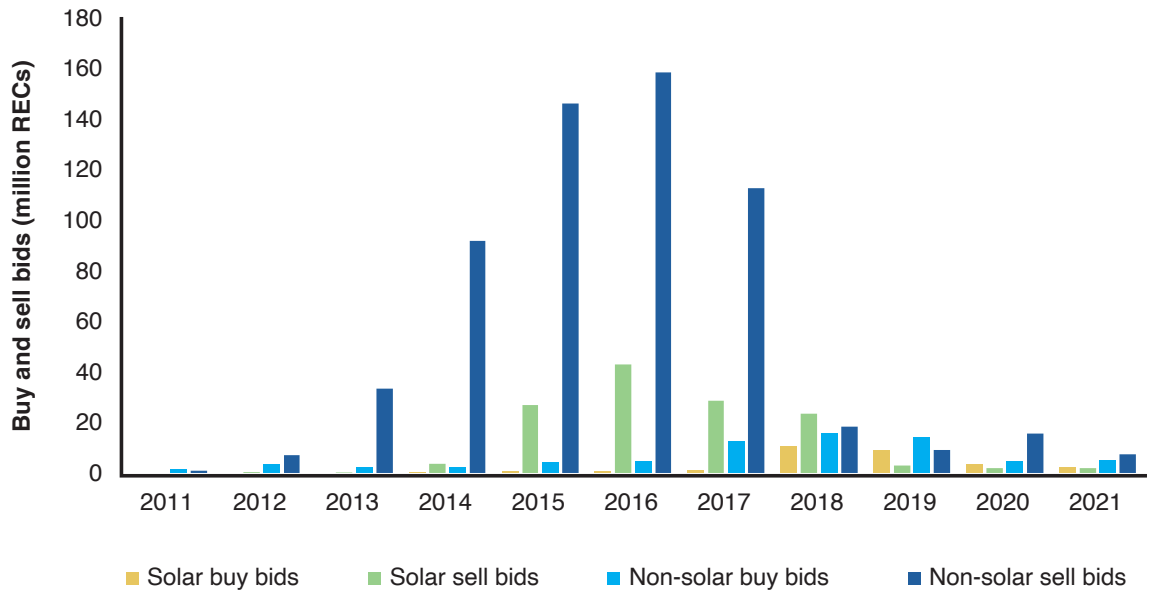
8. Renewable Energy Certificates (RECs), a Market-Based Mechanism, Were Not Effective

The REC market did not succeed due to poor RPO compliance and pricing issues

The states with fewer RE resources frequently cited their inability to meet their RPO targets. In these states, the availability of RE resources and the RPO targets set for the obligated entities (i.e., DISCOMs and corporations) were mismatched. Renewable energy certificates (RECs), a market-based mechanism, were introduced in 2010 to promote RE and facilitate RPO compliance. The central electricity regulator designed and implemented the governing regulations for RECs, and REC trading commenced on India's power exchange in February 2011.

Figure 7 shows that RECs are persistently oversupplied in the Indian market. Low, non-uniform RPO targets across states and state regulators' weak enforcement of RPO compliance are the two primary reasons for the REC mechanism's poor performance. Furthermore, because of high prices and regulatory uncertainties, project developers are reluctant to register their projects under the REC scheme. Developers find that renewable power sales are more viable than REC sales. Thus, projects with 2,073 MW capacity were deregistered as of March 2018 (Srivastava 2022). Price and regulatory uncertainties also reduced lenders' interest in committing long-term funds to set up new projects under the market-based scheme. These factors led to a significant decline in the volume of sell bids from 2018 onwards (Figure 7).

Figure 7. Trends in REC trading in India.



Source: Compiled from the Indian Energy Exchange and Power Exchange India.
Note: 1 REC = 1 MWh.

9. Localization of the RE Industry Considered Important for Sustained Growth

The NSM, adopted in 2010, was the first national program that referenced domestic content requirements (DCRs). The aim of the DCRs was to promote domestic solar manufacturing and establish India as a solar manufacturing hub. However, the United States objected to the DCR policy of Phase II of the NSM, and the dispute was raised to the World Trade Organization (WTO). India lost the case in 2016. Consequently, India dropped the original DCR provisions in 2017 and modified them in 2019. The revised policy set domestically manufactured cells and modules as a prerequisite for 12 GW of solar PV projects created by the central public sector. These undertakings were intended for self-use or use by the central and state governments or government entities. Subsequently, the GoI established schemes for rooftop solar cells for residential use, standalone solar agriculture pumps and the solarization of existing grid-connected agriculture pumps. These schemes all fell under the DCR mandate (JMK Research and Analytics 2022).

Localization policies need to be carefully designed and executed

Despite the substantial demand (36.8 GW) created by these DCR mandates, the Indian solar power market has not been significantly affected (JMK Research and Analytics 2022). India currently has manufacturing capacities of 3 GW for solar cells and 15 GW for modules (Bhaskar 2022). India's DCR policy lost momentum after the WTO ruling. However, the country continued to add solar capacity using less costly imported cells and panels, largely supplied by Chinese manufacturers.

Given India's sizable RE targets, the GoI has made a renewed push to ramp up the country's domestic manufacturing capacity. The GoI seeks to increase its manufacturing capacity for solar cells and modules by 25 GW by April 2023. It also aims to increase its manufacturing capacity of wafers by 10 GW. It has taken several actions to achieve these goals.

- First, the GoI allocated 240 billion rupees (~$3.28 billion) in the 2022–2023 Union Budget to encourage local manufacturing. This budget will fund production-linked incentives for high-efficiency solar modules. This support is in addition to 45 billion rupees (~0.62 billion) already allocated to schemes for manufacturing solar PV modules.

- Second, the GoI has imposed a basic customs duty of 40% on modules and 25% on solar cell imports from April 1, 2022. This policy is intended to encourage local manufacturing and discourage imports.

Industry analysis suggests that the production-linked incentive scheme and the customs duty on imported modules will eliminate the existing price gap. Domestic modules may even become competitive by 2 to 3 cents per watt at current prices (The Economic Times 2022).

10. Many Policy Measures Have Been Deployed to Encourage Investment

The RE industry has benefited from a range of policy and regulatory support mechanisms at the central and state levels

India has used a wide range of policy instruments to promote the deployment of RE capacity. When the GoI started to encourage RE in the early 1990s, it was much more expensive than fossil-fuel-based power generation. To bolster RE's deployment and increase its attractiveness relative to other power-generation sources, several fiscal, financial and price-based incentives were offered to RE producers. Initially, the GoI offered capital subsidies ranging from 30% to 40% of the benchmark costs of RE projects through the MNRE. However, with declining technology costs, the MNRE has reduced this assistance in recent years. Some state policies offered additional capital subsidies beyond those provided by the GoI. The GoI also provided low-interest loans to eligible beneficiaries through the Indian Renewable Energy Development Agency. FiTs were dominant price-based policy incentives that created a favorable price regime for RE relative to other conventional sources of electricity. Other key policy interventions used to promote RE deployment are as follows:

Different policy instruments play specific roles in promoting renewables

- Grid interconnection – Licensees (i.e., transmission and distribution companies) are responsible for developing evacuation infrastructure beyond interconnection points. This policy reduces the risks associated with setting up RE projects away from the main grid. The GoI also exempted solar and wind producers from having to pay interstate transmission charges for solar and wind electricity to encourage RE adoption. This exemption has been extended for solar and wind projects commissioned through June 30, 2025.

- Flexible grid access – Previously, RE generators were required to sell their power to the DISCOMs, which provided them with grid connectivity. However, EA 2003 provided open access to the electricity transmission and distribution system to eligible consumers, generators and DISCOMs upon payment of the applicable charges. This was subject to network availability. Only a few states permitted those consuming below 1 MW to utilize this open access, as most states adopted a limit of 1 MW or more. To boost RE use, in 2021 the MoP published draft rules for promoting RE through open access. These rules lowered this limit to the consumption of 100 kW or more, except for captive consumers.

- Enabling infrastructure and innovative business models – The development of solar parks has been a flagship project of the GoI. The program was launched in December 2014 to promote the large-scale deployment of grid-connected 'plug-and-play' solar projects. Solar parks aim to provide land and shared infrastructure to project developers and offer centralized procurement. Thus, they can reduce project risks, lower costs and increase the ease of doing business for public and private developers. Owing to the solar park project's success, its initial capacity target of 20 GW was increased to 40 GW in March 2017. As of November 30, 2021, 52 solar parks with a cumulative capacity of ~38 GW have been approved by the MNRE. Additionally, ~9.2 GW of further capacity has been commissioned.

- Inter State Transmission System (ISTS) connected hybrid scheme – The ISTS-connected wind-solar hybrid scheme was launched in May 2018. This scheme provides a guiding framework for the promotion of large grid-connected wind-solar hybrid systems to optimally and efficiently utilize transmission infrastructure and land. These systems reduce the variability in RE power generation and achieve better grid stability.

- Generation Based Incentives (GBI) – GBI was a central scheme launched by the MNRE with a focus on promoting generation rather than merely setting up projects. The scheme was limited to 5 MW per developer across India (and a maximum of 10 MW per state). It offered outcome-based incentives to RE producers in addition to the FiTs provided by state utilities.

- Viability Gap Funding (VGF) scheme – The VGF scheme provides one-time financial support to cover the difference in the costs of domestic and imported solar cells and modules. The scheme is implemented through SECI, and the MNRE sporadically reviews the maximum permissible VGF amount.

- Granting of industry status – Several state policies accord industry status to RE projects. This allows them to benefit from such incentives as low-interest rate loans, loan guarantees, and investment and R&D subsidies. They also benefit from land sold at concessional rates to private developers and exemptions on stamp duties and registration fees.

- 'Must run' status for RE power plants – To boost investors' confidence, the MoP introduced the Electricity (Promotion of Generation of Electricity from Must-Run Power Plant) Rules, 2021. Under these rules, RE generation can only be curtailed in the case of a technical constraint or issues related to grid security. If power from must-run power plants is curtailed, then the procurers are liable to compensate power generators at the rates agreed upon under PPAs. The renewables sector has already been granted must-run status under the Indian Electricity Grid Code.

- Concessions on development costs – In addition to fiscal and financial incentives, most state policies extend other incentives to RE project developers to reduce project development costs. These incentives include the identification and conversion of land use, land registration and environmental impact assessment studies. Other incentives are the preparation and submission of applications for obtaining the necessary approvals and signing grid connection contracts and PPAs.

- Dedicated transmission infrastructure for seamlessly integrating RE – A dedicated program, the Green Energy Corridor, has been created to transport large-scale RE from high RE potential states and synchronize it with the national grid. About 20,000 circuit kilometers of dedicated transmission lines for RE have been created.

- Facilitating approvals and clearances – Identifying and acquiring land and obtaining the necessary clearances and approvals are some of the greatest challenges faced by developers. An administrative department of each state government is designated as the State Nodal Agency (SNA) to discharge these functions. The SNA is also responsible for coordinating with other relevant state government agencies to implement MNRE programs effectively and channel central government subsidies for RE.

- Concessions on import duties – In the past, developers were offered concessions on import duties for items imported to set up solar and wind projects to achieve RE goals. However, such concessions have been withdrawn to encourage local manufacturing and discourage imports.

It is important to recalibrate policies through various stages of market development

- Accelerated depreciation (AD) benefits – AD benefits were a key factor in the increase in wind capacity installations in India. The objective of these benefits was to encourage private sector investment in RE by lowering producers' overall tax burdens. The government also provided similar benefits to solar developers.

- Creating demand through quantity-based policy instruments – RPOs and RECs were two quantity-based policy instruments used to create demand for renewables in India.

Over time, several support mechanisms, especially fiscal and financial incentives, have been redesigned, downscaled or withdrawn. These revisions were instituted in view of the dramatic fall in RE prices and the development of India's RE market.

11. Distributed Renewable Energy (DRE) Is Promoted for Various Demand-Side Applications

Land identification and acquisition is likely to remain a significant barrier for large-scale RE projects in India. Thus, DRE can provide alternate avenues for greening the supply chain in key sectors, such as agriculture and healthcare. The GoI focuses on various distributed technologies in addition to solar rooftops. These technologies include solar pumps, small-scale RETs for rural and productive uses, solar study lamps, solar street lights and off-grid decentralized solar plants. They can expand the scale of RE deployment in rural and remote areas and provide end users with an affordable, reliable electricity supply. The GoI is also promoting DRE usage in cities with the development of the Solar Cities program, which promotes RE and energy efficiency measures.

12. Timely and Transparent Policies and Regulations Are Vital to Instill Industry Confidence

Transparent and timely policies and regulations are vital for maintaining investors' trust

India's RE footprint has largely been developed by the private sector. Government policies with clearly articulated objectives and incentives to engage in the RE sector have been crucial for spurring RE deployment in India. More importantly, the GoI has used a public consultation process to formulate these policies. Draft policies are published online and placed in the public domain for comments by individuals, groups of people or anyone likely to be affected. Once finalized, all policies are publicly accessible. This process has helped to improve policies' transparency and effectiveness and earn trust from industry players and investors.

The government has also made changes to existing policy designs and has introduced new policies to support RE deployment from time to time. These policies are aligned with expanding national goals, the progression of technology and market evolution. Electricity regulators follow a public consultation process that is similar to the policymaking process when designing regulations. When draft regulations are placed in the public domain for input, they are accompanied by an explanatory note. This note lays out the reasons for the regulators' choices in bringing forward the regulations. Further, EA 2003 clearly distinguishes between the roles and mandates of policymakers and regulators, minimizing the chances of potential conflicts due to a lack of clarity. Overall, this transparency and public consultation have provided a solid foundation for the growth of India's RE sector.

Conclusions

With ~106 GW of RE capacity installations, India's RE sector has grown substantially. This journey has been challenging but commendable. The financing and bankability of RE projects were often seen as major issues arising from the poor financial performance of DISCOMs. However, India's RE sector has overcome these challenges.

Developing a strategic plan for deploying renewables is the first step toward a sustainable energy transition. However, setting the requisite policies and regulations is necessary to realize this plan. The transparent and timely promulgation of policies and regulations is vital for maintaining investors' trust. Issues are likely to arise as policies are implemented. However, they need to be addressed by making suitable and timely changes to policy and regulatory frameworks, as India has done. The competitive bidding process, setting RPO targets and institutionalizing payment guarantee schemes are the three most notable interventions contributing to RE growth in India.

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About the Project

KAPSARC has initiated a regional electricity market integration research project to explore the potential opportunities that could be harnessed by developing a common electricity market for the Gulf Cooperation Council and wider Middle East and North Africa (MENA) region. It examines a range of issues relating to electricity market integration, including the experiences of other power pools and their potential application in the MENA region. The focus of the project is on understanding and examining electricity market policy and legislation, market design and structure, regulatory and system operations to identify best practices and to provide insights into policy and regulatory issues. Its various outputs are intended to fill existing knowledge gaps and facilitate ongoing efforts toward regional electricity market integration.

About KAPSARC

KAPSARC is an advisory think tank within global energy economics and sustainability providing advisory services to entities and authorities in the Saudi energy sector to advance Saudi Arabia's energy sector and inform global policies through evidence-based advice and applied research.

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