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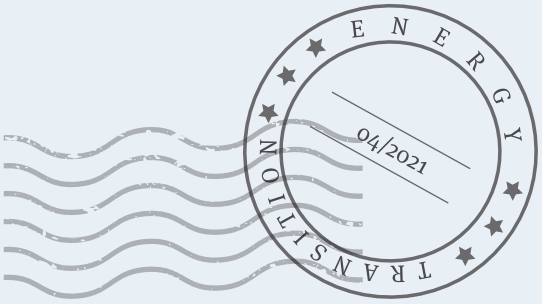

How India's Solar and Wind Policies Enabled its Energy Transition

A Decade in Review

Harsha V. Rao and Disha Agarwal

Report | April 2021

Over the last ten years, India has demonstrated a functional RE pathway to the world. As it sets out to become a renewable energy powerhouse by 2030, it is essential that we review the journey and draw lessons that can take us there.

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Shakti Sustainable Energy Foundation seeks to facilitate India's transition to a sustainable energy future by aiding the design and implementation of policies in the following areas: clean power, energy efficiency, sustainable urban transport, climate change mitigation and clean energy finance.

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In ten years of operations, The Council has engaged in 278 research projects, published 212 peer-reviewed books, policy reports and papers, created 100+ new databases or improved access to data, advised governments around the world nearly 700 times, promoted bilateral and multilateral initiatives on 80+ occasions, and organised 350+ seminars and conferences. In July 2019, Minister Dharmendra Pradhan and Dr Fatih Birol (IEA) launched the CEEW Centre for Energy Finance. In August 2020, Powering Livelihoods — a CEEW and Villgro initiative for rural start-ups — was launched by Minister Mr Piyush Goyal, Dr Rajiv Kumar (NITI Aayog), and H.E. Ms Damilola Ogunbiyi (SEforAll).

The Council's major contributions include: The 584-page *National Water Resources Framework Study* for India's 12th Five Year Plan; the first independent evaluation of the *National Solar Mission*; India's first report on global governance, submitted to the National Security Adviser; irrigation reform for Bihar; the birth of the Clean Energy Access Network; work for the PMO on accelerated targets for renewables, power sector reforms, environmental clearances, Swachh Bharat; pathbreaking work for the Paris Agreement, the HFC deal, the aviation emissions agreement, and international climate technology cooperation; the concept and strategy for the International Solar Alliance (ISA); the Common Risk Mitigation Mechanism (CRMM); critical minerals for *Make in India*; modelling uncertainties across 200+ scenarios for India's low-carbon pathways; India's largest multidimensional energy access survey (ACCESS); climate geoengineering governance; circular economy of water and waste; and the flagship event, Energy Horizons. It recently published *Jobs, Growth and Sustainability: A New Social Contract for India's Recovery*.

The Council's current initiatives include: A go-to-market programme for decentralised renewable energy-powered livelihood appliances; examining country-wide residential energy consumption patterns; raising consumer engagement on power issues; piloting business models for solar rooftop adoption; developing a renewable energy project performance dashboard; green hydrogen for industry decarbonisation; state-level modelling for energy and climate policy; reallocating water for faster economic growth; creating a democratic demand for clean air; raising consumer awareness on sustainable cooling; and supporting India's electric vehicle and battery ambitions. It also analyses the energy transition in emerging economies, including Indonesia, South Africa, Sri Lanka and Viet Nam.

The Council has a footprint in 21 Indian states, working extensively with state governments and grassroots NGOs. It is supporting power sector reforms in Uttar Pradesh and Tamil Nadu, scaling up solar-powered irrigation in Chhattisgarh, supporting climate action plans in Gujarat and Madhya Pradesh, evaluating community-based natural farming in Andhra Pradesh, examining crop residue burning in Punjab, and promoting solar rooftops in Delhi and Bihar.

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Harsha researches the legal and regulatory framework of the energy sector. Before joining The Council, she worked as a litigation lawyer in Delhi. She has also worked with the project finance team of a leading law firm in India.

"Renewable energy already makes sense. We should now take steps to deepen the market and make it more flexible."

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Disha co-manages The Council's Renewable Energy Programme. She works on legislative, policy, and regulatory frameworks at the intersection of power and renewables. She has experience in strategy development; renewable energy policy and market analyses; stakeholder management and collaborations; grant-making; and fund-raising. Before joining The Council, she was with Shakti Sustainable Energy Foundation, leading programmes on renewables and climate policy during her tenure.

"India is set to become a renewable energy powerhouse over this decade. This is when we need to adopt pathways to reducing the sector's reliance on policies."

This study focuses on the evolving policies and risks in India's utility-scale solar and wind energy sector, and mitigating strategies used at various points in time.

Image: iStock

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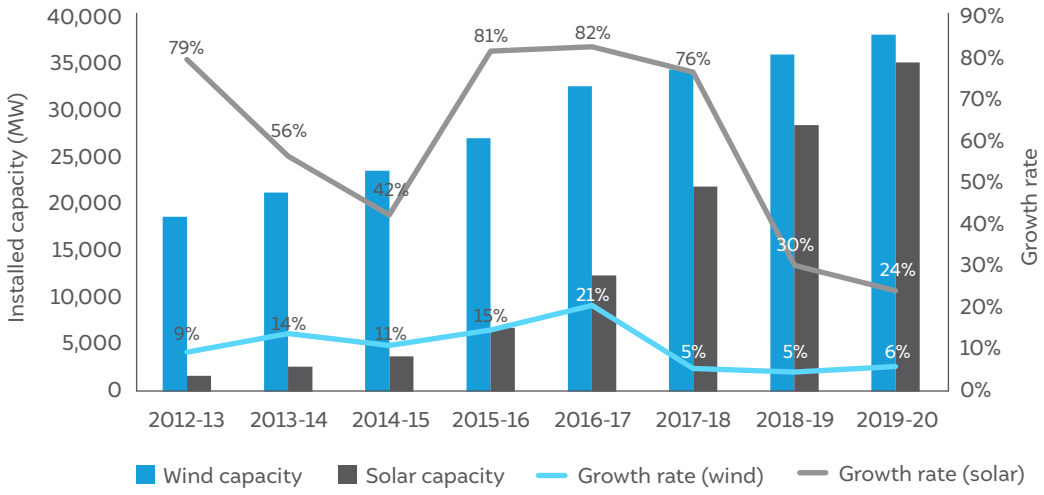
Acronyms

AAPERC	Andhra Pradesh Electricity Regulatory Commission
APPC	average power purchase cost
APSPDCL	Andhra Pradesh Southern Power Distribution Company Limited
AD	accelerated depreciation
APTEL	Appellate Tribunal of Electricity
BERC	Bihar Electricity Regulatory Commission
BREDA	Bihar Renewable Energy Development Authority
CAG	Comptroller and Auditor General of India
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
COVID-19	coronavirus disease 2019
CPP	captive power plants
CST	central sales tax
DCR	domestic content requirement
DRE	distributed renewable energy
EA	*Electricity Act 2003*
FiT	feed-in tariffs
FY	financial year
GBI	generation-based incentive
GERC	Gujarat Electricity Regulatory Commission
GST	goods and services tax
GUVNL	Gujarat Urja Vikas Nigam Limited
GW	giga watt
IEGC	*Indian Electricity Grid Code*
INR	Indian rupee
InSTS	intra-state transmission system
IRP	integrated resource planning
ISTS	inter-state transmission system
KERC	Karnataka Electricity Regulatory Commission
KPCL	Karnataka Power Corporation Limited
KREDL	Karnataka Renewable Energy Development Limited
LC	letter of credit
LTA	long-term access
MERC	Maharashtra Electricity Regulatory Commission
MNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
MoSPI	Ministry of Statistics and Programme Implementation

MPERC	Madhya Pradesh Electricity Regulatory Commission
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MW	mega watt
MWh	mega watt-hour
NAPCC	National Action Plan on Climate Change
NLDC	National Load Despatch Centre
NREDCAP	New and Renewable Energy Development Corporation of AP Limited
NSM	*National Solar Mission*
NTP	*National Tariff Policy*
NVVN	NTPC Vidyut Vyapar Nigam Limited
O&M	operation and maintenance
OEMs	original equipment manufacturers
PGCIL	Power Grid Corporation of India Limited
PIB	Press Information Bureau
POSOCO	Power System Operation Corporation Limited
PPA	power purchase agreement
PSA	power sale agreement
PSERC	Punjab State Electricity Regulatory Commission
PSM	payment security mechanism
PSPCL	Punjab State Power Corporation Limited
PV	photovoltaic
RBI	Reserve Bank of India
RE	renewable energy
REC	renewable energy certificate
RERC	Rajasthan Electricity Regulatory Commission
RES	renewable energy sources
RPO	renewable purchase obligation
SECI	Solar Energy Corporation of India Limited
SERC	state electricity regulatory commission
STU	state transmission utility
TOD	time of day
TSERC	Telangana State Electricity Regulatory Commission
TNERC	Tamil Nadu Electricity Regulatory Commission
UPERC	Uttar Pradesh Electricity Regulatory Commission
UPNEDA	Uttar Pradesh New and Renewable Energy Development Agency
VAT	value-added tax
VGF	viability gap funding
WTO	World Trade Organisation

Executive summary

In 2015, India announced ambitious targets for renewable energy—175 GW by 2022—one of the largest expansion initiatives in the world. Just four years later, at the United Nations Climate Action Summit 2019, the Prime Minister of India pledged to increase India's renewable energy (RE) capacity to 450 GW by 2030 (PIB 2019). India's journey to reaching these targets is at a critical juncture. The pace of capacity addition in utility-scale wind and solar power, which saw a rapid increase during 2014–2017, has since slowed down (Figure ES1).



Note: Figures for 2019-20 are only up to December 2019.

Figure ES1
Pace of capacity addition in wind and solar projects has slowed down

Source: CEA. 2019. Growth of Electricity Sector in India From 1947-2019. New Delhi: CEA, MoP; CEA. 2020. All India Installed Capacity as on 31 December 2019. New Delhi: CEA.

Private investment has shaped deployment trajectories so far. Today, solar and wind technologies have advanced, supply chains have strengthened, and expertise has developed. Despite the highs and lows, investor confidence in India's RE sector continues to remain robust. Further, many factors favour investments in RE. It has proved itself to be resilient in times of crisis, including the COVID-19 induced shocks in 2020. **There are strong signals that RE is a preferred choice, not just because of its green attributes, but because of its favourable cost economics for all stakeholders**.

Evolving policies at the Central and state level have played a significant role in building investor confidence. **From our study of the evolution of the sector, we learn that the initial policies were instrumental in propelling RE growth**. Every time a roadblock emerged, India has been successful in testing and identifying alternate approaches and solutions. Some of these innovative approaches include tariff bundling; encouraging solar parks to benefit from economies of scale; creating payment security mechanisms to address counterparty risks; encouraging solar–wind hybrid parks to improve utilisation factors; testing and introducing protocols and mechanisms such as security constrained economic dispatch (SCED), a real-time market (RTM), market based economic dispatch (MBED), and a green term-ahead market (GTAM) to optimise grid integration costs, etc. **However, a mixture of legacy issues and recent developments threaten the current business models and existing policies may no longer be sufficient to ensure continued growth of the sector**.

Both the Central government and the state governments have different spheres of influence (Table ES1) affecting the power sector. Hence, both Central and state policies need to be studied to understand the functioning and evolution of the sector.

CENTRE	STATES
Set the broader policy direction for the electricity sector under the *Electricity Act 2003* (EA).	Operate with independence, within the overarching framework set by the Centre.
Primary responsibility and control over the national grid. Setting technical standards for the grid to be maintained by the states.	Directly influence land availability, grid connectivity, and build-out of intra-state transmission and distribution infrastructure. Determine applicable charges to use infrastructure.
Set bidding guidelines for power procurement.	Power procurement for supply to consumers.
Set renewable purchase obligations (RPOs).	Set tariffs and cross-subsidy levels that affect end consumer and hence consumption of power.

Table ES1
Spheres of influence of the Centre and states

Source: Authors' analysis

Central policies: kickstarting solar but leaving wind behind

The initial drivers for RE capacity addition were fiscal, financial, and tax incentives, like accelerated depreciation, generation-based incentives, and feed-in tariffs (FiTs) determined by state commissions. Wind turbine manufacturers were the first movers. The de-licensing of generation under the *Electricity Act 2003* (EA) set the stage for private investments in RE.

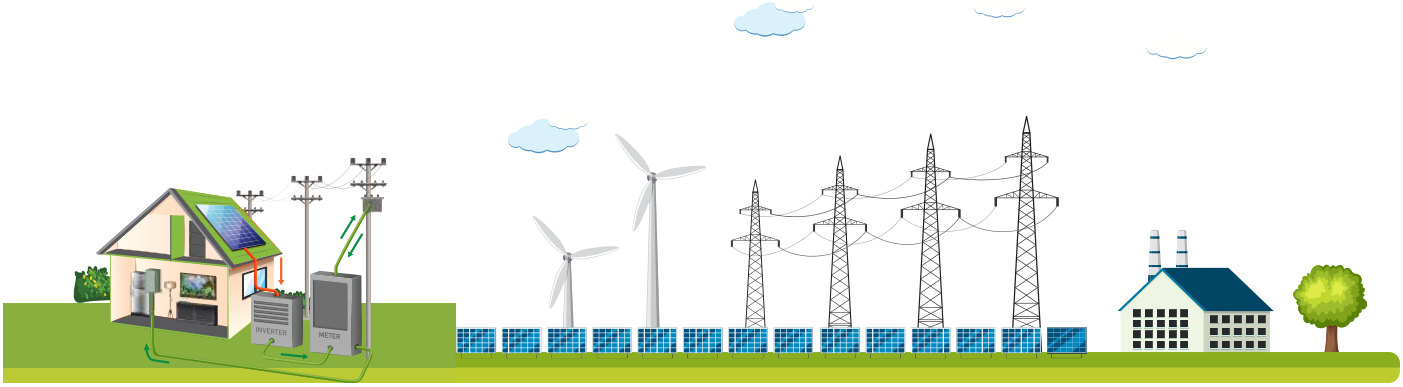
However, the introduction of the *National Solar Mission* (NSM) in 2010 brought about a massive jump in solar capacity addition and turned the spotlight to utility-scale RE projects. The NSM addressed offtake and payment risks, with creditworthy trading intermediaries signing long-term power purchase agreements (PPAs) with project proponents. The payment and offtake risks arose from the higher costs of solar power as opposed to prevailing conventional power tariffs and poor financial health of distribution companies or discoms (primary bulk procurers of power). The NSM progressed from a FiT regime to competitive bidding and was successful in increasing solar capacity deployment in the country from just 2 MW in 2007–08 to 3,744 MW in 2014–15 (CEA 2019).

Competitive bidding also became mandatory for wind power from 2017. However, it did not see the same level of success as solar. While tariffs did come down, the rate of growth of wind capacity also reduced (see Figure ES1) because the low tariffs disrupted the business model of existing players who were also equipment manufacturers. The future trajectory of wind deployment remains to be seen, with solar tariffs continuously falling and the evolution of the models adopted by independent RE power producers.

Critical requirements that Central policies have not fully tackled are those of timely procurement of suitable land, timely construction of evacuation and transmission facilities, and minimising curtailment. These are also the areas in which states have significant roles and authority. The Ministry of New and Renewable Energy (MNRE) introduced the *Solar Park Scheme* in 2017 to address land-related issues and fast-track deployment through land aggregation and access to the Central transmission network. However, the scheme's target of setting up at least 50 solar parks by 2022, is still distant (MNRE 2020). It has been unable to solve coordination issues, and the ability of the Centre in developing schemes to address land issues is limited.

Inadequate demand creation mechanisms

Initially, in the absence of cost-competitive tariffs, large buyers of power were mandated to purchase RE through renewable purchase obligations (RPO) under the *National Tariff Policy, 2006*, in a bid to create demand for RE. The EA authorises state regulators to set their own targets and regulations on RPOs. In subsequent years, the Ministry of Power (MoP) and the MNRE made multiple attempts to nudge states to set higher RPO targets and ensure strict compliance. However, our analysis shows that there have been considerable lags in both.



We find that the reasons for middling compliance with RPO targets are:

- Mismatch between the incentives for a RE-rich state to host an RE power plant and a RE-deficit state to buy either power or RE certificates (RECs) from these power plants. This has resulted in RE-rich states having the highest compliance with RPOs, while RE-deficit states do not see sufficient benefits or strict enforcement to be pushed to fully comply with their RPOs. This has, in turn, affected the ability of even RE-rich states to increase their rates of deployment and RPO compliance.
- Enforcement mechanisms are weak. A framework for regular monitoring of compliance is absent. Enforcement of RPO by state regulators is not strict enough.

Currently, apart from setting up inter-state projects, there are no other mechanisms to equitably share the costs of hosting RE projects to supply power to other states. Further, despite RE tariffs attaining grid parity, investors continue to rely on RPOs for demand creation, indicating deeper causes obstructing further RE penetration in markets. Inadequate compliance of Central policies by states also point to certain legitimate state concerns that may not have been addressed (Figure ES2).

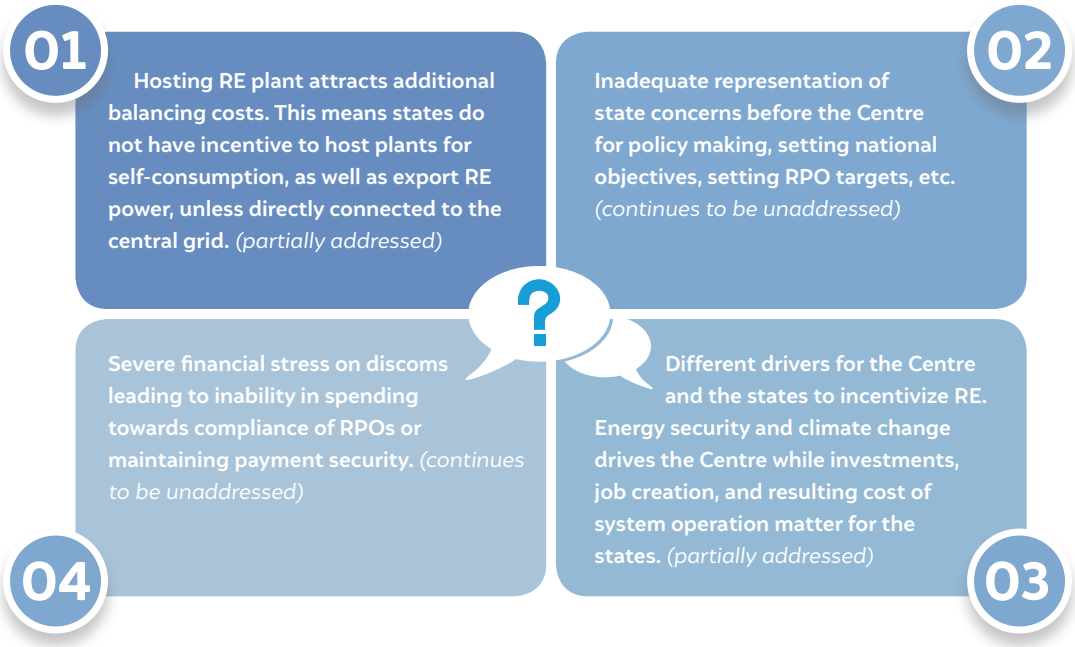


Figure ES2
State concerns that remain unaddressed in Central policies till 2014 and beyond

Source: Authors' analysis

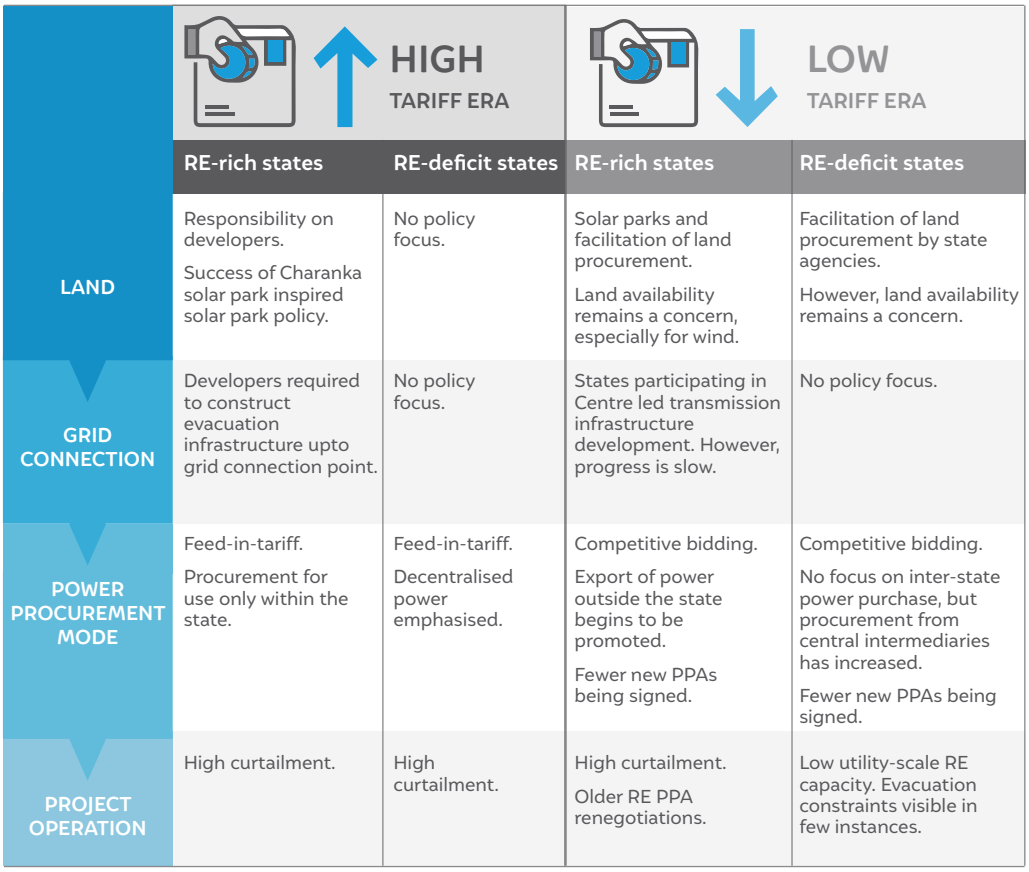
Centre and states have different drivers for promoting RE

We also note that the main drivers for promoting RE are slightly different for the Centre and the states. While the Centre initially emphasised energy security and climate change mitigation, the states were keen to obtain the benefits of private investment and job creation. It is only lately that the Centre has also emphasised the job creation and domestic manufacturing potential in RE.

Most RE-deficit states are inclined to meet their RPO targets mostly through local deployment, even if the local deployment is inadequate to meet the targets. This is particularly true for solar, which is a more abundant and widespread resource throughout the country. State-level RPO regulations, compliance provisions, participation in REC markets, and achievement levels demonstrate this. However, with stricter enforcement measures and falling tariffs, the inter-state transmission system (ISTS) procurement of wind and solar power has seen a rise.

Lack of enthusiasm of states in the high-tariff era

State-level institutions have the power and responsibility to ease land procurement for projects, facilitate connectivity to the grid, enable the construction of transmission infrastructure, and ensure offtake of the power generated from the plants. From our analysis of the RE policies of eight RE-rich states and three RE-deficit states, we find that policies vary widely on these fronts (Figure ES3).*



	HIGH TARIFF ERA		LOW TARIFF ERA	
	RE-rich states	RE-deficit states	RE-rich states	RE-deficit states
LAND	Responsibility on developers. Success of Charanka solar park inspired solar park policy.	No policy focus.	Solar parks and facilitation of land procurement. Land availability remains a concern, especially for wind.	Facilitation of land procurement by state agencies. However, land availability remains a concern.
GRID CONNECTION	Developers required to construct evacuation infrastructure upto grid connection point.	No policy focus.	States participating in Centre led transmission infrastructure development. However, progress is slow.	No policy focus.
POWER PROCUREMENT MODE	Feed-in-tariff. Procurement for use only within the state.	Feed-in-tariff. Decentralised power emphasised.	Competitive bidding. Export of power outside the state begins to be promoted. Fewer new PPAs being signed.	Competitive bidding. No focus on inter-state power purchase, but procurement from central intermediaries has increased. Fewer new PPAs being signed.
PROJECT OPERATION	High curtailment.	High curtailment.	High curtailment. Older RE PPA renegotiations.	Low utility-scale RE capacity. Evacuation constraints visible in few instances.

Figure ES3
Developments across project deployment and operations

Source: Authors' analysis

Pre-2014, when RE tariffs were still quite high, the policies of even the RE-rich states did not provide a lot of support to private investors in the sector. The responsibility of obtaining land was placed on the developers themselves. Even though the states notified their own RE policies, they did not meet their targets. States like Gujarat and Rajasthan saw considerable capacity deployment under the NSM in this period, owing to the easy availability of land and high wind and solar potential. Charanka Solar Park in Gujarat, set up in 2012, was successful in attracting investors. This inspired the push towards establishing more solar parks in the country. Because evacuation infrastructure was inadequate, state policies required developers to finance and construct the required infrastructure, at least till the interconnection point.

* The RE-rich states covered are Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, and Telangana and the RE-deficit states covered are Bihar, Punjab, and Uttar Pradesh.

However, beyond the interconnection point, transmission infrastructure continues to remain a challenge. This, coupled with the financial difficulties of the distribution utilities, led to the severe curtailment of RE power. The state policies only incentivised RE project development that supplies power to their own state discoms. Some states, like Maharashtra, Karnataka, and Andhra Pradesh, even made it mandatory to sell electricity only to discoms within their borders and obligated entities within the state.

Lowering tariffs corresponded with increased state promotion of RE, but legacy issues came in the way. The year 2014 marked the beginning of a significant departure from the past. Many developments favoured the RE sector, and Central and state policies found greater synergy. As RE tariffs fell steeply, states moved to incentivise large-scale projects, including solar parks. They sought to capitalise on investor interest in this sector, and states like Andhra Pradesh extended the incentives available to other industry, like land allotment, facilitation of clearances, tax incentives, etc., to RE power plants. There was a shift in focus from setting up projects for self-consumption to supporting projects for the export of power to other states. Rajasthan, Maharashtra, and Andhra Pradesh provided developers with incentives, such as time bound open access approval, facilitating land procurement, exemption on charges, etc., for setting up inter-state projects. States also turned their attention to facilitating deployment, and many policies tasked their state agencies with facilitating revenue land procurement for the planned and systematic development of projects.

However, the PPAs signed in the high-tariff era have become a sore thumb for RE-rich states. These agreements, which were signed for 20–25 years, must be honoured by discoms even though cheaper power is available. States attempted to push back against these obligations as early as 2014, when Gujarat moved to renegotiate tariffs. Andhra Pradesh made the most recent attempt in 2019. These moves by states have added to the set of risks to be mitigated. In all these cases, the states were ultimately unsuccessful in renegotiating tariffs as their actions were struck down in courts or due to interventions by the Central Government. However, states continue to employ other means, like curtailment, to reduce their obligations under expensive contracts. Considering that the state bears these costs at the end, we need a more equitable solution that can ensure a fair transition for all players, without creating uncertainty for investors.

In RE-deficit states, state policies emphasised decentralised power as opposed to utility-scale projects. Their primary drivers were the RPO targets and the potential for private investment. For example, Punjab and Bihar focused on ensuring payment security and ease of doing business in their states. The existing policies of RE-deficit states do not exhibit intention to increase their inter-state purchase of RE, for example, they do not lay out any roadmap or explicit commitment of procuring power from any of the trading intermediaries like Solar Energy Corporation of India Limited (SECI) or from other states to meet their RPOs. Any purchase made is unplanned and this prevents RE-rich states and intermediaries from accurately forecasting demand.

Varied and evolving challenges have to be tackled to achieve 450 GW RE target by 2030. The existing policies have resulted in tremendous outcomes, though short of the targets we set for ourselves. As we advance in our energy transition journey, it is apt that we incorporate the policy lessons from the journey so far (Figure ES4).

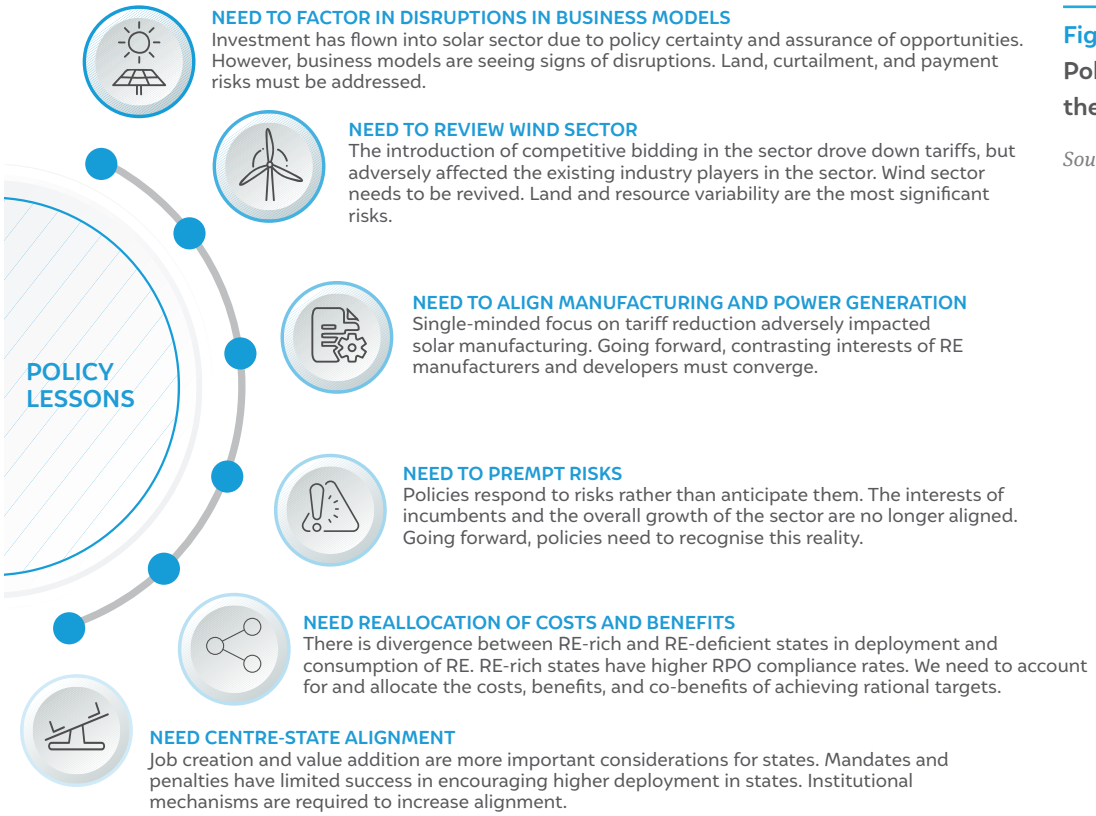


Figure ES4
Policy lessons from the journey so far

Source: Authors' analysis

India's electricity sector is grappling with issues, both legacy and novel. Legacy issues, affecting discom financial health, is an obstacle to further growth of the RE sector. Further, new market and technological advancements like storage and new trading platforms at the doorstep have the potential to bring economy and choice in power procurement and support the energy transition. Growth pathways must, hence, emphasise market-based choices for generation technologies and market-driven procurement and dispatch of electricity.

The inhibitions and counterproductive steps of the state governments, like renegotiations of PPAs, rolling back incentives, etc., are reflective of genuine operational and financial implications (Figure ES5). State actions show the evolving nature of challenges in RE deployment. High tariffs were the initial roadblock, which were then followed by infrastructural and operational challenges, such as land availability, transmission, and grid integration issues, and other legacy issues that soon became starkly visible.

With an increasing share of RE in their energy mix, RE-rich states have improved their capabilities to manage RE variability, harness system flexibility, and forecast and schedule demand and supply. However, grid integration continues to be a challenge. There has been some push-and-pull between state regulators, system operators, and generators around bearing additional costs relating to forecasting, scheduling, and deviation settlement. The contentions relate to the availability of forecasting methods, formulae for penalties, the status of aggregation, error bands, and permissible revisions. Forecasting and scheduling add to the costs borne by host states.

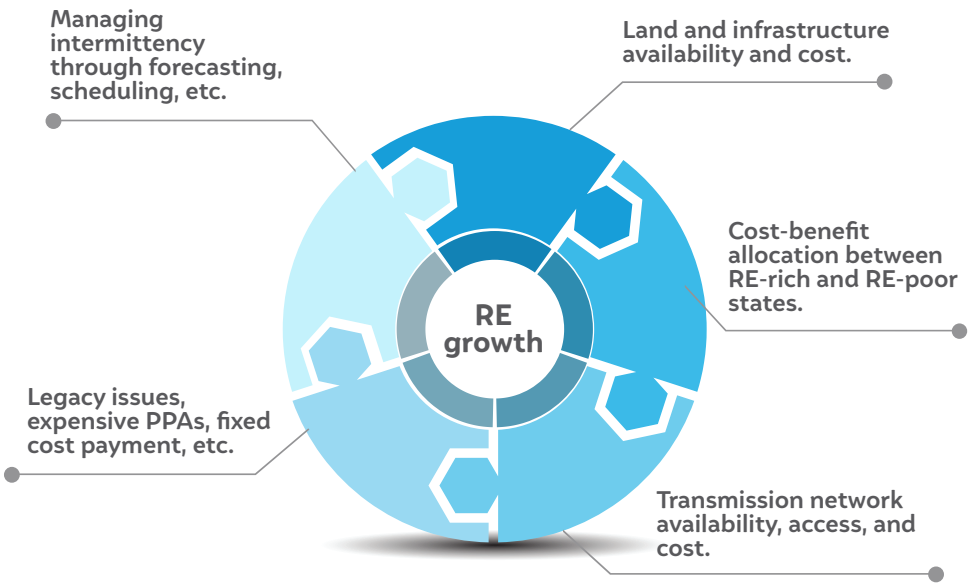


Figure ES5
Operational and financial challenges in increasing RE's share in the energy mix

Source: Authors' analysis

Policies must pre-empt risks and support transition to a market-driven sector. Going forward, policy decisions must enable the overall growth of the sector rather than target scale through incumbent models. The incumbent business models and market mechanisms are at the cusp of disruptions caused due to natural market progression, technological advancement, and discoms' responses in meeting their challenges (Figure ES6).

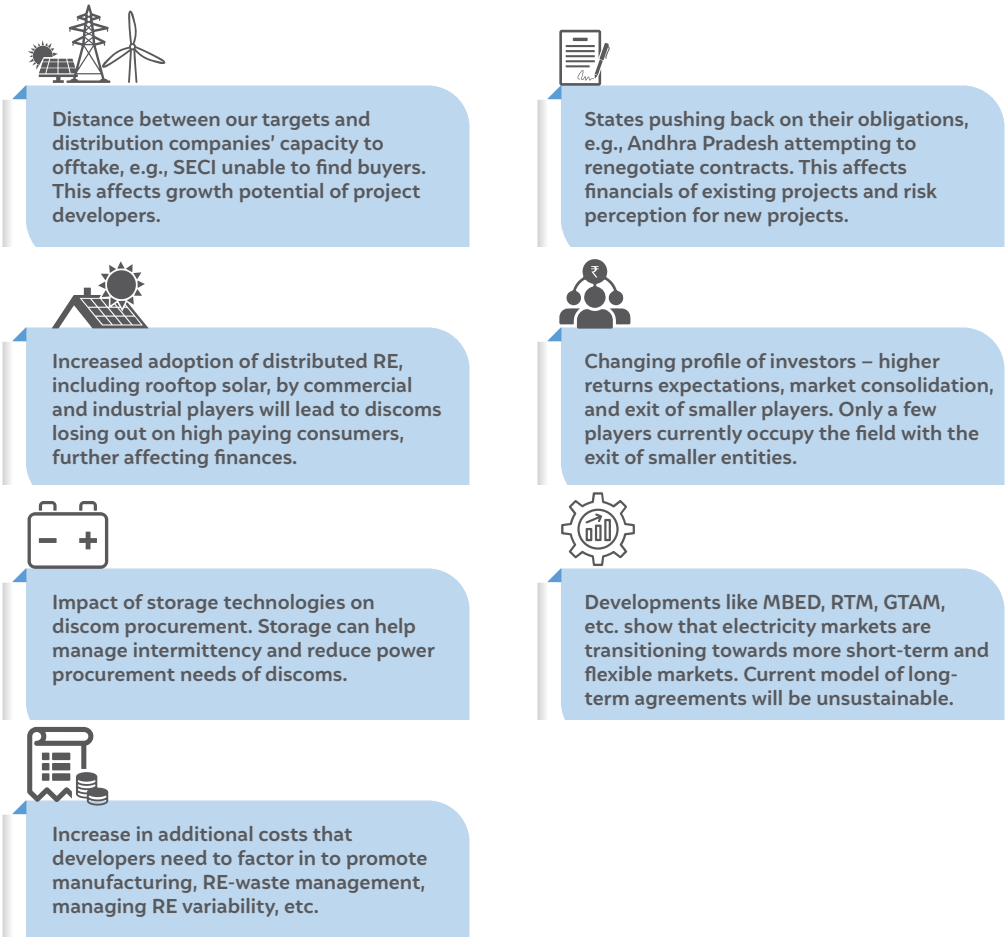


Figure ES6
Signals of disruption to the existing business models of investors

Source: Authors' analysis

Unlocking the demand for RE and capitalising on the immense opportunity that it presents requires innovative solutions that account for legacy issues and yet are forward looking. The policies must anticipate these changes and prepare for them while investors need to hedge their bets and modify ways of doing business to continue to lead the energy transition.

We recommend the following changes to the policy framework. These are based on policy lessons from the study of the sector's evolution and anticipate the power sector transition that is upon us.

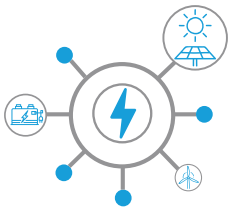
- **Centre–state and inter-state alignment is essential**. Collaboration and coordination need to be prioritised instead of mandates and penalties. Costs and benefits for all actors must be clearly accounted for. An institutional framework must be created that increases Centre–state and intra–state coordination, cooperation, and engagement. Resource planning, budgetary allocations, and policy priorities should be outcomes of these formalised processes.
- **Institutional framework must build in planning, coordination, and analytical requirements**. Data collection, management, and analysis should be systematic. Monitoring and reporting practices should be robust and continuous.
- **Addressing counterparty risks will require transformation of RE procurement models**. Market mechanisms allow for the cost recovery and benefit sharing. Capacity deployment must happen based on market mechanisms and market determined price signals. PPA terms must reduce and sole priority in power procurement should be efficiency and flexibility for discoms. Power procurement as a mechanism to support RE or any future technology will not be sustainable in India till discom finances are sorted out.
- **Contrasting interests of RE manufacturers and developers must converge**. Supply chains must be diverse and resilient to shocks. Investors must innovate and policy must support backward and forward integration in RE supply chains.
- **Accelerating the flow of capital into the sector requires new investment models** that can tap into diverse sources of finance and simultaneously enable the transition of the energy markets.

Between 2016 and 2018, solar capacity in RE-rich states tripled, recording a consecutive year-on-year growth rate of more than 70 per cent.

Image: iStock

1. Introduction

From approximately 21 GW of utility-scale solar and wind capacity at the end of financial year (FY) 2012 (1 GW solar and 20 GW wind), India achieved 70 GW capacity by 31 September 2020 (32 GW ground-mounted solar and 38 GW wind) (MNRE 2020b). This growth story is undoubtedly remarkable. Solar and wind energy have also proved to be resilient in times of crisis, including during the COVID-19 pandemic in 2020, and have continued to attract investment and attention from policymakers.



Storage, new market platforms, and a realisation of the benefits of decentralising power generation have the potential to impact the utility-scale sector in new and unexpected ways

However, the story of India's solar and wind power generation is at a critical juncture. The rate of growth of capacity addition has been slowing down (see Figure 1). India's path to reaching an installed capacity of 160 GW by 2022 (100 GW for solar and 60 GW for wind) and 450 GW by 2030 is hindered by complex challenges. They arise from the precarious financial health of distribution companies (discoms) (Garg and Shah 2020); the investment required to build associated infrastructure; the dynamics of increasing market penetration of renewable energy (RE) while making fixed cost payments for thermal projects (PEG 2018); direct and indirect energy subsidies in favour of conventional fuels;[1] and difficulties in balancing the priorities of the Centre and states (Tongia, Harish, and Walawalkar 2018). Some of these challenges are not new, especially the discom crisis and those of inadequate infrastructure. However, their impact on the growth of RE is significant. For instance, discoms are finding it challenging to continue to pay fixed costs for thermal assets while complying with the must-run status of RE. Forecasting and scheduling are now critical for the integration of variable RE power with the grid. These challenges in consuming the power generated from RE plants dissuades discoms from increasing their RE portfolio and hampers revenue from operating assets and further capacity addition. These issues must be addressed on a priority basis to scale up RE capacity deployment and utilisation levels. New technologies like storage, new market platforms, and a growing realisation of the benefits of decentralising power generation also have the potential to impact the utility-scale sector in new and unexpected ways.

1. These subsidies include oil and gas subsidies and coal subsidies, by way of concessional taxes, non-compliance or non-enforcement of pollution regulations, direct benefit transfers on consumption, public distribution at subsidised rates, etc. (Garg, Viswanathan, et al. 2020).

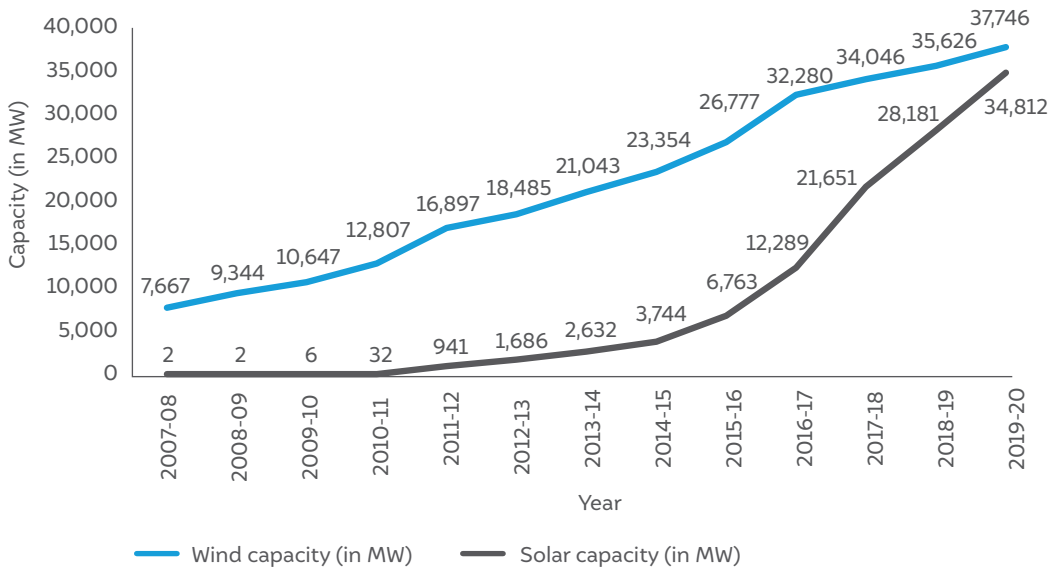


Figure 1
The rate of growth in solar and wind capacity addition is slowing down (2008–2020)

Source: CEA. 2019. Growth of Electricity Sector in India From 1947-2019. New Delhi: CEA, MoP; CEA. 2020. All India Installed Capacity as on 31 December 2019. New Delhi: CEA

Before we embark on a policy analysis to determine the best tools to address the above challenges, we look back and study the sector's evolution and evaluate the policies' impact on RE. As RE growth slows and faces newer challenges, it is the right time to conduct such an analysis. Such an exercise will enable us to understand what are the gaps in the existing policies that need to be mended to adapt to the changing dynamics and yet achieve our objectives. The legislative architecture, along with a diversity of stakeholders and their objectives and interests, makes power sector policymaking and governance a complex space. Therefore, policy evaluation can be done through multiple lenses. This study focuses on the evolving risks for project developers in the bulk RE procurement market and the policy response of the Centre and states to those risks.

We focus on the bulk power procurement market because RE growth has been led by utility-scale wind and solar energy projects over this decade, with discoms being the largest power purchasers.[2] While there are dedicated schemes and programmes for the scaling up of other renewable energy sources as well as for distributed RE (DRE), they are of a different nature than those of utility-scale RE since they operate at a more decentralised level.[3] Further, the levels of risk and the challenges facing private investors are markedly different for utility-scale solar and wind on the one hand, and distributed and other RE resources on the other. However, we will briefly discuss the impact of growth of DRE on utility-scale RE in our last section.

This study focuses on the evolving risks for project developers in the bulk RE procurement market and the policy response of the Centre and states to those risks

1.1 Methodology

We collated all Central and state policy documents from 2009–2019. We then created a comprehensive framework to review each Central and state policy. For each policy, we recorded the key drivers; stated purpose and objectives; targets; key features and incentives provided; budgetary outlays (if any); institutional arrangements; beneficiaries; stated reasons for amendments; and risks that the policy intended to mitigate. For Central policies, we also identified the role required of the state governments. The framework helped us examine the

2. Though the rooftop industry continues to mature with multiple market players, innovative business models, and new financing structures.

3. This is a consequence of the failure to establish competitive markets for RE even though it is among the aims of the *Electricity Act, 2003* (EA). The gap in the official data, which does not capture captive power projects, demonstrates this failure.

alignment between Central and state objectives and targets, and inconsistencies between and within the policies. The key features of the policies we studied are set out in Tables A4–A6 of the Annexure. We also conducted extensive secondary research to assess the actual performance of these policies, actions and developments on the ground, and the risks that they addressed.

Our study contributes to policy research as it combines a national-level analysis with a close examination of the policies and their impacts at the state level. RE resources are not uniformly spread across the country, and some states have performed better than others. We cover the following RE-rich and RE-poor states in this study:

Solar and wind-rich states

- Andhra Pradesh
- Gujarat
- Karnataka
- Madhya Pradesh
- Maharashtra
- Rajasthan
- Tamil Nadu
- Telangana

Solar and wind-deficit states

- Bihar
- Punjab
- Uttar Pradesh

The RE-rich states are the top eight in terms of resource potential and capacity addition in wind or solar power or both. For the RE-poor areas, we have picked states that are not only deficit in solar and wind but also lack alternative power sources, like hydro or coal, though they have biomass-based power capacity. In all these states, the power supply position, access to energy, and power sector infrastructure have evolved over the last decade.

In this report, we begin by briefly mapping out the institutional framework of the power sector to understand the different agencies that implement and/or hinder the implementation of these policies. We then trace the evolution of the Central policies, which largely focus on supply-side risks. Next, we evaluate the demand-side measure, renewable purchase obligations (RPOs). Subsequently, we trace the key drivers and policy focus and evaluate policy performance, first in the RE-rich states and then in the RE-deficit states. For the state-level analysis, we divide our assessment into policies pre- and post-2014, since 2014 marked a departure from the previous years in policymaking activity and its consequences. We assess the policies based on the risks they were successful in addressing, the risks that they left unaddressed, and how they measure up to the next generation of challenges. We conclude by pointing to the points of transformation of the sector and the nature of required policy focus going forward.

We assess the policies based their success in addressing risks, the risks they left unaddressed, and how they measure up to the next generation of challenges

1.2 Institutional framework

The long history of policymaking in the power and RE sector has led to a proliferation of agencies and bodies (see Table 1). The legislative architecture under the *Electricity Act, 2003*, (EA) allows states to autonomously undertake activities such as target-setting; framing and enforcing regulations; developing and implementing policy; and setting up institutional mechanisms.

However, the Central Government sets the policy direction through its *National Electricity Policy*, the *National Tariff Policy*, and the *National Electricity Plan* which the state governments and regulators are required to follow. These policy documents cover electricity planning, project bidding and procurement, tariff structures, RPOs, and optimum utilisation of resources and infrastructure.

The Central Electricity Regulatory Commission (CERC) and state electricity regulatory commissions (SERCs) have parallel jurisdictions and functions with respect to promoting the generation of RE, tariff determination, and dispute resolution. Typically, CERC does not have the authority to provide policy guidance or issue directions to the SERCs. However, SERCs are bound by the technical rules, guidelines, and standards set by the CERC in the *Indian Electricity Grid Code* (IEGC), based on which they prepare their own state grid codes.

Table 1
The institutional structure of the power sector

Source: Authors' analysis

	Central	Regional and State/ Union Territory level
Ministries	Ministry of Power (MoP)–Nodal ministry for the power sector. Prepares the *National Electricity Policy*, the *National Tariff Policy*, and the *National Electricity Plan*. Ministry of New and Renewable Energy (MNRE)–Nodal ministry for increasing RE deployment in the country.	Relevant energy departments and ministries of the states/ union territories (UT).
Regulators	Central Electricity Regulatory Commission (CERC)–Tariff determination, dispute resolution, preparing the *Grid Code* and *Supply Code* (to be followed by the operating entities), promote RE, etc. Appellate Tribunal for Electricity (APTEL)– Appellate body for dispute resolution.	State Electricity Regulatory Commissions (SERC) and Joint Electricity Regulatory Commissions (JERC)–Tariff determination, dispute resolution, preparing the grid code and supply code (to be followed by the operating entities), promote RE, etc.
Statutory/ autonomous bodies	Central Electricity Authority (CEA) National Load Dispatch Centre (NLDC) Bureau of Energy Efficiency (BEE) Power Financial Corporation (PFC), REC Limited, Indian Renewable Energy Development Agency (IREDA)– Provide financing and implement schemes for RE projects. National Institute of Wind Energy (NIWE), National Institute of Solar Energy (NISE), Central Power Research Institute (CPRI), etc.– Research and development institutes to estimate RE potential in the country and evaluate the latest technologies in power generation.	Regional Load Dispatch Centres (RLDC) Regional Power Committees State Load Dispatch Centres (SLDC) state nodal agencies (SNAs)–implement RE schemes and oversee RE deployment at the state.
Operating entities	Generation utilities, e.g., NTPC, NHPC, Damodar Valley Corporation (DVC) Transmission utility– Power Grid Corporation of India Limited (PGCIL) Independent power producers– projects connected to the Central grid Trading/Market entities– NTPC Vidyut Vyapar Nigam (NVVN), Solar Energy Corporation of India (SECI), etc.	Generation utilities– state-owned generators Transmission utilities Distribution utilities Independent power producers–projects connected to state grids Trading/market entities

2. Evolution of Central policies

The trajectories of wind and solar have been varied yet have affected each other. Often similar policies have had widely varying impact on wind and solar. This section briefly describes the policy scenario pre-2010 and then narrates the policy evolution in the last decade (See Table 2 for brief description of the policies). The section concludes with the assessment and lessons from this journey.

2.1 Pre-2010 – private-sector participation and prioritising renewables

The initial drivers for new and renewable energy were the successive oil crises in the 1980s that compelled the government to reduce the country's dependence on imported oil and focus on alternative sources of power. RE was also one of the strategies to combat climate change.

The government has made accelerated depreciation (AD) of 100 per cent available for both wind and solar power generation since 1994 to incentivise RE capacity deployment.

The enactment of the EA also intended to transform the state-controlled electricity sector into a competitive electricity market with private players regulated by the state (Kumar and Chatterjee 2012). Promoting environmentally benign policies is a stated objective of the EA, and it envisages renewable sources of energy as a significant contributor to the electricity mix. The de-licensing of electricity generation under the EA, and the mandating of power procurement through competitive bidding under the *National Tariff Policy, 2006*, (NTP 2006) were game-changing reforms towards increasing private-sector investments in power generation. The NTP 2006 permitted discoms to procure RE at tariffs fixed by their respective SERCs, also called feed-in tariffs (FiTs).[4] The SERCs determined the FiTs based on their tariff determination regulations. Central regulations, in turn, guided these regulations. The CERC notified the first guidelines for tariff determination in 2009 [*(CERC (Terms and Conditions for Tariff Determination from Renewable Energy Sources) Regulations, 2009)* (Tariff Determination Regulations)]. The first generic tariff order determined utility-scale solar PV tariff of INR 18.44 and wind power tariffs of INR 5.63, 4.90, 4.17, and 3.75 (for Wind Zones 1, 2, 3, and 4 respectively).[5]

The policies' cumulative effect was that by 2010, RE accounted for 9.7 per cent of the available installed power generation capacity in the country (MoP 2010). This capacity was mainly wind energy and bagasse-based cogeneration.[6] Successful demonstration projects led by the ministry and collaborations with global technology providers were key triggers of establishment of domestic manufacturing and supply chain in India (Ganesan et al. 2014). The AD incentive was particularly useful for private entities, who set up distributed and small-scale wind turbines to avail of it. This domestic demand also supported development of wind manufacturing capacity in India (Sud 2015; Idam Infra 2016).

Solar power, however, was lagging. Despite the available incentives, there were no immediate responses from investors, developers, and most state governments, primarily due to high technology costs. Till March 2010, solar capacity remained at 6 MW. Subsequently, significant policy actions leading to cost reductions and investment commitments marked an upward growth trajectory (see Figure 1).

Policy/scheme	Technology	Risks and barriers targeted to be mitigated/ benefits
Promotion of RE, competitive bidding, and RPO in *National Tariff Policy, 2006*		Creating demand for expensive RE power through RPOs. Policy certainty and continued government support for promotion of RE.
National Action Plan on Climate Change, 2008		Creating demand for expensive RE power through RPOs. Policy certainty and continued government support for promotion of RE.
National Solar Mission, 2010		Managing offtake risk by signing long-term power purchase agreements (PPA) and providing payment security. Policy certainty and continued government support for promotion of RE.

Table 2
Evolution of Central policies for utility-scale wind and solar energy – 2010–2019

Source: Authors' analysis


Wind


Solar

4. This flexibility was required because RE tariffs at this time could not be compared to those of conventional power. However, the NTP 2006 also noted that RE power would eventually have to compete with power from other sources at their full cost.
5. Order dated 3 December 2009 issued by CERC in Petition No. 284/2009 titled *Determination of Generic Levellised Generation Tariff*, http://www.cercind.gov.in/2009/November09/284-2009_final_3rdDecember09.pdf.
6. Due to its economic co-benefits, bagasse-based cogeneration developed mostly in the sugar producing regions of India.

Table 2 contd

Policy/ Scheme	Technology	Risks and barriers targeted to be mitigated/ benefits
Introduction of renewable energy certificates (REC), 2010		Creating mechanism to broaden the demand base.
Must-run status in *Grid Code, 2010*		Addressing transmission and curtailment risk.
GBI for grid interactive wind power projects, 2009 and 2013		Financial incentives for setting up wind power projects.
NSM Phase I Batch II (Bundling scheme), 2011		Managing offtake risk by signing long-term PPAs and providing payment security. Lowering tariff for discoms by bundling thermal and solar power.
NSM Phase II Batch I, 2013 (VGF Scheme)		Managing offtake risk by signing long-term PPAs and providing payment security. Low tariffs for discoms through competitive bidding. Financial support for project developers.
Green Energy Corridor project, 2013		Addressing transmission risk and offtake risk by reducing congestion on grid.
Scheme for solar park development, 2014		Delay and roadblocks in land identification, aggregation, and acquisition. Delays in obtaining approvals and clearances. Risk of conflict with environment or social impact assessment. Lowering cost of supporting infrastructure and services.
NSM Phase II Batch III, 2015		Managing offtake risk by signing long-term PPAs and providing payment security. Low tariffs for discoms through competitive bidding.
National Tariff Policy, 2016		Creating demand for RE by setting common national trajectory for RE's share in consumption.
NSM Phase II Batch IV (State specific VGF scheme), 2016		Managing offtake risk by signing long-term PPAs and providing payment security. Low tariffs for discoms through competitive bidding. Financial support for project developers.
Commencement of competitive bidding in wind, 2016		Managing offtake risk by signing long-term PPAs and providing payment security. Low tariffs for discoms through competitive bidding.
MoP's order on waiver of inter-state transmission charges and losses, 2016		Financial incentive for export of power outside the state.
MNRE's policy for re-powering wind projects, 2016		Support to utilize wind resources efficiently.
Competitive bidding guidelines for solar, 2017		Managing offtake risk by signing long-term PPAs and providing payment security. Low tariffs for discoms through competitive bidding.

Table 2 contd

Competitive bidding guidelines for wind, 2017		Managing offtake risk by signing long-term PPAs and providing payment security. Low tariffs for discoms through competitive bidding.
MoP and MNRE's order on opening and maintaining adequate LC as PSM under PPAs by distribution licensees, 2019		Addressing payment risk from discoms.

2.2 Post-2010 policies for solar

The *Jawaharlal Nehru National Solar Mission* (NSM), notified in January 2010, was a turning point in the RE story. The NSM was one of eight missions developed as part of India's *National Action Plan on Climate Change* (NAPCC). Its primary objective was to develop and deploy solar energy technologies, including utility-scale, distributed solar, and solar thermal energy. It targeted the entire ecosystem of solar energy deployment and included measures to support research and development, human resource development, the increase of technical capacity and awareness of these technologies. Such measures included providing technical assistance; training; customs and excise duty concessions/exemptions on capital equipment, critical materials, components, and project imports; ease of doing business; and enabling domestic manufacturing through exemptions and incentives. The NSM laid out a phase-wise approach until 2022 that brought about policy certainty.

The risks for investors and financiers were considerable. The upfront costs were high, while returns were not guaranteed (since the technology had not yet proven its track record within India). Further, even if discoms were willing to sign power purchase agreements (PPAs), low connectivity and transmission capacity hindered offtake. However, more significant was the payment risk, arising due to the poor financial health of discoms. The payment risk adds as much as 1.07 per cent of the additional risk premium to the cost of debt (Atal and Shrimali 2018).

To counteract the payment risk, the NSM devised an arrangement whereby NVVN (NTPC Limited's trading arm) would purchase power from the solar developer for onward sale to state discoms under a power sale agreement (PSA). The standard PSA included a clause stating that in case the discom failed to make timely payments, NVVN could invoke the tripartite agreement signed by the Central Government, the relevant state government, and the Reserve Bank of India (RBI).[7]

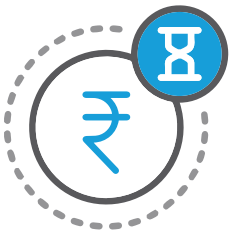
The NSM envisaged that the key driver for promoting solar power would be the RPO mechanism, with the FiT and PPA duration determined by the CERC. It aimed to achieve parity of solar and coal tariffs by 2030.

NSM was to be implemented in three phases. The target for Phase I, which lasted till 2013, was 1,000 MW. The initial target of 20 GW was increased to 100 GW in 2015, to be achieved by December 2022. As of November 2020, 36,910.49 MW of solar power capacity has been installed (MNRE 2020b).

7. Article 6.4.8 of the Standard Draft PSA between NVVN and Distribution Utility (2010), http://www.nvvn.co.in/DRAFT%20PSA_NVVN-Discom_March%2029,%202010.pdf. In case a state discom defaulted on any payment obligations, NVVN could invoke this agreement and the pending dues could be routed to it through the RBI. The Centre can then deduct the relevant amount from the annual fund transfers from the Centre to the state, which is the most significant source of state government revenue.

Phase I

The guidelines to operationalise the first phase of NSM were notified in July 2010. Many projects had already begun construction before this notification. Such projects were permitted to migrate to the NSM and sign PPAs with NVVN. The NSM selected fresh projects based on the discounts that the developers were offering on CERC-approved tariffs applicable as of the date of submission of their applications. These projects needed to be commissioned within 12 months of the developers signing the PPA. In Phase I, the NVVN could bundle unallocated conventional power procured from the NTPC and sell it to discoms to average the tariffs.



JNNSM Phase I was successful in achieving its target of 1000 MW grid-connected power. However, developers and financiers raised concerns about delayed payments even before the notification of Phase II guidelines

For payment security, the standard PSA required the buying utility to open a six-month letter of credit (LC) backed by an escrow account in favour of NVVN. Further, under an order dated 30 June 2011, the MNRE created a separate payment security fund of INR 486 crore. However, despite the implicit state guarantee, transaction advisers suggested that investors be cautious. The standard PPA was not considered bankable (Sustainability Outlook 2010; Jog 2013). High project costs and unproven technology increased the risk. Developers were also concerned that the PPA prices could be reduced during its duration.

Additionally, domestic content requirement (DCR), that required polycrystalline photovoltaic (PV) cells and modules being used to be manufactured in India, was imposed on NSM projects. The DCR distorted the market towards other PV technologies like thin film (Paliwal and Hamberg 2015), and adversely affected the existing manufacturing base in India that predominantly manufactured polycrystalline PV. DCR would have constrained developers' technology choices and did not benefit the domestic manufacturers (Ganesan et al. 2014).

The government eventually withdrew DCR after failing to defend the move before the World Trade Organisation (WTO) in a dispute initiated by the United States of America in 2013 on grounds that DCR was discriminatory against imports under the 'National Treatment' principle (WTO 2016).

Phase I was successful in achieving its target of installed capacity of 1,000 MW of grid connected power. It also served to demonstrate the technology and the intermediary arrangement under the NSM. However, even before the Phase II guidelines were notified, developers and financiers raised concerns about delayed payments. To manage this risk, the lenders demanded that NVVN be made a beneficiary of the tripartite agreement (Jog 2013).

Phase II

The Solar Energy Corporation of India Limited (SECI) was designated as the implementing agency for Phase II. SECI, a public-sector company, is an electricity trading licensee and signs PPAs with developers to purchase power for on-sale to discoms and other consumers. In February 2017, SECI became a beneficiary of the tripartite agreement between the Government of India, state governments, and the Reserve Bank of India. Consequently, ICRA Limited (a credit rating agency) enhanced SECI's credit rating from AA- to AA+. This increased the bankability of SECI projects. SECI was required to create a payment security fund of INR 500 crore to cover for three months' payment. By 2014, SECI received bids worth 2,170 MW, under reverse bidding conducted by it, and signed PPAs and PSAs with state discoms (SECI 2014). Phase II focused on providing viability gap funding (VGF) to project developers. However, the utility of the VGF initiative is questionable, as the actual expenditure of the committed funds progressively declined across the various schemes (see Table 3). After the notification of the

Guidelines for Tariff Based Competitive Bidding Process for Procurement of Power from Grid Connected Solar PV Power Projects (Solar Bidding Guidelines) in 2017, tariff became the sole bidding parameter, and VGF fell into disuse.

Year	NSM Phase II batch	Bidding parameter	Tariff	Allotted and commissioned capacity	VGF per MW	Estimated expenditure (in INR crore)	Actual expenditure (in INR crore)
2013	750 MW Batch I	Discount on VGF	INR 5.45 per kWh INR 4.75 with AD	680 MW	The lower of INR 2.5 crore and 30 per cent of project cost	1,875	742
2015	2,000 MW Batch III	Discount on VGF or tariff	INR 4.43 per kWh for the first year, annual escalation of INR 0.05/ kWh for the next 20 years, with the maximum tariff capped at INR 6.43/ kWh	Awarded 2,155 MW; 2,295 MW capacity reported as commissioned in the states of Andhra Pradesh, Chhattisgarh, Karnataka, Maharashtra, and Uttar Pradesh at both solar park and non-solar park locations (as on 31 December 2019)	The lower of INR 2.5 crore and 30 per cent of project cost	1,875	742
2016	Phase II Batch IV	Discount on VGF or tariff. After 2017 – only tariff	No fixed tariff	Awarded 3,420 MW (as on 31 December 2019). 2,470 MW capacity commissioned in the states of Gujarat, Odisha, Maharashtra, Rajasthan, UP, Andhra Pradesh (Kadapa Solar Park), and Karnataka (Pavagada Solar Park) (as on 31 December 2019)	INR 1 crore for open category 1.25 for DCR projects	5,050	191.63

Table 3
Snapshot of VGF schemes

Source: Author's adaptation from MNRE. 2020. Annual Report 2019–20. New Delhi: MNRE; and SECI. 2019. 8th Annual Report 2018–19. New Delhi: SECI.

Phase III

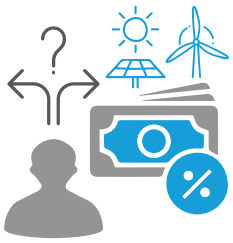
Phase III of the NSM is currently underway. The target is to achieve 100 GW of cumulative solar capacity by 2022. The bidding is conducted under the Solar Bidding Guidelines. Various intermediary procurers are participating in conducting the auctions, including SECI, NTPC, and NHPC Limited. As of March 2020, solar capacity of 21.35 GW was under various stages of implementation, and 31.27 GW was under different stages of bidding (ETEnergyWorld 2020).

2.3 Impact of other policies on project deployment

After the high-growth period of 2016–2018, capacity addition slowed in 2018–19, which was a cause for concern. It represents a break in the growth momentum. There are multiple contributory factors for the slowdown.

The introduction of the Goods and Services Tax (GST) in 2017 created considerable confusion and administrative challenges.[8] It decelerated the growth momentum and raised project costs by 10–15 per cent (Soman et al. 2019). The imposition of safeguard duties on imports of solar cells and modules from China and Malaysia was introduced in 2018. Eventually these costs were made good to the project developers by their PPA counterparties under the 'change-in-law' clause of the PPA. However, the uncertainty surrounding its timeline, increased cost of procuring components from exempted jurisdictions, and litigations before the regulatory commissions to get the duty adjudged as change-in-law added to the costs of under-construction projects and delayed new projects (Thomas 2018; Jai 2018). Payment delays by discoms, renegotiation threats, curtailment, tariff ceilings on bids, etc. also caused many investors to delay their investment decisions and many SECI tenders were undersubscribed (Buckley and Shah 2020; Chatterjee 2019). Tariff ceilings were removed by MNRE in March 2020 to revive investor interest.

Lately, SECI has struggled to find buyers for the auctioned capacity. For example, under a manufacturing-linked solar auction conducted in January 2020, SECI is yet to sign the PPA even after 10 months of awarding the project because it is unable to find buyers for the power (Reuters 2020). This development shows the signs of stress and limits to the NSM model for RE growth.



After an impressive growth period between 2016–18, various factors, in addition to counterparty risks, such as introduction of GST and safeguard duties on imported cells and modules led to change-in law cases delaying projects as well as investor decisions

2.4 Solar Park Scheme

Land procurement in India is hugely complicated, with challenges ranging from the legal to the political (TERI 2017). For developers, private procurement is expensive and time-consuming. This is evidenced by the consecutively increasing time limit for obtaining possession under the NSM. In Phase I, 180 days was the time limit; in Phase II, Batch I, the time limit was increased to 210 days; and currently, developers must show possession only at the time of commissioning the project.

As the number of RE projects increases, we are witnessing more acute problems in relation to the acquisition of land (Tenddulkar 2019). Land is, however, a state subject, and the Centre has limited scope to enable easier land procurement. To facilitate economies of scale and support systematic planning and deployment, in 2014, the MNRE launched a first-of-its-kind scheme to develop ultra-mega solar parks. In 2017, the target under the scheme was enhanced from 20,000 MW to 40,000 MW with an objective to set up at least 50 solar parks by 2022 (MNRE 2020a). Under this scheme, solar park developers can acquire land, obtain the necessary permissions, and build the required infrastructure, including evacuation infrastructure for the capacity to be housed within the park. As of December 2019, the MNRE had approved 39 solar parks with a total capacity of 22,879 MW across 17 states (MNRE 2020a).

8. The GST is supposed to be an integrated tax on both goods and services. In the earlier tax regime, goods and services were taxed separately (excise/import duties/VAT on goods and service tax on services). For RE, the cells and modules are taxed at 5 per cent while services attract an 18 per cent GST rate. However, for RE works contracts (i.e., the engineering, procurement, and construction contracts), the supply of equipment necessary for setting up a power plant and the service component (i.e., the actual setting up of the plant) are difficult to segregate. The government eventually fixed a 70:30 ratio for the goods and services components of the contracts, respectively (William 2020).

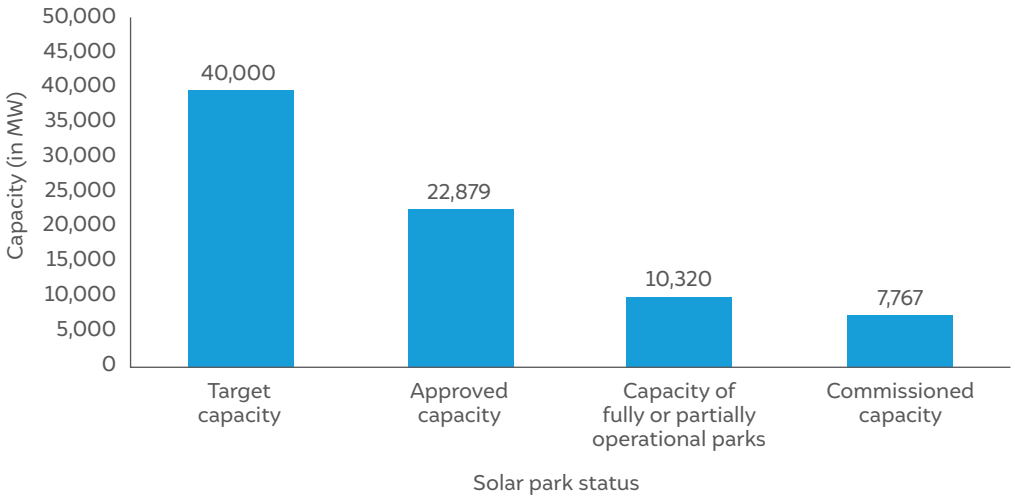


Figure 2
The pace of solar park development under the Central scheme has been slow (as on 31 December 2019)

Source: Authors' adaptation from MNRE. 2020. Annual Report 2019-20. New Delhi: MNRE.

2.5 Post-2010 policies for wind

The NSM defined solar power development, while wind policies followed a separate trajectory till late 2016. The flip-flops of the Central Government in withdrawing and re-introducing benefits such as AD and generation-based incentives (GBI) had adverse effects on wind capacity addition. 100 per cent AD was introduced in 1994. AD was reduced to 80 per cent in 2002. GBI was introduced in 2010. Both AD and GBI lapsed in 2012 but were reintroduced in 2013.

Wind power was brought into the competitive bidding regime with the 2016 interstate transmission system (ISTS) wind scheme for 1,000 MW and the notification of the *Guidelines for Tariff Based Competitive Bidding Process for Procurement of Power from Grid Connected Wind Power Projects* in 2017 (Wind Bidding Guidelines). SECI floated the first tender for ISTS wind in October/November 2016; it concluded in February 2017, and PTC India Limited signed the PPAs (Saumy 2017).[9] The bidding procedure and guidelines were similar to those conducted for solar energy. It helped bring tariffs down from INR 4.16–6.02 FiT to INR 3.46 (see Figure 3). The primary reason for the lower tariff was reduced counterparty risk (CRISIL 2017) with competition driving down tariffs even lower.

9. Order dated 3 December 2019 issued by CERC in Petition No. 340/AT/2019 titled *PTC India Ltd v. SECI and Ors.*, http://www.cercind.gov.in/2019/orders/340-AT-2019.pdf.

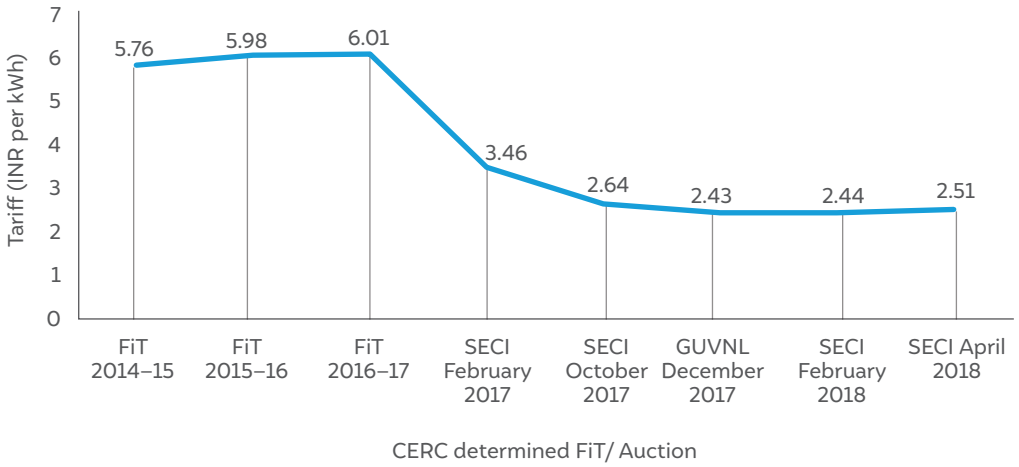


Figure 3
Competitive bidding in wind brought down the tariffs significantly

Sources: FiT orders: Order dated 15 May 2014 issued by CERC in Petition No. SM/354/2013 (Suo-Motu) titled Determination of generic levellised generation tariff for the FY 2014-15; Order dated 31 March 2015 issued by CERC in Petition No. SM/004/2015(Suo-Motu) titled Determination of generic levellised generation tariff for the FY 2015 - 16; Order dated 30 March 2016 issued by CERC in Petition No. SM/03/2016 (Suo-Motu) titled Determination of levellised generic tariff for FY 2016-17. Auction tariffs from India RE Navigator. 2020. "Auction Results". Accessed November 28, 2020. https://india-re-navigator.com/wind.

After the discovery of these lower tariffs, even under-construction projects were brought within the bidding regime, or else their tariffs were renegotiated. The reduced tariffs led to reduced margins and concerns that the existing, thriving ecosystem, which was driven by original equipment manufacturers (OEMs), is collapsing.[10] After 2017, there was a sharp decrease in the rate of growth of capacity additions (see Figure 1), leading to unsold inventory with the OEMs. Discoms were no longer willing to sign PPAs on FiTs, and the pace of bidding failed to keep up with expectations.

Further, because of the low tariffs it has become essential that the developers set up projects in high wind density sites. Land has hence become the most crucial element of investment decisions in wind. However, state policies have not been very conducive in this aspect. The consequent delays in setting up projects is further affecting wind OEMs (Dutt, Arboleya, and Gonzalez 2020). Since the introduction of competitive bidding in wind, 19.1 GW has been auctioned, but only 14.5 GW has been awarded. In 2020, the wind bids have been linked to storage, blended with solar, or been part of hybrid projects. Bidding was particularly constrained in 2019, were 5,400 MW was tendered but only 2,720 MW was awarded (India RE Navigator 2020).

10. This is evidenced by the stressed balance sheets of major wind OEMs, including Suzlon and Inox, and the exit of Senvion from the Indian market. The number of OEMs has reduced from 14 to 5 (Arora 2019). Thin margins are a feature of the entire RE sector, however, specifically in case of wind, competitive bidding and the resulting low tariffs caused a disruption to the existing ecosystem of the industry.

2.6 Policy assessment

We now briefly discuss some of the continuing structural risks that the above policies have failed to address or inadequately addressed and surmise the policy lessons from the Central policies (See Table 4 for India's project pipeline to achieve the targets).

Sub-sector	Target (GW)	Installed capacity (GW)	Under implementation (GW)	Tendered (GW)	Total (installed + pipeline)
Solar	100	35.74	33.36	20.66	89.76
Wind	60	8.25	8.25	1.57	47.82
Biomass	10	10.03	0	0	10.03
Small hydro	5	4.74	0.46	0	5.2
Wind–solar hybrid			1.44	1.2	2.64
RTC / assured peak power supply			1.6	5	6.6
Total	**175**	**88.511**	**45.11**	**28.43**	**162.05**

Table 4
India's progress towards 175 GW renewable energy by 2022

Source: Amitesh Sinha. 2020. "India's Ambition and Opportunities in Solar Manufacturing." Presentation, India PV Edge 2020, Virtual conference, 6 October.

Land risk

Land availability constitutes a major challenge for developers and causes significant project delays. The development of solar/RE parks provided comfort to developers and led to the realisation of economies of scale. However, as against the solar park target of 40,000 MW by 2022, as of December 2019, only 7,767 MW have been commissioned (see Figure 2). Solar park development comes with a chicken-and-egg problem. Without committed projects, it is expensive to develop solar parks; but once projects are awarded, solar park development cannot take place within the time provided for project commissioning since solar parks require a longer time for construction. Furthermore, because solar parks require even greater parcels of land, chances of land conflicts are higher. While states such as Rajasthan and Gujarat have fared well because of the presence of abundant wastelands, others, such as Andhra Pradesh (e.g., Kadapa and Ananthapur) and Karnataka (e.g., Pavagada), have all faced land conflicts. Other issues that developers face relate to the quality of the land, ancillary infrastructure, and upfront and operation and maintenance (O&M) fees. Proposed solar park projects have been cancelled because of unexpectedly high bid tariffs (Seetharaman and Chandrasekaran 2019). Though there have been success stories like the Rewa Solar Park (Bhaskar 2020), we need better planning and coordination between the Centre and the states to mitigate land-related barriers and risks.

Curtailment and evacuation risks

RE faces a high degree of curtailment risk (Aggarwal and Chawla 2019). The *Grid Code, 2010*,[11] (Grid Code) which must be followed by all states, grants a must-run status to power generated from wind and solar plants. This means that utilities and system operators must prioritise evacuation of power from must-run plants unless there are grid unavailability, security, or

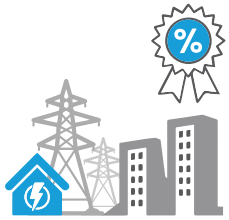
11. Clause 5.2 (u) of the Grid Code.

safety constraints. However, commercial considerations, grid unavailability, and technical grid security concerns lead to curtailment, which translates to revenue loss for developers. Curtailment could contribute to 14 per cent of the risk premia (Atal and Shrimali 2018).

In the early set of PPAs, there was no provision to compensate generators in case of backdown of power. However, the *Solar Bidding Guidelines* and the *Wind Bidding Guidelines* incorporated provisions that require the power purchaser to compensate the generator in case of backdown for reasons other than technical constraints. However, must-run status has not been as effective as intended, and the risk of curtailment persists.

Further, as RE deployment grows, problems arising out of the inadequacies of the evacuation infrastructure assume greater proportions. The problem is compounded by the need for transmission infrastructure to be in place before an RE project is conceptualised, because the infrastructure takes up to five years to complete, while RE projects typically take between 12–18 months to launch (H. Singh 2017).

A functioning ISTS is also essential, as it helps diffuse the costs and benefits of RE across the country and can enable effective implementation of the RPO. Hence, inter-state transmission charges and losses have been exempted since 2016 and will continue to be exempted till June 2023. Policymakers recognised this problem early on, and PGCIL proposed a transmission plan for the envisaged RE capacity in 2011, dubbed the *Green Energy Corridor*. A loan-plus-grant mechanism was devised to fund inter- and intra-state transmission corridors in 2015. However, this programme does not address the incentive problem – it requires the states to cooperate and take the initiative to submit project proposals for obtaining grants, provide last-mile connectivity, and improve their own transmission infrastructure. There is not enough incentive for RE-rich states to spend money to build the required infrastructure. There is no clear accounting or evidence of the benefits that a RE-rich state government will receive if it allocates money and human resources for this purpose.



Any transmission infrastructure expansion programme needs to solve for the incentive problem facing the states

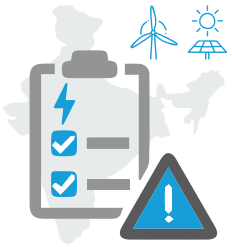
Further, there is no transparent data published on curtailment duration, curtailing entities, and reasons for curtailment. So far, generators have pooled their data and been able to demonstrate evidence of curtailment. However, no one knows the exact reasons for such curtailment. It is hence difficult to analyse the predominant causes and accordingly frame a policy response.

Payment risk

As we have just discussed, assured offtake at a fixed tariff for the lifetime of the project helped investors tide over the risks of adopting a new and untested technology and helped increase the scale of these projects.

While payment obligations were assured, on-time payments remain a concern. Delayed payments affect investor returns and project cash-flows adversely. Most PPAs have provisions that require the purchaser to create a payment security mechanism (PSM). Opening letters of credit (LC) is the most common PSM. However, there is widespread non-compliance of this provision. SECI had not created any LC under any of its PPAs (though it has a good track record of payment) (Economic Times 2019). As a solution, in June 2019, the MoP directed the NLDC and the SLDC to dispatch power only after an LC had been opened for the power

being scheduled. The discom would also be liable to pay full tariff on the power that is not scheduled. The concerned discom was also precluded from purchasing power from the power exchange and getting a short term open-access (STOA) (MoP 2019). This move essentially brought system operators into contract enforcement which ideally should be beyond their remit. Apart from this drawback in the design, according to feedback from the developers, the move did not change anything on the ground. However, it has had only one year of effective operation since once COVID-19 struck, MoP partially rolled back the directive till 30 June 2020 and permitted scheduling of power even if the PSM was reduced by 50 per cent (MoP 2020b).



India is a strong force in the global RE space. However, existing policies are not sufficient to address the deep-rooted issues and evolving nature of risks inhibiting a natural transition to RE

Policy lessons

The success story so far has made India a dominant force in the RE space globally. It was able to leverage its growing market and even take leadership on global initiatives like the International Solar Alliance. After the implementation of the NSM, solar power deployment increased exponentially. Further, the competitive bidding regime introduced first in solar and then for wind was successful in driving down tariffs.

However, existing policies are not sufficient to address risks arising from the structural pathologies of the electricity sector and the changing nature of barriers and risks. With RE prices falling, it may seem that RE procurement would be the natural choice for discoms. However, discoms hold-out on signing PPAs with the expectation that tariffs would fall even further with each passing auction (Prasad 2020). Deep-rooted issues such as the procurer's obligation to pay fixed costs under long-term PPAs, inadequate demand-supply planning, and skewed fuel subsidies distort the market. Further, policies that burden the discoms further like the LC requirement, have no real impact on the ground.

Tying discoms down in long-duration PPAs reduces their ability to respond to new market developments and forces them to procure at above-market costs, posing a greater risk for the sector in the long term. While these policies may work for project developers in the short term, they do not make the most commercial sense for discoms. The fixed cost payment issue is one such example. Technologies like storage and introduction of market platforms have the potential of bringing in economic efficiencies in discom procurement strategies (CERC 2018). Hence, a variation in procurement strategy for discoms is imminent and policies must enable them. Such variation is already visible in the thermal markets where MoP has commenced medium-term power procurement. Resistance from incumbent market players is expected and must be addressed for a transition that works for all stakeholders.

Further, the policy framework till now has a serious gap in data collection and transparency. There is lack of data on project-specific information on generation, technology selection, etc. Detailed data on these aspects could have informed policy activity on cost and technology, bringing in greater efficiencies. The Centre has the mandate to formulate policy in this regard and must make up for the lost time.

3. Renewable purchase obligations – a regulatory mechanism for creating demand

The NSM, *Solar Park Policy*, and other fiscal incentives are supply-side measures, targeted at reducing investment risks. However, a measure to create demand was essential because RE was considerably more expensive than conventional power in 2010. Demand for RE was created through the RPO mechanism.

The EA enabled state regulators to specify a minimum purchase obligation. Section 86(1) (e) of the EA requires the SERCs to "promote cogeneration and generation of electricity from

renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee."

The NTP 2006 required the SERCs to fix the RPOs, "taking into account availability of such resources in the region and its impact on retail tariffs." In the absence of any fixed target or specific obligation, only a few states notified the purchase obligations. The initial movers were Gujarat (2005), Kerala (2006), Rajasthan (2007), and Madhya Pradesh (2008).

In the absence of any fixed target or specific obligation before 2010, only a few states notified the purchase obligations. The initial movers were Gujarat (2005), Kerala (2006), Rajasthan (2007), and Madhya Pradesh (2008)

Fixed targets were set for the first time under the NAPCC, which prescribed that RE (including bioenergy and small hydro) should account for 5 per cent of total grid purchase in 2010, which would increase to 15 per cent by 2020, with a one per cent increase each year. In 2011, the NTP 2006 was amended to include a minimum RPO of 0.25 per cent for solar power by the end of 2012–2013 and 3 per cent by 2022.

During 2010–2012, many states notified their respective RPO regulations. This activity was most likely driven by the increased government and investor focus on RE after the introduction of the NSM. The obligated entities, i.e., the entities on whom the RPOs were imposed, were discoms, captive consumers, and open-access consumers.

The policymakers were, however, cognisant of resource variability across the different states. To bridge the resource gap and ensure sustained demand for RE, they enabled the issuance and trading of renewable energy certificates (REC). Under the REC mechanism, registered RE generators receive one REC against one MWh of energy they produce.[12] The power component is sold separately to discoms and open-access consumers at the average power purchase cost (APPC) or a mutually agreed price, respectively. The RECs are categorised into solar and non-solar RPOs. These RECs can be put up for sale in power exchanges, where they can be bought by obligated entities and voluntary buyers or retained by the generator to meet their own RPOs (the latter was allowed from 2013). The CERC periodically fixes a floor price and forbearance price and the trading occurs within this price band.

3.1 Setting RPO targets

The RPO targets notified by states are set out in Table A1 in the Annexure. As is evident, states' RE ambition varies widely, and there was considerable variance between them and the NAPCC targets. Karnataka, Tamil Nadu, Maharashtra, and Rajasthan set relatively high targets, while Andhra Pradesh, Bihar, Madhya Pradesh, and Uttar Pradesh set quite low targets.

The trajectory set out in the NAPCC did not have any legally binding value on the SERCs, and the states were technically free to determine their RE targets. However, their targets were inadequate to achieve national policy objectives.

To address the inadequacy of the RPO targets, the NTP was revised in 2016, enabling the Ministry of Power (MoP) to notify a common trajectory from 2016–17 to 2018–19. The MoP has notified the RPO trajectory up to FY 2021–22 (Table 5) (MoP 2016; 2018). Since then, states must align their trajectories to that set by the Central Government.

12. The detailed procedure for all matters relating to RECs is set out in the *CERC (Terms and Conditions for Recognition and Issuance of Renewable Energy Certificates for Renewable Energy Generation) Regulations, 2010* (REC Regulations). The first solar and non-solar RECs were issued in May 2012 and March 2011, respectively.

Category	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22
Non-Solar	8.75	9.5	10.25	10.25	10.25	10.5
Solar	2.75	4.75	6.75	7.25	8.75	10.5
Total	11.5	14.25	17	17.5	19	21

Table 5
MoP trajectory for RPO

Source: MoP. 2016. Guidelines for Long-term RPO Growth Trajectory of Renewable Purchase Obligations (RPOs) for Non-solar as well as Solar. Order No. 23/3/2016-R&R. New Delhi: MoP, 22 July; MoP. 2018. Long-term RPO Growth Trajectory of Renewable Purchase Obligations (RPOs) for Solar and Non-solar for a Period of Three Years i.e. 2019–20 to 2021–22. Order No. 23/03/2016–R&R. New Delhi: MoP, 14 June.

Till January 2017, only three states – Andhra Pradesh, Madhya Pradesh, and Rajasthan – had issued draft regulations specifying a trajectory in line with the one prescribed by the MoP (MNRE 2017). In 2017, Karnataka revised their official policy targets from 2,000 MW to 6,000 MW of solar power to match the RPO trajectories set by the MoP (The Hindu 2017). Till March 2020, only nine states had aligned their RPO trajectories with that of the MoP (MoP 2020a). The remaining states are yet to either notify their 2021–22 trajectories or align them with the Central trajectory. While Maharashtra has not aligned its targets, it provides incentives of INR 0.25 per kWh above the state prescribed RPO for procurement up to the MoP target.

3.2 Compliance with RPO

The obligated entities can comply with their RPOs through two routes: direct procurement (FiT/competitive bidding) and purchasing RECs from power exchanges.

State regulations typically contain provisions for monitoring compliance, which require the obligated entities to submit information to the state nodal agencies, and the nodal agencies are required to file periodic compliance reports with the SERC. The SERC can also initiate suo moto proceedings to verify compliance.

In cases of non-compliance, SERCs are typically required to direct the obligated entities to deposit such amounts as the SERC may determine in a separate fund, which will then be used to purchase RECs and develop transmission infrastructure. However, certain provisions – like permitting target revision, fungibility between solar and non-solar RPOs, and carrying forward the RPOs – are specific to the states. SERCs can also revise the RPOs in case of constraints in the availability of renewable energy. A snapshot of the provisions can be found in Table A2 in the Annexure.

As early as 2013, power producers filed a petition before the Appellate Tribunal of Electricity (APTEL),[13] claiming that various state discoms and obligated entities were not complying with the RPO regulations. The petition arose due to the failure of state commissions to implement their RPO regulations. The petitioners submitted that the SERCs frequently allowed deferment, carry-over, and exemptions of the obligations and did not enforce compliance by directing purchase of RECs despite their availability. The MNRE also submitted that discoms made inadequate provisions for compliance while the SERCs did not invoke penal provisions to enforce compliance. It further submitted that the SERCs did not seek RPO compliance reports in accordance with the regulations, and that many had not even announced their long-term RPO trajectories. The CERC submitted that the REC market had a large, unsold inventory of non-solar RECs that were being traded at floor prices. It further noted that the demand for RECs is largely driven by very few private distribution licensees and few captive/open-access customers; meanwhile, the state discoms generally do not purchase RECs to fulfil their RPOs.

13. The petition was filed under Section 121 of the Electricity Act, 2003, which empowers the tribunal to issue orders, instructions, or directions to the appropriate commission for the performance of its statutory functions.

The SERCs used the provisions built by them in the RPO regulations to allow non-compliances to occur. The APTEL directed the SERCs to strictly enforce compliance and use the provisions sparingly and in accordance with the spirit of the mandate.

Variance in compliance within states

The MNRE has consistently been urging states to align their RPO trajectories with that of the Central Government and ensure strict compliance. In August 2019, the MNRE sought APTEL's intervention to nudge SERCs to enforce and align RPOs and not to allow any waivers or carrying forward (MoP 2020a). In 2019–20, some RE-rich states, including Maharashtra, Gujarat, Tamil Nadu, Rajasthan, and Telangana, fell short of meeting their RPO targets. Apart from Andhra Pradesh, Rajasthan, Karnataka, and, more recently, Tamil Nadu, no other state has met their RPO targets (MoP 2020a). Figure 4 compares the RPO compliance situation across 2015–16 and 2017–18 of Tamil Nadu, Maharashtra, Bihar, and Punjab and is representative of the compliance situation across the country.

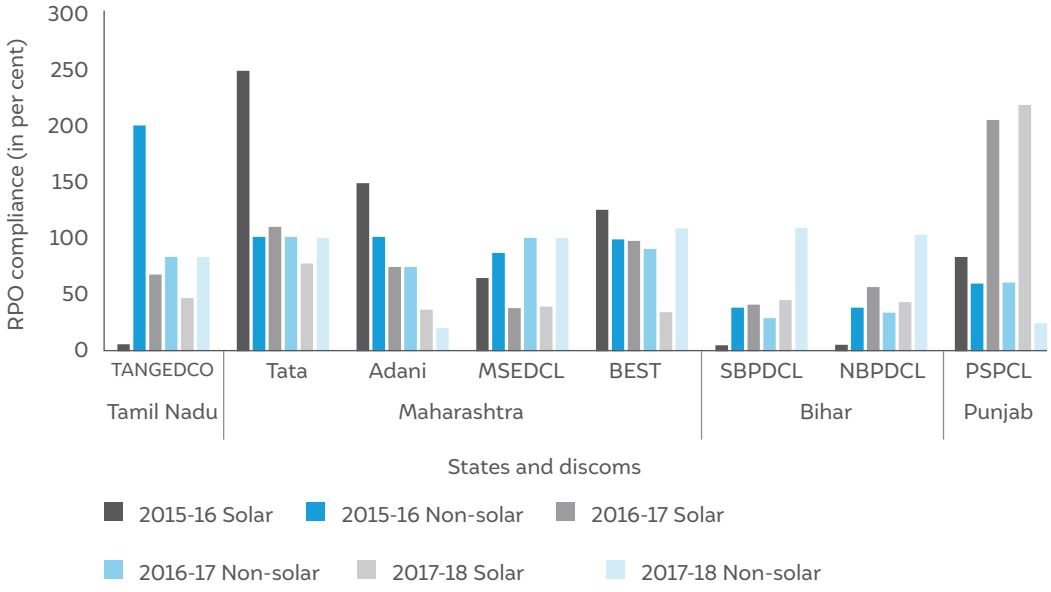


Figure 4
Compliance with RPOs is uneven among states and discoms

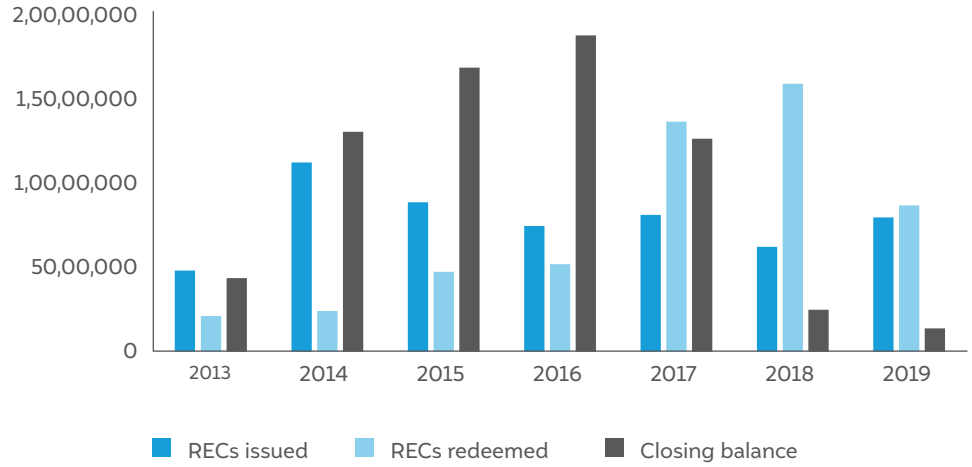
Source: Authors' adaptation from Order dated 11 August 2017 issued by the TNERC in T.P. No.1 of 2017 titled Determination of Tariff for Generation and Distribution; Order dated 27 March 2019 issued by the MERC in Case No.36 of 2019 titled Case for Verification of compliance of Renewable Purchase Obligation targets by Maharashtra State Electricity Distribution Co. Ltd for FY 2017-18; Order dated 2 April 2019 issued by the MERC in Case No.37 of 2019 titled Case for Verification of compliance of Renewable Purchase Obligation targets by Brihanmumbai Electric Supply & Transport Undertaking for FY 2017-18; Order dated 2 April 2019 issued by the MERC in Case No.38 of 2019 titled Case for Verification of compliance of Renewable Purchase Obligation targets by Tata Power Co. Ltd.–Distribution) for FY 2017-18; Order dated 4 April 2019 issued by the MERC in Case No.39 of 2019 titled Case for Verification of compliance of Renewable Purchase Obligation targets by Adani Electricity Mumbai Limited for FY 2017-18; Order dated 23 October 2017 issued by the PSERC titled Annual Revenue Requirement and Determination of tariff for MYT control period from FY 2017-18 to FY 2019-20 and for True up of FY 2015-16; Order dated 19 April 2018 issued by the PSERC in Petition titled True up of FY 2016-17, Annual Performance Review –APR) for FY 2017-18 and Determining the Annual Revenue Requirement –ARR) for FY 2018-19; Order dated 27 May 2019 issued by the PSERC in Petition No. 02 of 2019 titled True up of FY 2017-2018, Annual Performance Review –APR) for FY 2018-19, Approval of Revised Annual Revenue Requirement –ARR) and Determination of Tariff for FY 2019-20; Order dated 25 February 2019 issued by the BERC in Case No. 40 and 48 of 2018 and Case No. 41 and 47 of 2018 titled Tariff Order for FY 2019-20 for NBPDCL and SBPDCL; Order dated 24 March 2017 issued by the BERC in Case No. 45 of 2016 titled Tariff Order for FY 2017-18 for NBPDCL; Order dated 24 March 2017 issued by the BERC in Case No. 46 of 2016 titled Tariff Order for FY 2017-18 for SBPDCL; Order dated 21 March 2018 issued by the BERC in Case No. 40 of 2017 titled Tariff Order for FY 2018-19 for NBPDCL; Order dated 21 March 2018 issued by the BERC in Case No. 41 of 2017 titled Tariff Order for FY 2018-19 for SBPDCL

Karnataka and Tamil Nadu, which set ambitious targets, have high rates of compliance. However, Madhya Pradesh and Uttar Pradesh were unable to reach their ambitious targets. Andhra Pradesh, Gujarat, Maharashtra, and Rajasthan set modest targets with relatively high compliance levels. The other states were unable to accomplish even their low targets. The Comptroller and Auditor General of India (CAG), in their analysis of RPO compliance in 24 states between 2010–11 and 2013–2014, noted that non-compliance was more common among the RE resource-deficit states (CAG 2015, chap 2). This trend in non-compliance by the states has remained largely unchanged since then.

In most cases, the RPO served as a ceiling on deployment, rather than a fillip. Most RE-rich states limited discoms' procurement of wind and solar power up to the RPOs targets notified by their respective SERCs. The RPO regulation of Gujarat explicitly required the discoms to source RE from within their areas of supply. Similarly, the Bihar RPO regulation requires discoms to meet their RPOs from sources within their state. Discoms can source power from outside the state only in case of shortfall within the state. Further, there is no indication or incentive in the state RE policies for discoms to exceed the RPO targets. Grid integration concerns and the technical limitations to RE power's sale to other states restrict RE deployment.

Participation in the REC market mechanism

The trading mechanism instituted for RECs in the power exchanges has not led to its uptake, as there has been a consistently high number of unredeemed RECs (see Figure 5). In addition, developers installed only around 2266 MW of RE capacity in 2010–2017 under the REC mechanism.



Note: The closing balance is the balance in December of each year.

Figure 5
RECs consistently remain unsold in the market

Source: Authors' adaptation from REC Registry of India. 2020. "Month-wise RECs Report." REC Registry of India. Accessed 30 November. https://www.recregistryindia.nic.in/index.php/publics/recs.

The REC market has not adequately boosted compliance with the RPO regime. Up to 2014, only 4.77 per cent of the RPO compliance was through the REC route (CAG 2015, chap 2). For resource-deficit states to meet their RPOs through RECs, a higher number of resource-deficit states should constitute the buyers – which however is not the case (see Table 6). Instead, the data shows that resource-rich states are also the highest buyers of RECs.

State	Share of total RECs purchased by state entities (total RECs redeemed up to 2017–18 are 3,70,43,171) (in per cent)	Share of total RECs purchased by the state discom (total RECs purchased by all discoms up to 2017–18 are 2,24,99,976) (in per cent)
Maharashtra	30.7	44
Gujarat	13.3	13.1
Rajasthan	6.2	0
Bihar	4.6	7.5
Madhya Pradesh	4.4	0
Punjab	3.3	3.9
Tamil Nadu	1.9	0
Karnataka	1.7	0
Andhra Pradesh	1.6	0
Uttar Pradesh	0.4	0

Table 6
Resource-rich states are also the highest buyers of RECs

Source: Authors' adaptation from POSOCO. 2018. Renewable Energy Certificate Mechanism in India: Key Learnings, Data Analysis and Way Forward. New Delhi: POSOCO, NLDC.

Another noteworthy fact is that among the large buyers, i.e., Maharashtra and Gujarat, there is significant private-sector participation. In Gujarat, private discoms make the most REC purchases. The other significant chunk of buyers are the union territories, which fall within the Central Government's purview and for this reason may be more enthusiastic in their use of the REC mechanism (POSOCO 2018).

It appears that the factors behind participation in the REC market are independent of resource availability and utilisation.

3.3 Causes of under-achievement

The possible causes of under-achievement of the REC mechanism in boosting RPO compliance are discussed below.

Declining number of sellers

The SERCs have contended in the past that developers stand to gain supernormal profits by setting up REC projects, since they are entitled to normal tariffs plus the REC price. Analyses also anticipated that the high floor prices could provide windfall gains to developers (A. Singh 2010).

However, this did not hold true in practice. Though there was an initial spurt in the number of projects that were registered under the mechanism, as solar and wind tariffs continued to fall, the registration of new projects under the REC mechanism reduced (see Figure 6). There is a clear preference for FiT/auctions over the REC route. Of the total 85,908 MW of RE capacity (including all types of RES) in India as of 31 December 2019 (MNRE 2020a), only 4,046 MW was registered under the REC mechanism (REC Registry of India 2020b) (see Table A3 of the Annexure for the number of projects registered in the selected states).

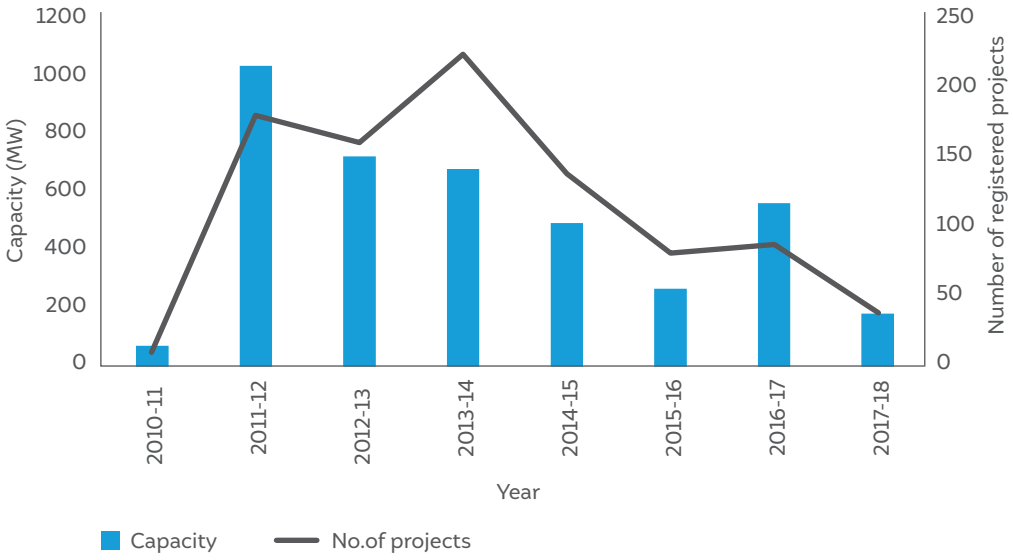


Figure 6
The registration of new projects under the REC mechanism has reduced

Source: Authors' analysis of data published by POSOCO. 2018. Renewable Energy Certificate Mechanism in India: Key Learnings, Data Analysis and Way Forward. New Delhi: POSOCO, NLDC.

Cashflow for REC projects

In the early 2010s, there was still a wide gap between the APPC and solar and wind tariffs. It would have been risky to register as a REC project, since REC prices would be discovered in energy exchanges within the approved bands. The floor price is calculated by determining the gap between the minimum requirement and the APPC. This minimum requirement is an estimation that considers O&M expenses, interest on term loans, working capital, and repayment terms; it is fixed to ensure the economic viability of the project. However, these numbers are estimated based on prevailing rates as opposed to historic rates. Hence, the prices have, expectedly and consistently, fallen (see Table 7); the floor price has reached zero. This would impact the cashflows of a project registered when the costs were high.

Control period	Non-solar (INR/ MWh)		Solar (INR/ MWh)	
	Floor price	Forbearance price	Floor price	Forbearance price
1 June 2010–FY 2012	1,500	3,900	12,000	17,000
1 April 2012–FY 2017	1,500	3,300	9,300	13,400
1 April 2017–FY 2020	1,000	3,000	1,000	2,400
1 July 2020–30 June 2021	0	1,000	0	1,000

Table 7
REC floor prices and forbearance prices have consistently fallen

Source: Order dated 1 June 2010 issued by the CERC in Petition No. 99/2010 (Suo Motu) titled Determination of Forbearance and Floor Price for the REC Framework; Order dated 23 August 2011 issued by the CERC in Petition No. 142/2011 (Suo Motu) titled Determination of Forbearance and Floor Price for the REC Framework to be Applicable from 1st April 2012; Order dated 30 March 2017 issued by the CERC in Petition No. 02/SM/2017 titled Determination of Forbearance and Floor Price for the REC framework to be Applicable from 1st April 2017; Order dated 17 June 2020 issued by the CERC in Petition No. 05/SM/2020 titled Determination of Forbearance and Floor Price for the REC Framework.

The declining trend of the market price of the REC (see Table 7) shows that buyers are unwilling to pay a higher price and that there is significant uncertainty surrounding the expected returns on investment.

This would especially affect larger projects' participation in the REC mechanism. Investors prefer projects with PPAs as they offer assured returns over a longer duration. This is also indicated by data on the average size of projects registered under the REC mechanism (Table 8).

RE source	Maximum capacity (MW)	Minimum capacity (MW)	Average capacity (MW)	No. of projects	Total capacity (in MW)
Solar PV	19.00	0.10	2.04	360	736
Wind	50.4	0.23	5.25	413	2,167

Table 8
Average size of a registered plant as of FY 2018

Source:Authors' analysis of data published by POSOCO. 2018. Renewable Energy Certificate Mechanism in India: Key Learnings, Data Analysis and Way Forward. New Delhi: POSOCO, NLDC.

For projects developed after the fall in costs, the situation has reversed. The APPC in most cases may be higher or equal to solar and wind tariffs. If any new projects are registered under the REC regime today, they could sell power to the host discoms at the APPC (or SERC-notified tariffs), and RECs thus sold can help an obligated entity meet its RPO.

Cost for host discoms/states

The responsibility and cost of balancing power from REC projects (the cost of maintaining system balance due to injection of variable power in the grid) fall on the host state. This could limit the number of REC projects the state would host for the availability of other obligated entities.

For RE-deficit states, it would be more commercially viable to procure RECs to meet their RPOs (they will incur conventional power purchase costs plus REC costs) and avoid the balancing costs associated with procuring RE directly. However, data shows that discoms do not avail of this route to meet their RPOs. This may be due to behavioural resistance to shift to REC or due to the indifferent enforcement of RPOs.

Cost for other obligated entities

Initially, there was considerable resistance from open access and captive consumers to the RPO obligations imposed upon them. The dispute was eventually settled by the Supreme Court in *Hindustan Zinc Limited v. RERC*,[14] in which the Court held such imposition to be valid. Open-access consumers have the freedom to switch to grid purchase, in which case they do not need to comply with RPOs separately.

Regulatory gaps

The REC market is a 'compliance market', i.e., the demand for RECs arises from a legal mandate and is not organic demand.[15] In this context, non-compliance can result from the following situations:

14. Judgment dated 13 May 2015 issued by the Supreme Court of India in Civil Appeal No. 4417 of 2015. https://www.recregistryindia.nic.in/pdf/REC_Regulation/Supreme_Court_Judgement_regarding_RPO_Compliance.pdf.

15. The voluntary component of the REC market is the exception. However, its share is only 0.1 percent of the REC market (POSOCO 2018).

- ***Regulatory uncertainty***

As discussed above, RPO regulations allow carrying forward, exemptions, etc., which create demand uncertainty. Other regulatory causes also contribute to commercial uncertainty. Initially, the life of the REC was only one year, after which it expired if not redeemed. These expired RECs generated no returns on investment for investors. This would have dissuaded many investors from setting up REC projects. The validity period was subsequently increased to two years by the CERC through an order dated 11 February 2013; however, this did not give investors sufficient confidence. Commercial uncertainty was further exacerbated by the fact that demand was also not certain due to the low RPO targets set by states before the MoP set a common trajectory for all in 2016.

RPO compliance for FY 2015–16 was finally determined by the Gujarat Electricity Regulatory Commission (GERC) on 26 December 2019

- ***Inadequate enforcement***

There was no unified framework for monitoring RPO compliance on an on-going basis until the MNRE announced the constitution of the RPO compliance cell in 2019. The SERCs are relatively lenient with regards to non-compliance. For example, they permit the carrying forward of shortfall[16] and the use of the previous year's surplus to meet shortfalls in the next year.[17] There have also been delays in reviews of compliance. For example, compliance for the period FY 2015–16 was finally determined by the Gujarat Electricity Regulatory Commission (GERC) on 26 December 2019. While there are generic penalties prescribed in the EA for contravention of regulations made under the EA, it is difficult to imagine that the SERCs would be highly inclined to strictly invoke these provisions against their own state discoms.

Inability of the obligated entities to comply with the mandate

While non-enforceability and regulatory gaps lead to non-compliance, the practical reason is that RPOs and RECs are an additional cost burden for discoms, which are already under severe financial stress. Further, many inefficient thermal projects continue to operate to their technical minimum to provide the baseload, which limits the extent of RE procurement. Certain states have indicated that they would be willing to purchase RECs provided they find an offtaker for the thermal capacity that is already contracted by the discoms. Many states, which were earlier in a power deficit situation, but have now become power surplus states, find it difficult to meet the current RPO levels and have no incentives to raise their RE ambitions.

16. Order dated 4 August 2015 issued by the GERC in suo motu Petition Nos. 1307 of 2013 and 1312 of 2013 titled *Suo-motu Proceedings in Petition Nos. 1307 of 2013 and 1312 of 2013 in Pursuance of Hon'ble APTEL Direction Contained in Order Dated 16.04.2015 in Appeal Nos. 258 of 2013 and 21 of 2014 and the Order Dated 14.05.2015 in I.A. No. 187 of 2015.* Accessed 22 October 2020. https://www.gercin.org/wp-content/uploads/document/en_1438799511.pdf.

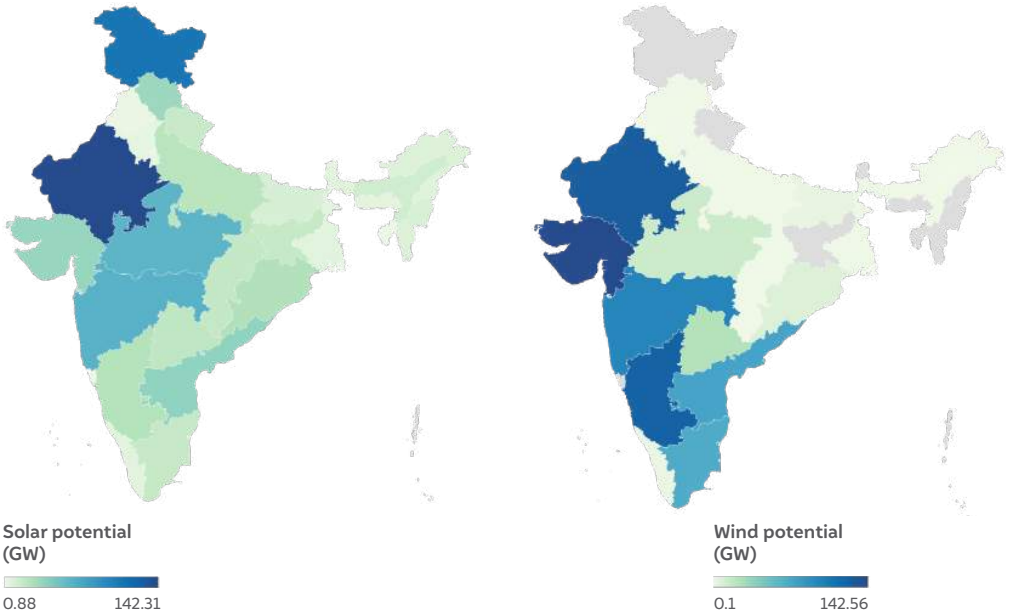
17. Order dated 4 April 2019 issued by the MERC in Case No. 39 of 2019 titled *Case for Verification of Compliance of Renewable Purchase Obligation Targets by Adani Electricity Mumbai Limited for FY 2017–18.*

India must implement a comprehensive market reforms roadmap, with an intent to remove current inefficiencies while designing a market architecture that minimises total system costs in the future.

Image: iStock

4. Policy evolution in RE-rich states

The southern and western states of India have a long history of RE development since RE resources are concentrated in these states (Figure 7). These states attracted investments in solar and wind energy well before the launch of NAPCC and the NSM. This section recounts the journey of RE policies in states that have high solar and wind energy potential. The RE-rich states covered are Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, and Telangana.



Note: Wind potential is at 120 m above ground level.

Figure 7
RE resource potential is concentrated in western and southern India

Source: Authors' analysis based on data from MNRE. 2020. Annual Report 2019-20. New Delhi: MNRE.

4.1 Policies pre-2014

In January 2009, Gujarat became the first Indian state to launch a solar power policy (Economic Times 2010). In 2012–13, over 40 per cent of Tamil Nadu's total capacity was based on wind power (TN Energy Department 2012), well before the Government of India adopted the ambitious target of 175 GW RE capacity by 2022, including 60 GW wind.

In the first phase of NSM, Karnataka Power Corporation Limited (KPCL) was the first state-owned utility to be found eligible for the development of a solar project (Deloitte 2015). Rajasthan attracted a slew of projects, primarily because of abundant land and resource availability. In 2011, Karnataka was the first southern state to introduce an exclusive policy for the development of solar energy.

Key drivers

Through 2010–14, the underlying policy motivations across RE-rich states were increasing energy access, closing demand-supply gaps, increasing industrial productivity, utilising local resources for power generation, garnering private investments, creating employment opportunities through project deployment and local manufacturing, responding to local environmental challenges, and addressing climate change risks.

Policy focus

In most of the initial policies, support was provided in the form of FiTs/bundled tariffs. The power was sold through long-term PPAs to state discoms or to NVVN under NSM bundling schemes. However, we observed shortfalls in administrative and institutional mechanisms, like negligible support for land acquisition and approvals and clearance processes; lack of strengthening of evacuation infrastructure to tap the best sites; no provisions for building knowledge and capacity in key implementing entities; and no requirement for improved data collection and communication to aid industry's decision-making and project planning. The challenges of the distribution sector also impacted the progress of the sector during the implementation of the NSM. Policies, therefore, failed to create an enabling environment and were not adequate to attract significant investors in the RE business. Accordingly, these policies attracted a poor response in many RE-rich states. For example:

- In Andhra Pradesh, only 131.84 MW of solar PV capacity was commissioned till FY 2014 against the 2,000 MW of solar capacity envisaged under Andhra Pradesh's *Solar Power Policy 2012*.
- In Tamil Nadu, only 132.58 MW of solar PV was installed over 2012–15 against a target of 3,000 MW in *Tamil Nadu Solar Policy, 2012*.
- Karnataka's *Renewable Energy Policy 2009–14* enabled the addition of 1,021.08 MW during the five-year policy period against a target of 4,200 MW.

Performance of policies

During 2012–2014, several states failed to achieve NSM and their state policy targets within the stated time (Stromsta 2012) (See Table 9). States such as Rajasthan, Andhra Pradesh, and Tamil Nadu conducted auctions in 2013, but there were delays in signing PPAs. Gujarat was the only state that adopted the FiT system under its solar policy, that was much more attractive than NSM and other state policies. Even then, there were time overruns. Rajasthan auctioned 75 MW of solar capacity in March 2013. However, elections in the state delayed land allocation processes (Sengupta 2013). In December 2012, Tamil Nadu conducted a 1,000 MW auction, out of which only 698 MW was awarded at INR 6.48 per unit. This may reflect investors' risk perception of the discom finances and operations in the state (TNN 2013).

Project deployment in most states was below the target capacity under the policies

State	Wind/solar policy and year	Targets in policy	Achievement against targets
Andhra Pradesh	*Solar Power Policy, 2012* *Solar Power Policy, 2015* *Wind Power Policy, 2015* *Solar Power Policy, 2018* *Wind Power Policy, 2018* *Solar–Wind Hybrid Policy, 2018*	5,000 MW 5,000 MW additional capacity in 5 years	3,559.02 MW total solar capacity as of December 2019
Bihar	*Policy for Promotion of New and Renewable Energy Sources, 2011* *Policy for Promotion of New and Renewable Energy Sources, 2017*	1,969 MW grid-connected solar (total solar target is 2,969 MW solar)	149.35 MW total solar capacity as of December 2019
Gujarat	*Wind Power Policy, 2007* *Solar Power Policy, 2009* *Wind Power Policy, 2013* *Solar Power Policy, 2015* *Wind Power Policy, 2016*	No targets but discoms required to purchase power up to their RPOs	2,763.55 MW total solar and 7,359.22 MW total wind capacity as of December 2019. For 2019–20, solar RPO compliance is 46.2 per cent and non-solar RPO compliance is 122.57 per cent.
Karnataka	*Karnataka Renewable Energy Policy, 2009* *Solar Policy, 2011* *Karnataka Solar Policy, 2014* *Karnataka Renewable Energy Policy, 2016*	200 MW (including solar thermal) Additional 2,000 MW between 2014–2021 4,400 MW additional wind capacity between 2016–2022	31 MW total solar capacity in FY 2014 7,243.92 MW solar added between FY 2014 and December 2019 1,884.25 MW wind added between FY 2016 and December 2019
Madhya Pradesh	*Policy for Implementation of Solar Power Based Projects, 2012* *Wind Power Project Policy, 2012*	No targets but discoms required to purchase power up to their RPOs	2,519.89 MW wind and 2,237.48 MW solar as of December 2019. For 2019–20, solar RPO compliance is 84.7 per cent and non-solar RPO compliance is 71 per cent.
Maharashtra	*New Policy for Power Generation from Non-Conventional Sources, 2008* *Comprehensive Policy for Grid Connected Power Projects based on New and Renewable (Non-conventional) Energy Sources, 2015*	2,000 MW of wind 7,500 MW solar till 2020 5,000 MW wind till 2020	4,446 MW total wind capacity in FY 2015 5,000.33 MW wind and 1,663.42 MW solar as of December 2019
Punjab	*New and Renewable Sources of Energy Policy, 2012*	10 per cent of the capacity portfolio by 2022	947.1 MW solar as of December 2019
Rajasthan	*Rajasthan Solar Energy Policy, 2011* *Policy for Promoting Generation of Electricity from Wind, 2012* *Rajasthan Solar Energy Policy, 2014* *Rajasthan Solar Energy Policy, 2019* *Rajasthan Wind and Hybrid Energy Policy, 2019*	Target of 10,000–12,000 MW in next 10–12 years 300 MW (2013–14), 400 MW (2014–15) and 500 MW (2015–16) 25,000 MW 24 GW utility-scale solar by 2025 2,000 MW wind for RPO by 2025 Target is only for discom purchase	4,844.21 MW solar as of December 2019 100.25 MW (in 2013–14), 524.1 MW (in 2014–15) and 684.95 MW (2015–16) of wind capacity 4,844.21 MW total solar and 4,299.72 MW total wind as of December 2019

Table 9

Targets specified under policies and achievements

Source: Authors' analysis. RPO achievement figures from MoP. 2020. Agenda Background, Conference of Power and Renewable Energy Ministers of States and UTs, 3 July 2020. New Delhi, 3 July.

Capacity achievement figures from CSO. Energy Statistics 2010. New Delhi: MoSPI; CSO. Energy Statistics 2012. New Delhi: MoSPI; CSO. Energy Statistics 2013. New Delhi: MoSPI; CSO. Energy Statistics 2014. New Delhi: MoSPI; CSO. Energy Statistics 2015. New Delhi: MoSPI; CSO. Energy Statistics 2016. New Delhi: MoSPI; CSO. Energy Statistics 2017. New Delhi: MoSPI; CSO. Energy Statistics 2018. New Delhi: MoSPI; CSO. Energy Statistics 2019. New Delhi: MoSPI; CSO. Energy Statistics 2020. New Delhi: MoSPI; MNRE. 2019. Annual Report. New Delhi: MNRE.

Table 9 contd

State	Wind/solar policy and year	Targets in policy	Achievement against the targets
Tamil Nadu	*Tamil Nadu Solar Policy, 2012* *Tamil Nadu Solar Policy, 2019*	3,000 MW by 2015 9,000 MW by 2023	142.58 MW total solar capacity in FY 2015 3,788.36 MW solar as of December 2019
Telangana	*Telangana Solar Power Policy, 2015* *Telangana Wind Power Policy, 2016*	No target No target	3,620.75 MW solar and 128.1 MW wind as of December 2019
Uttar Pradesh	*Solar Power Policy, 2013* *Solar Power Policy, 2017*	500 MW by 2017 Target up to the RPO	336.73 MW solar by 2017 1,045.1 MW solar by December 2019. Solar RPO compliance for 2019–20 is 30.5 per cent

Note: The capacity achievement figures include only grid connected capacity while the targets may include decentralised capacity.

By 2013, Gujarat had installed over 850 MW of solar PV projects, the largest capacity in India at that time. However, the holding company of discoms in Gujarat – Gujarat Urja Vikas Nigam Limited (GUVNL) – moved to renegotiate the tariffs specified under the signed PPAs, citing excessive profits to developers/investors (Balan 2014). Although GUVNL's attempt was struck down by the APTEL, this was the first time that the risks related to contract sanctity emerged in the Indian market, which hurt business and investor confidence.

As a result of the withdrawal of AD in 2012, and delays in the re-introduction of the GBI, wind power deployment rates also declined in 2013. Without the AD or GBI, the tariff of a typical new wind power plant was in the range of INR 4 to 5 per unit (for 'Zone 2' and above sites). Due to this sudden policy gap, the market collapsed from 3 GW in 2011 to below 2 GW in 2012 and 2013 (CAG 2015, chap. 4).

Figure 8 depicts the growth of solar and wind capacity across states. This clearly shows that total capacity started to increase more rapidly 2014 onwards. Wind power, on the other hand, grew at a constant pace till 2012, after which it plateaued for a couple of years, and it again picked up in 2016 and 2017. After 2017, wind deployments slowed down again.

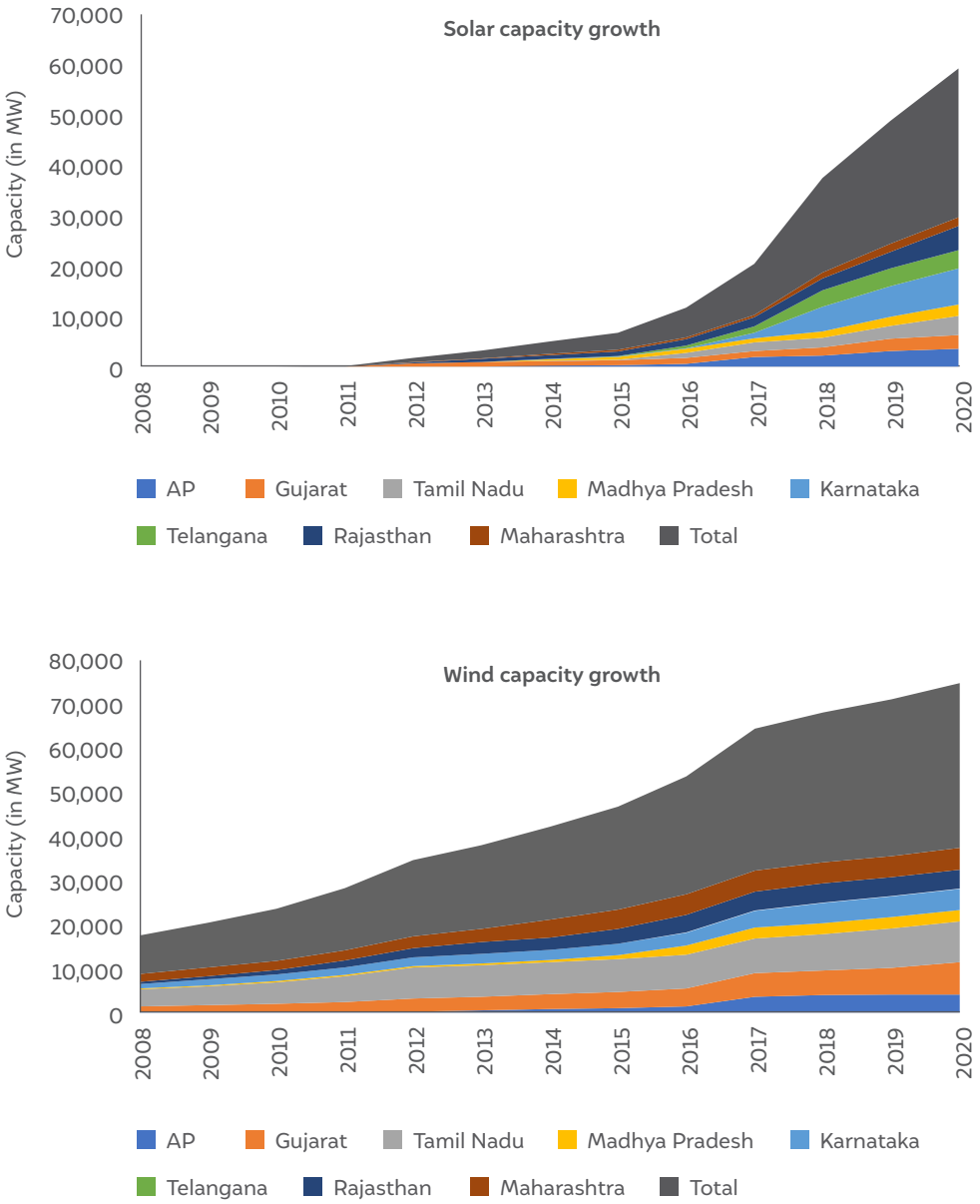


Figure 8
Solar and wind capacity increased rapidly 2014 onwards

Sources: Authors' analysis based on CSO. Energy Statistics 2010. New Delhi: MoSPI; CSO. Energy Statistics 2012. New Delhi: MoSPI; CSO. Energy Statistics 2013. New Delhi: MoSPI; CSO. Energy Statistics 2014. New Delhi: MoSPI; CSO. Energy Statistics 2015. New Delhi: MoSPI; CSO. Energy Statistics 2016. New Delhi: MoSPI; CSO. Energy Statistics 2017. New Delhi: MoSPI; CSO. Energy Statistics 2018. New Delhi: MoSPI; CSO. Energy Statistics 2019. New Delhi: MoSPI; CSO. Energy Statistics 2020. New Delhi: MoSPI; MNRE. 2020. Annual Report 2019–2020. New Delhi: MNRE.

Policies for project planning and development phases

Several initial policies assigned the full responsibility for project planning and construction to developers. This included locating and acquiring suitable land, conducting resource assessments, obtaining all clearances and permissions, and bearing the cost of ensuring connectivity to the nearest evacuation point. Although some policies did talk about single-window clearance through state nodal agencies, the portal or facility was non-functional on the ground. Some state policies, for example, *Gujarat Solar Policy, 2009*, *Andhra Pradesh Solar Policy, 2012*, *Andhra Pradesh Wind Policy, 2015*, and *Karnataka RE Policy, 2009–14*, did include enabling provisions for the facilitation of revenue/barren lands:

- Gujarat developed the first solar park in the country in 2012 – Charanka Solar Park – that houses around 600 MW capacity and provides the required infrastructure for projects.

- The New and Renewable Energy Development Corporation of AP Limited (NREDCAP) in Andhra Pradesh worked with the state's revenue department to procure land in advance and sign long-term leases with the developers at predetermined rates.
- In Karnataka, 10 per cent of barren government lands, reserved for industrial use, were allocated to Karnataka Renewable Energy Development Limited (KREDL) for RE development. KREDL could sub-lease the identified revenue, barren, or panchayat lands to project developers for 30 years. No procedure was specified for the selection of developers and allotment of land to them. Therefore, this later led to land banking by wind developers. As per the state policy, KREDL was supposed to undertake wind resource assessment studies, identify potential sites, and notify land parcels as reserved for wind project development.

Many policies did not specify the application procedures to be followed by the project developers

Many policies did not specify the application procedures to be followed by the project developers. For example, Tamil Nadu Energy Department's *Policy Note 2012–13* was totally silent on land allocation criteria – for land owned by the state's revenue department and for private lands (TN Energy Department 2012). Hence, almost the entire wind capacity in the state is installed on private lands. The criteria for allotting land developed by state nodal agencies (SNA) or special purpose vehicles (SPVs) was not articulated – whether it was first-come-first-served basis, or a robust assessment framework for leasing land, or a system that prioritised certain project categories. The arrangements under which the land could be allotted to developers were mainly land-lease-based. However, the policies were not clear on how these lease values will be determined. Mostly, these rates were linked to market prices, which could increase significantly owing to land-use patterns and the limited availability of land.

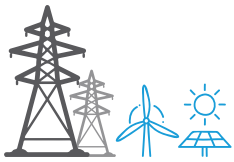
The land-related provisions in state wind policies, or their silence on those aspects, led to developers/manufacturers acquiring huge tracts of private land in wind-rich states, which they could retain while carrying out wind resource assessments (Naidu 2013). They started implementing the project once the desired infrastructure came up or once they struck a deal with the offtaker. As a result, the per MW capital costs were high because of a huge component of land premiums that were built into it. However, this could be considered a way to address the risks wind developers had to bear at that time.

Grid connectivity policies

According to the *Grid Code*, for intra-state networks, the state transmission utility (STU) or discom is responsible for strengthening grid infrastructure to evacuate RE power and bears the associated costs. It is also responsible for extending the grid up to the pooling sub-station. However, given the financial health of discoms and some STUs, these steps were rarely taken. States took to ad-hoc arrangements to establish grid connection. For example, in Gujarat, the following solution was adopted: the STU provided the necessary equipment for connecting projects to the grid, while the developers provided the workforce and the required finances. This arrangement was then followed by many other RE-rich states. Thereafter, the park/zone approach was promoted under several later policies.

As per the *CERC (Grant of Connectivity, Long-term Access and Medium-term Open Access in Inter-state Transmission and Related Matters) Regulations, 2009*, renewable energy plants of

more than 50 MW could connect to the ISTS to take advantage of reduced congestion in the higher-voltage grid, but no wind or solar plant availed of that option till as late as 2018. This could have been because project development frameworks and power sale contracts were signed with local entities. Or, under the point of connection transmission pricing (on a MW basis), the charges on wind projects may have been a burden, as their capacity utilisation factors are lower than that of thermal power plants. Further, at that time, and even now, PGCIL substations are often far from wind farm sites, resulting in high connectivity costs for developers.



During 2012–14, many states experienced power shortages. Therefore, RE was also considered an option to meet the demand of large commercial and industrial units

Policies addressing project operations and power procurement

Most policies provided for power procurement by discoms from wind and solar plants through long-term PPAs to meet the RPOs. Many states, in 2012–14, experienced power shortages. Therefore, RE was also considered an option to meet the demand of large commercial and industrial units in these states. For example, the Karnataka Electricity Regulatory Commission (KERC) notified a fixed-term, concessional open-access regime for solar energy, including exemption from wheeling and banking charges and cross-subsidy surcharge for the first 10 years of operation for solar projects that did not fall under the REC mechanism. However, this was rolled back in 2018.[18] Many other states offered incentives and exemptions such as nil or minimal wheeling and transmission charges for wheeling of power consumed within the state, cross-subsidy surcharge exemption for open access obtained for third-party sales within the state, exemption from paying electricity duties for sale to discoms and/or for captive consumption and third-party sale within the state, and different arrangements for banking of RE power.

It appeared that most RE-rich states preferred RE plants to sell power to discoms or third parties or serve captive demand within the state itself. For example:

- Maharashtra's *New Policy for Power Generation from Non-Conventional Sources, 2008*, required developers availing the benefits of the policy to sell 50 per cent of the electricity generated from the plant to the discom – Maharashtra State Electricity Distribution Company Limited (MSEDCL) – at the Maharashtra Electricity Regulatory Commission (MERC)-approved rate under the PPA, and the remaining 50 per cent only within the state.
- Karnataka's *Renewable Energy Policy, 2009–14*, required RE plants to sell electricity to discoms under PPAs approved by KERC or use it for captive purposes. There was no mention of third parties within the state who could buy RE power through open access.
- Andhra Pradesh's *Solar Policy, 2012*, captures only intra-state sale of power to discoms or third party.

Curtailment

Following the *Grid Code*, the must-run status of RE plants was adopted by states in their respective grid codes. However, inadequate grid availability has been a challenge in RE-rich states, more so in the period 2009–2014. In Tamil Nadu, wind generation increases significantly during the monsoons (April–September), when power demand is also relatively low. Before 2014, the intra-state grid was unable to absorb the excess generation due to low demand and could not transmit it to other regions because of limited inter-connections with

18. Order dated 14 May 2018 issued by the KERC in matter no. S/03/2017 titled *In the Matter of Revision of Wheeling and Banking Charges for Renewable Power Projects*. https://kredlinfo.in/general/wheeling%20and%20banking%20charges%2014.05.2017.pdf.

the national grid. This led to the severe curtailment of wind power. In 2014, the southern grid was inter-connected with the national grid, providing some relief to the southern states, but many industry players (Saumy 2019) and the MNRE (Chandrasekaran 2017) have continued to ask states to prevent curtailment of RE power. Curtailment for wind power plants averaged around 30–35 per cent of generation in the peak season during 2012–15 (Jhawar 2020).

Inhibitors	Corresponding risks
Inadequate support for land procurement	Inadequate support for land procurement
Lack of evacuation infrastructure and delays in grid connectivity	Delay in commissioning leading to cost overrun
Mismatch between national targets and state RPO trajectories; low RPO compliance	National targets at risk, restricted markets/ demand
Poor credit profile of state discoms	Offtake risk, payment risk
Uncertainty in incentives – lapsing and withdrawal of GBI and AD	Cashflow risks
Curtailment of power	Offtake risk
No provisions for RE sale outside the state	Restricted markets/demand

Table 10
2010–2014: Developments that held back RE deployment and associated risks that remained

Note: Authors' analysis

4.2 Policies post- 2014

From 2014 onwards, the Indian market witnessed a steep fall in solar tariffs, owing to a variety of reasons ranging from domestic factors to global developments. The NSM was successful in signalling India's commitment towards solar development. Although the rate of installation was slow during 2012–2014 and risks and inhibitors continued (Table 10), investor outlook remained positive.

Key drivers

As power deficits in states reduced, demand grew slower than expected, and solar tariffs declined drastically. In response, most RE-rich states developed policies with the intent of ensuring state-level energy security, meeting agricultural and domestic loads through solar, and aiming to become investment-friendly destinations. In addition, creating employment opportunities through project deployment as well as local manufacturing, and responding to local environmental challenges and addressing climate change risks, remained some of the commonly stated drivers across these states.

Policy focus

Most policies starting 2014–15 included provisions to facilitate the development of large-scale solar parks in a systematic and structured manner with the help of SECI. Instead of individual states conducting their own auctions to procure solar power and meet their solar RPOs, states preferred to buy power through SECI, while continuing to procure wind power directly at preferential tariffs till 2017. Many policies specified clear targets to be achieved over

a five-year period. Most policies, at least on paper, aimed to mitigate project development, counterparty, and operations-related risks in the sector to lower the cost of RE generation in their respective states. Progressive policies such as the Andhra Pradesh's *Solar Power Policy, 2015* and *Wind Power Policy, 2018* provided deemed industry status to RE projects, and explicitly accorded them must-run status. Unlike in the pre-2014 era, these policies acknowledged the need to facilitate the sale of RE power outside the state. For example,

Unlike in the pre-2014 era, the policies now acknowledged the need to facilitate the sale of RE power outside the state

- The *Rajasthan Solar Energy Policy, 2014*, aimed to meet the energy requirements of Rajasthan as well as India.
- Maharashtra's *Comprehensive Policy for Grid-connected Power Projects Based on New and Renewable (Non-conventional) Energy Sources, 2015*, aimed to facilitate the sale of renewable power outside the state once the state's RPOs were met. The policy even included a provision for deemed open access for the sale of energy within or outside the state if permission is not granted within the period specified in the MERC regulations. It also gave RE projects the option to terminate their existing PPA with the state discom and opt for open access.
- AP's *Solar Power Policy, 2018*, provided transmission and distribution charge exemptions for inter-state wheeling of power (which was later rolled back through an amendment).
- AP's *Renewable Energy Export Policy, 2020*, aimed to facilitate the leasing of land for setting up RE power plants and manufacturing facilities and to export power to other states.

The reason for this shift in focus is that RE-rich states would want to utilise their abundant land and resource potential to attract huge private-sector investments, generate revenues for the exchequer, and create local jobs, but would not be able to absorb all the generation within the state to meet their own demand.

Global market developments

Apart from reduced risk perceptions due to stronger institutional mechanisms, developers' expectation of fall in solar module prices also drove them to place extremely aggressive bids in the auctions (Deign 2017). Solar module prices witnessed an overall drop in prices (see Figure 9). However, even small fluctuations in module prices can affect project economics adversely.

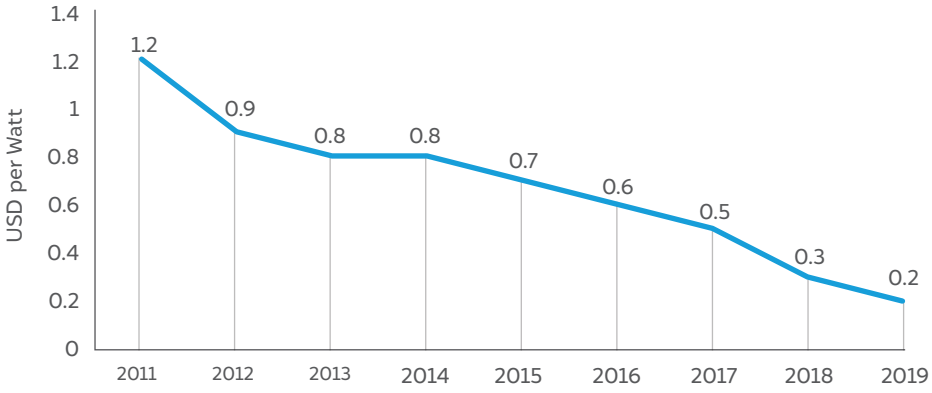


Figure 9
Average module (multicrystalline) prices have declined (2011–2019)

Source: IEA. 2020. "Evolution of Solar PV Module Cost by Data Source, 1970-2020." 30 June. Accessed 28 November 2020. https://www.iea.org/data-and-statistics/charts/evolution-of-solar-pv-module-cost-by-data-source-1970-2020.

There were short periods when module prices increased during 2017–2020 due to various reasons such as China slashing its subsidies, reduced polysilicon supply in China, module suppliers demanding price renegotiation, and supply chain disruptions due to the COVID-19 pandemic (Bridge to India 2017). Excessive reliance on imported modules and largely from a single country, makes the projects vulnerable to geopolitics and domestic policies intended to promote domestic manufacturing (Chawla 2020).

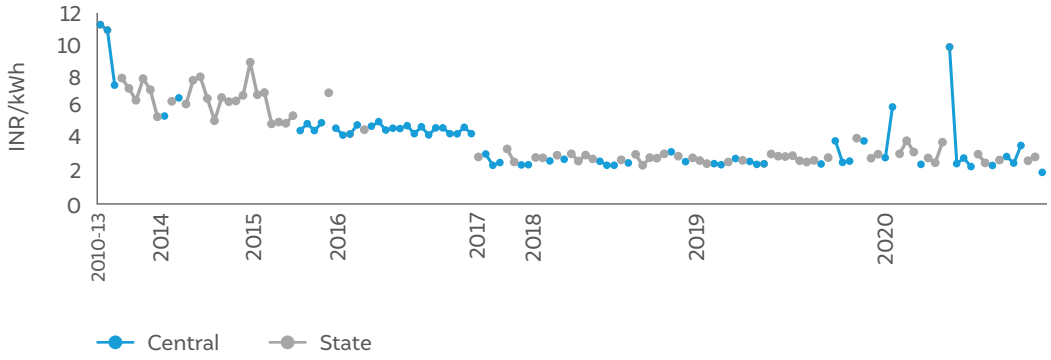


Figure 10
Solar tariffs discovered in Indian auctions

Source: India RE Navigator. 2020. "Auction Results." Accessed November 28, 2020. https://india-re-navigator.com/wind.

Wind tariffs declined following the initial rounds of bidding; however, the decline was not at the same pace as that of solar. Even as discovered tariffs kept declining and were comparable with or even lower than tariffs of thermal projects, RPOs remained the key driver and the primary Central Government lever for states to increase their RE uptake. This is primarily because of the additional cost implications for discoms as they balance the increased variability in the system while being tied-up in long-term thermal PPAs.

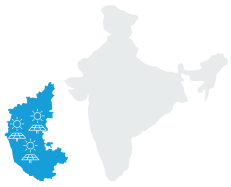
Performance of policies

Although all the policies seemed to be favourable and directed towards providing an enabling environment for RE development, on-ground implementation and compliance remained weak, which was the main reason for the prevailing risks in the sector. Almost all RE-rich states, like Tamil Nadu, Andhra Pradesh, Gujarat, Karnataka, Rajasthan, and Maharashtra, have made policy and regulatory decisions on electricity matters that have often been inconsistent with national policies and priorities. They have made retrospective changes to policies, threatened to renege on existing PPAs, delayed payments to RE generators, and curtailed RE power.

One main reason for these inconsistent and ad-hoc actions was the drastic and rapid decline in solar tariffs starting 2014 (see Figure 10). The wind sector too transitioned to competitive bidding in late 2016 because of the success of reverse auctions in reducing solar tariffs. While competition and reduced tariffs were desirable outcomes for Central policies, it led to states losing confidence in RE PPAs signed at higher tariffs as compared to the lower tariffs discovered in subsequent auctions. This not only led to the re-negotiation of PPAs but also delayed the procurement of new RE capacity in anticipation of further declines in tariffs.

On the other hand, the policies helped advance the setting up of solar parks, which was a comforting factor for developers and investors, and one of the contributing factors for

bringing down tariffs. However, there were execution bottlenecks on the ground. Project development was delayed because tenders were concluded while the park infrastructure was still under construction.



Karnataka has recorded the largest solar capacity deployments in the country in 2017, 2018, and 2019

Amongst the RE-rich states, Karnataka has been a consistent performer for solar. Under the *Karnataka Solar Policy, 2014–2021*, it has recorded the largest solar capacity deployments in the country in 2017, 2018, and 2019. In 2017, Karnataka installed more than 2 GW of large-scale solar and contributed to almost 25 per cent of the total capacity addition in India in that year. By March 2019, with over 5.3 GW, Karnataka had the highest installed capacity of utility-scale solar with a pipeline of around 2.8 GW. Other state policies that have attracted investments include those of Rajasthan, Andhra Pradesh, Tamil Nadu, and Maharashtra. In 2018, these five states had more than 80 per cent of the country's utility-scale solar capacity.

Meanwhile, after SECI successfully concluded two auctions for wind energy in 2017 resulting in reduced tariffs, many wind-rich states shifted to competitive bidding with SERC-determined generic tariffs as the tariff ceiling. During 2017, states such as Gujarat and Tamil Nadu auctioned additional wind capacity to meet their non-solar RPO targets (Saurabh 2017). Seven wind-rich states installed 5.5 GW of wind capacity in 2016–17 (Raikar 2018). However, in 2017–18, and 2018–19, the total wind installed capacity declined substantially, to just around 1.8 GW and 1.4 GW, respectively (IWTMF 2019). Low tariffs were quoted in initial bids, but the subsequent tenders were undersubscribed, most likely because the tariff ceilings were financially not feasible. The main reasons for states not being able to achieve their wind policy targets were the conditions and risks that reverse auctions failed to address: (i) wind resource is more concentrated than solar and high wind density sites are getting exhausted; (ii) ISTS is not planned/available for moderate/high wind sites; (iii) bearing the costs associated with connecting to the nearest ISTS sub-station, or connecting to STU networks instead, adds to the risks, and the resultant tariffs face tough competition from solar. Amongst wind-rich states, Gujarat led wind deployment in the country during 2016–2020, followed by Andhra Pradesh, Karnataka, and Tamil Nadu. Figure 11 shows the annual wind capacity addition in these states.

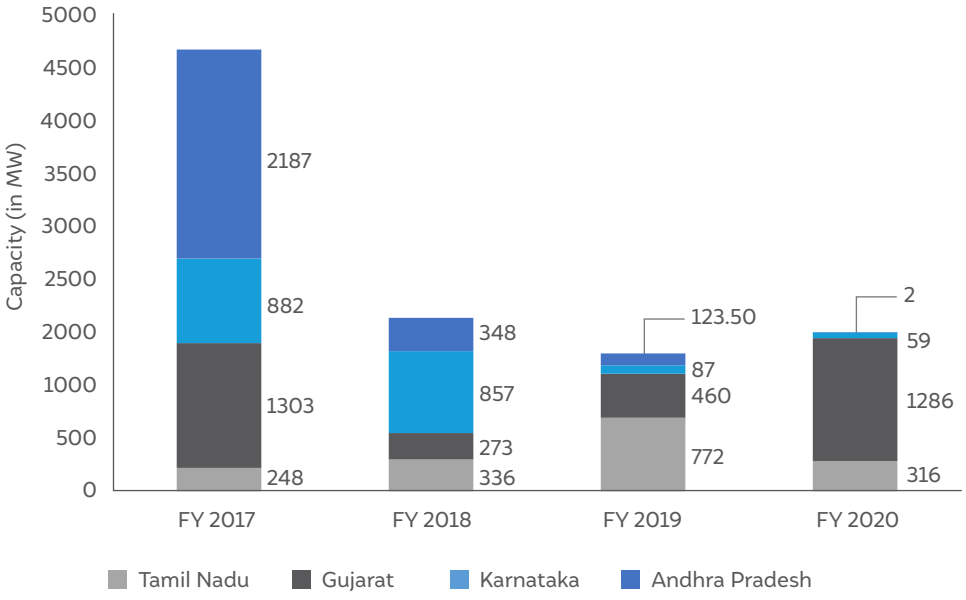


Figure 11
Gujarat saw the largest wind capacity additions among the wind-rich states (2016–2020)

Source: Authors' analysis based on CSO. Energy Statistics 2018. New Delhi: MoSPI; CSO. Energy Statistics 2019. New Delhi: MoSPI; CSO. Energy Statistics 2020. New Delhi: MoSPI; MNRE. 2020. Annual Report 2019–2020. New Delhi: MNRE.

In 2019, political risks in the RE sector were exemplified when the new government in Andhra Pradesh took a strong stand on renegotiating wind and solar PPAs signed under Andhra Pradesh's *Wind Power Policy, 2018* and *Solar Power Policy, 2018* (see Table 11).

Date in 2019	Event
1 July	AP government sets up a committee to renegotiate PPAs/PSAs signed between 2012 and 2016.
12 July	Letter from AP Southern Power Distribution Company Limited (APSPDCL), one of the two state discoms, to 139 wind and solar power plants to revise tariffs to INR 2.43 and INR 2.44, respectively.
25 July	The AP High Court stays the July 1 order based on a petition by developers.
24 September	The AP High Court quashes the July 1 order and July 12 letters in writ petitions filed by the developers. It directs the developers and discoms to approach the Andhra Pradesh Electricity Regulatory Commission (APERC) with their respective claims and to resolve all disputes in 6 months. In the interim, discoms will clear their dues and pay all power plants at the rate of INR 2.43 and INR 2.44 for wind and solar, respectively.
October	Petition filed by AP discoms before APERC to review the tariffs.
29 November	A compromise is reached between the Central and AP governments. There is to be no tariff revision but concessional loans to be extended to discoms from PFC and IREDA to clear the dues.
30 November onwards	AP discoms clear pending dues at the rate of INR 2.43 and INR 2.44 for wind and solar, respectively.
1 December	The AP High Court stays the public hearing of the APERC on the tariff review petition filed by developers.

Table 11
Timeline of the key events in the AP story

Source: Authors' analysis.

2016 onward, SECI's tendering activity has shifted towards ISTS-connected solar projects. Between 2016 to 2019, it issued tenders worth 13,000 MW of solar PV capacity (ISTS I to ISTS IX) and 12,600 MW of wind capacity (Tranche I to Tranche IX). Figure 12 shows the deployment progress of solar projects awarded under the ISTS I to ISTS IX tenders by the SECI (as of August 2020).

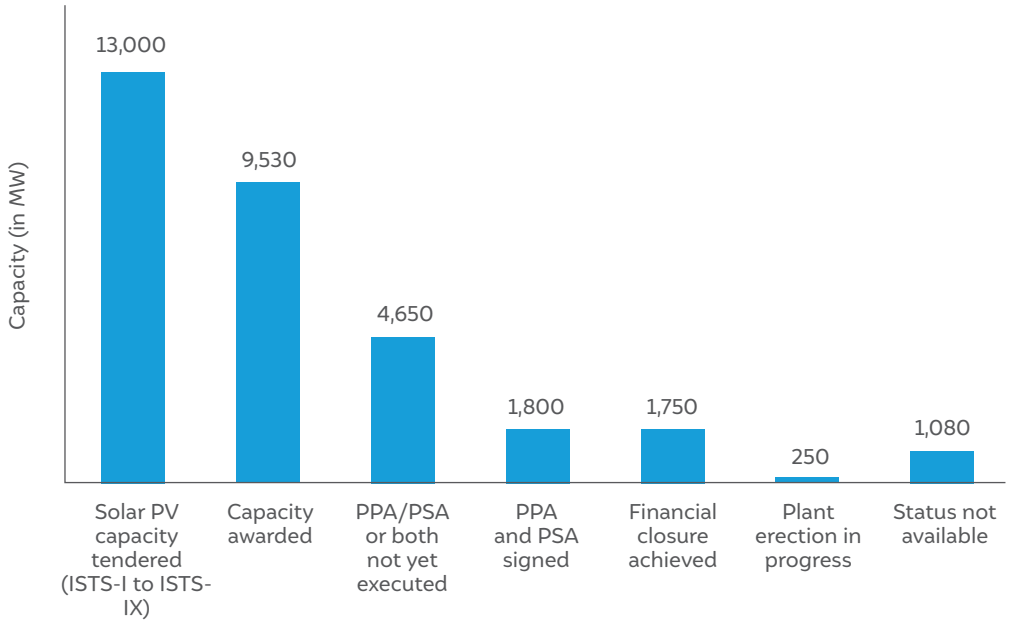


Figure 12
ISTS-connected solar PV projects have poor completion record

Source: Authors' analysis based on CEA. 2020. Report of Under Construction Renewable Energy Projects. New Delhi: Renewable Energy Project Monitoring Division (CEA).

As is evident, almost 50 per cent of the capacity that has been awarded is still awaiting closure of power purchase and/or power sale agreements. This implies that state discoms are not coming forward to offtake power from projects already awarded, leaving developers and investors in a lurch. **For the capacity for which PPAs and PSAs have already been signed, there have been significant delays because the required transmission/ evacuation infrastructure is not ready, and long-term access (LTA) to transmission has not been operationalised**. The COVID-19 pandemic has further impacted the construction of transmission lines, increased delays, and depressed electricity demand across the country. Because of the lockdown enforced to curb the spread of the pandemic, the MNRE had granted blanket extension of the scheduled commissioning timelines.

For wind projects too, the rate of commissioning has been rather slow (Figure 13). Most of the awarded projects will be coming up in Gujarat (Kutch). There were roadblocks with respect to the land allocation policy in Gujarat because of which no progress could be made. Few projects are likely to come up in other host states such as Tamil Nadu, Karnataka, Maharashtra, Madhya Pradesh, and Kerala. While the recent tenders (tranches VI to VIII) were undersubscribed, several projects awarded earlier are facing delays due to non-readiness of transmission infrastructure, and some projects have terminated their PPAs citing non-viability of projects at the discovered rates due to time and cost overruns. Notably, wind-rich sites are intrinsically more concentrated than solar, logistically as well as resource-wise. Therefore, unless the sites are identified and prepared and transmission networks are appropriately planned/ strengthened in advance, deployment would be slow. One more option being tested is the wind–solar hybrid or the blending approach and a bidding process akin to case I bidding in the conventional power sector, to ease out on transmission, variability, and land-related risks.

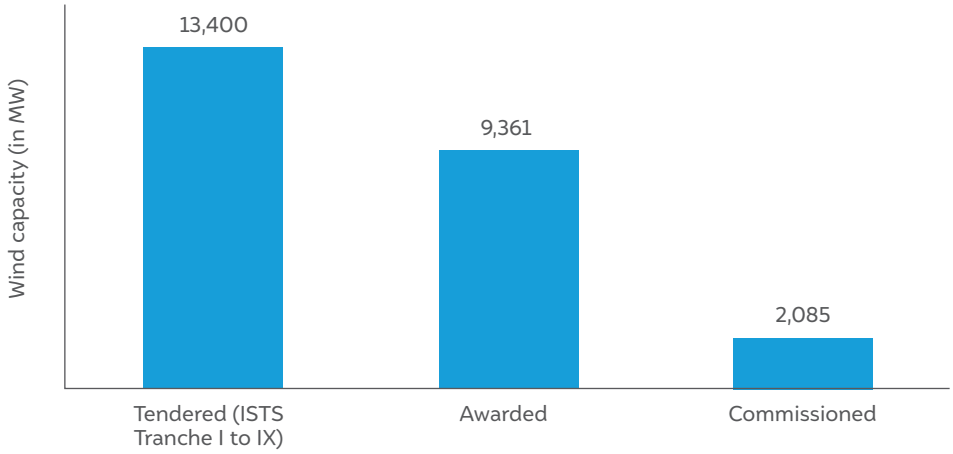


Figure 13
The rate of commissioning of wind projects has been slow (August 2020)

Source: Authors' analysis based on CEA. 2020. Report of Under Construction Renewable Energy Projects. New Delhi: Renewable Energy Project Monitoring Division (CEA); CEA. 2019. Summary of Solar and Wind Power projects (Commissioned and Under Construction) of SECI. New Delhi: Renewable Energy Project Monitoring Division (CEA).

Policies facilitating land procurement

The MNRE's solar park scheme encourage states to develop solar parks to solve land procurement and connectivity problems. All state policies encourage deployment in parks. Most policies provide for designating solar power park developers (SPPDs). The SPPDs may be a state government-designated agency; or a joint venture company (JVC) between a state-

designated agency and SECI; or a JVC between a state-designated agency and private agency; or a private agency.

The states, under their respective solar/RE policies, have provided the necessary support and arrangements for developing the parks, and projects have been successfully commissioned in the parks that are operational. However, there have been some challenges in developing these parks, including problems in land acquisition by the SPPDs and mismatch in timelines for development activities and setting up of solar projects. For example, developers are facing several challenges with permissions, clearances, and approvals at the Kadapa Solar Park in Andhra Pradesh, where the letters of award were issued in August 2018, but two years hence, developers have yet not been able to begin any work there.

For non-solar park projects, land procurement is typically the generators' responsibility, particularly for projects set on private lands. The *Karnataka Renewable Energy Policy 2016–22* was the only policy that assigned the responsibility of identifying suitable land banks to the state nodal agency. Andhra Pradesh's *Wind Power Policy, 2018* and *Solar Power Policy, 2018* had entrusted NREDCAP with the responsibility of securing government lands. However, this provision was rolled back in 2019.

The wind sector was again at a disadvantage here. Most policies, except recent solar–wind hybrid policies, did not address land requirements for wind power projects, which are typically more concentrated in certain pockets. In many cases, windy sites were located far from planned/existing intra- and inter-state networks. Further, all state policies require wind developers to either procure government land on a lease-hold basis on their own or procure private lands. Even in SECI's auction for ISTS-connected wind, developers faced difficulties in securing land leases from the state governments and revenue departments. For example, while Gujarat had announced a wind power policy in 2016 to attract investments, it took a policy decision in 2018 to not allocate any land to wind projects auctioned by SECI for exporting power to other states (Tenddulkar 2019). Later, in January 2019, Gujarat announced a new land policy for wind, solar parks, as well as wind–solar hybrid parks to demarcate land areas where these projects would be allowed.

In state-level policies, there appears to be some degree of disparity and uncertainty on grid connectivity, evacuation, forecasting, scheduling, and sale of power

Policies for grid connectivity and project operations

From 2014 onward, MNRE and SECI started coordinating with other line departments and agencies at the Central level, to plan, construct, and strengthen intra- and inter-state networks. To ensure the evacuation of power from 20 GW of wind and solar capacity, the Centre sanctioned a project to augment the Intra-State Transmission System (InSTS) in 2015–16. STUs in eight RE-rich states – Tamil Nadu, Rajasthan, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Himachal Pradesh, and Madhya Pradesh – are implementing this project.

In 2016, the Ministry of Power waived off inter-state transmission charges and losses for wind and solar projects, which is now applicable for projects being commissioned till June 2023. In state-level solar/wind/RE policies, there appears to be some degree of disparity and uncertainty on grid connectivity, evacuation, forecasting, scheduling, and sale of power:

- As of July 2019, 15 states had notified their regulations for forecasting, scheduling, and settlement of deviations for RE, broadly in line with the CERC regulations (Srivastava, Singhvi, and Rustagi 2019). Most of these states permit an error band of (+/-) 15 per cent, as per CERC regulations. In a few states, such as in Tamil Nadu, the error band is limited to a narrower range of (+/-) 10 per cent. Even within the same regional load dispatch region, the error bands notified by states differ. For example, Maharashtra permits (+/-) 15 per cent deviation while Gujarat allows only (+/-) 12 per cent deviation for wind developers.
- Andhra Pradesh's *Wind Power Policy, 2018* and *Solar Power Policy, 2018* stated that no transmission and distribution charges will be levied for inter-state wheeling of power. Later, the policy was amended in November 2019, and the exemptions were rolled back, and charges as determined by the APERC were made applicable.
- To discourage open-access transactions of wind power, Tamil Nadu increased the cross-subsidy surcharge for open-access consumers from 50 per cent of that for conventional power in 2016 to 60 per cent in 2018. Over the same period, it also increased open-access charges from 40 per cent to 50 per cent of that for conventional power. Such steps restrict significant new demand for RE amongst large commercial and industrial players by adding to the landed cost of RE power, even as RE tariffs become cheaper than discoms tariffs.
- Banking charges for wind and solar vary by state. The period of banking is also different for various states (Table 12).
- Although RE is accorded a must-run status by several policies and grid codes, curtailment continues for technical as well as commercial reasons. Older projects that have higher tariffs face higher curtailment than newer projects. In Tamil Nadu, curtailment has reduced from a peak of 30–35 per cent to 20–25 per cent currently (Jhawar 2020). However, it appears that commercial concerns are causing the Andhra Pradesh discoms to curtail RE power despite repeated judicial directions against it (Parikh 2020).

State	Banking charges	Banking period	Other conditions
Gujarat	No banking charges for wind projects	One month	Monthly settlement for non-REC wind projects. Banking facility not available for third-party sale and REC-based captive power plants (CPP).
Maharashtra	2 per cent of RE banked, in kind	One month	Energy banked during the peak time of day (TOD) hours may be drawn during off-peak TOD slots, but not vice-versa. The unutilised banked energy at the end of the month, up to 10 per cent of the total energy generated in that month, to be purchased by discoms at the applicable generic tariffs for the year.
Rajasthan	10 per cent of RE banked, in kind	April to March; barring peak hours as determined by the discoms	Banking allowed for CPP but not for third-party sales under open access within the state. The unutilised banked energy will lapse at the end of the year.
Tamil Nadu	For wind projects commissioned till 31 March 2018		
	14 per cent of input energy	One FY (April to March)	The unutilised banked energy as of March 31 to be encashed at 75 per cent of the applicable wind energy tariff for existing wind energy captive users.
	For wind projects commissioned on or after 1st April 2018		
	No banking charges	One month	Excess generation or unutilised banked energy at the end of the month to be purchased at 75 per cent of the wind energy tariff for captive users. For captive REC generators, the unutilised banked energy can be encashed at 75 per cent of the pooled cost of power.
Karnataka	2 per cent of the injected energy, in kind	January to June – for wind projects; April to September and October to March – for solar projects	Unutilised banked energy at the end of six months to be purchased by discoms at 85 per cent of the applicable generic tariff. The energy banked by non-REC projects during the peak ToD hours can only be drawn during the peak ToD hours.
Andhra Pradesh	No banking allowed		

Table 12

Banking charges and conditions across RE-rich states

Source: Authors' adaptation based on MERC (Distribution Open Access) (First Amendment) Regulations, 2019; Order No. 8/2020 dated 7 October 2020 issued by the TNERC titled Order on Procurement of Wind Power and Related Issues; Order No. 2/2020 dated 30 April 2020 issued by the GERC titled Tariff Framework for Procurement of Power by Distribution Licensees and Others from Wind Turbine Generators and Other Commercial Issues for the State of Gujarat; RERC (Terms and Conditions for Tariff Determination from Renewable Energy Sources) Regulations, 2020; Order dated 14 May 2018 in matter No. S/03/2017 issued by the KERC titled Revision of Wheeling and Banking Charges for Renewable Power Projects.

5. Policy evolution in RE-deficit states


Image: iStock

As discussed above, southern and western states in India have abundant RE and land resources to develop large-scale wind and solar power projects. However, the northern states in the Indo-Gangetic plains are densely populated, agricultural states. The mountain regions in the north have excellent solar resources and are sparsely populated but have forest areas and difficult terrains and low transmission capacities. The coal economy is dominant in the eastern states.

The policy response to developing large-scale solar and wind has been weak in the non-RE-rich states as compared to RE-rich states. Our review accounts for three key states – Uttar Pradesh, Bihar, and Punjab.

Policies in RE-deficit states promoted local project deployment, with little emphasis on discoms buying wind and solar power from other states or RECs to meet RPOs

Key drivers

The key drivers for promoting RE were poor power supply in the rural as well as urban area; growing energy needs in urban, industrial, and commercial sectors; and the need to comply with RPOs. Policies intended to attract private-sector investments, improve rural livelihoods, and create employment opportunities through grid-connected, decentralised RE projects, and local manufacturing facilities.

Policy focus

Most of the initial policies were notified starting late 2012 and largely focused on decentralised RE such as rooftop solar, solar irrigation pumps, off-grid renewables, and other RE resources such as bioenergy. For example:

- *Punjab New and Renewable Sources Policy, 2012*, focused on rooftop and decentralised/off-grid generation, waste to energy, biomass-based cogeneration, and new technologies.
- Uttar Pradesh's solar policies of 2013 and 2017 focused on decentralised solar as well as large-scale grid-connected solar because of wastelands being available in the Bundelkhand region.
- *Bihar Policy for Promotion of New and Renewable Energy Sources, 2011*, focused on biomass and biogas, cogeneration projects, mini/micro/small hydro, wind, and solar, and municipal solid waste-based projects, but with no specific targets.

These states' policies promoted the local deployment of projects. There was little emphasis on discoms buying wind and solar power from other states or buy RECs to meet solar and non-solar RPOs, which were set relatively low as compared to RE-rich states. This may be because the states were keen to attract investments and create jobs in their own states and bolster their own generation capacities rather than depending on other states.

Even the recent policies of the RE-deficit states do not demonstrate any intent to purchase power/RECs to meet RPOs, particularly the non-solar component.

Performance of policies

Among the RE-deficit states, Uttar Pradesh and Punjab are leading in terms of solar deployment. They are among the top 10 solar states in the country. However, their RPO compliance has remained weak. In the year 2019–20, the compliance level for Uttar Pradesh was only 35.3 per cent whereas for Punjab it was 43.8 per cent (MoP 2020a). Uttar Pradesh discoms also rank among the least performing discoms of the country (ICRA Limited and CARE Ratings 2019).

Uttar Pradesh notified two solar policies – once in 2013 which was later superseded by a policy in 2017. The *2013 Solar Policy* stated a target of 500 MW of solar capacity to be deployed

by 2017. This policy was the first of its kind because it had an exclusive budgetary allocation for discoms to procure solar power and for state nodal agencies to effectively administer and implement the policy. The policy achieved 420 MW against the target of 500 MW by 2017 but presented some uncertainties such as:

- The duration of power purchase agreements was made 10 years as opposed to the usual practice of 25 years; the possibility of extending PPAs beyond the 10-year duration at the prevailing APPC price did exist, but this represented an uncertainty for developers.
- Strict enabling provisions for establishing solar parks were missing. As a result, developers reported delays due to the lack of grid infrastructure and difficulties in allotting ready land inside solar parks.

In Uttar Pradesh, competitive bidding in early years discovered tariffs that were higher compared to other states, signalling the high risk perception amongst the industry

The Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) initiated a competitive bidding round in March 2013, which led to the discovery of tariffs in the range of INR 8.01 to INR 9.33 per unit, among the highest for any state during that time. These high tariffs may be attributed to real and perceived risks specific to the policy as well as the legacy power sector issues in the state. Later, there were many instances when UP's distribution companies renegotiated tariffs under the PPAs signed during 2015–16. This affected completed and under-construction grid-connected solar projects as well as the investor confidence in the sector.

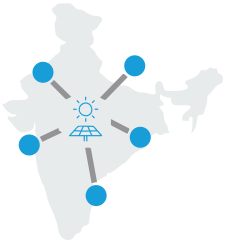
The *UP Solar Power Policy, 2017*, set high targets – 10,700 MW of installed solar capacity by 2022, out of which 6,400 MW should be utility-scale projects. Some improvements that were made included PPAs for 25 years, facilitative provisions for land procurement, additional incentives for projects in the Bundelkhand region, and modalities for establishing solar parks. Currently, 973 MW of large-scale solar projects are in operation, and about 1.7 GW capacity is under development (Ranjan 2020).

Recent tenders by UPNEDA have been cancelled or undersubscribed. In July 2018, UPNEDA cancelled a 1 GW tender floated in January citing high tariffs. Two tenders of 500 MW each in January and October 2019, were undersubscribed. The reasons reported for under-subscription included inadequate grid/evacuation infrastructure, particularly in the Bundelkhand region, and the changes made in the PPA.

Punjab, under its *New and Renewable Sources of Energy (NRSE) Policy, 2012*, aimed to install 1,000 MW solar by 2017. Till FY 2020, it had installed 947 MW (MNRE 2020). Although the policy emphasised installations within the state, the potential for large-scale solar power in the state is limited. Therefore, Punjab has been procuring solar and wind power from ISTS-connected projects to meet its solar and non-solar RPO targets. Punjab State Power Corporation Limited (PSPCL) signed long-term agreements with SECI and NTPC and has entered into short-term agreements with wind and solar generators for this purpose.

The *Bihar Policy for Promotion of New and Renewable Energy Sources, 2011*, was notified in June 2011. It did not state any specific targets for the segments covered. The new policy in 2017 set a target of 2,969 MW from solar by 2022, out of which 1,000 MW was dedicated to grid-connected rooftop solar. Even though this policy was notified in June 2017, it did not explicitly put out the intent to purchase solar and wind power through inter-state transactions or

Central procurement through SECI. By December 2019, Bihar had installed 341 MW of RE capacity (CEA 2020a), out of which grid-connected solar was 149 MW, and the rest was non-solar (small hydro, biomass, cogeneration etc.). In FY 2018–19, Bihar discoms procured 10 MW solar and 300 MW wind power through SECI's ISTS-connected projects.[19] In June 2019, the Bihar Renewable Energy Development Authority (BREDA) issued its first tender for setting up 250 MW of ground-mounted solar projects in the state, which was re-issued in December 2019 because the state regulatory commission did not approve the high ceiling tariffs. With these efforts, however, Bihar's RPO compliance at the end of March 2020 was 15 per cent with respect to Central trajectories (MoP 2020a).



Uttar Pradesh, under its *Solar Power Policy*, 2017, allowed solar developers to sell power across the country with a 100% waiver of transmission charges

Grid integration

The initial policies by these states had some typical provisions regarding grid connectivity and transmission of power. Like many other state policies on connectivity, Uttar Pradesh's solar power policies as well as Punjab's *RE Policy, 2012*, required developers to lay their own transmission lines to the nearest sub-station at their own cost. However, the UP government committed to bear all transmission-related expenditure for all solar projects in the Bundelkhand region. Under Bihar's *RE Policy, 2017*, the state government committed to bear connectivity-related expenditure only in cases where the RE plant is located within 10 km from the nearest sub-station.

Transmission charges

Punjab's 2012 policy accorded must-run status to grid-connected renewables and exempted transmission and wheeling charges for intra-state open-access sales for 10 years for RE projects commissioned up to 31 March 2017. No explicit exemptions were provided for inter-state open access unlike Uttar Pradesh which, interestingly, under its *Solar Power Policy, 2017*, allowed the solar developer to sell power across the country with a 100 per cent waiver of transmission charges – a one of its kind provision among policies rolled out by RE-deficit states. Bihar's *RE Policy, 2017*, provided exemptions for wheeling of power from RE projects put up for captive use or intra-state third-party sales.

Incentives for project development and operations

It is interesting to note that some provisions in these policies were outstanding. For example:

Offtake and payments

- Punjab required procurers to clear all payment dues within 60 days, with rebate entitlements as incentives for early clearances.
- UP allocated budgetary support for the first 200 MW of solar projects to be payable to discoms to equalise solar and conventional power. This support was equivalent to the difference between tariffs discovered for conventional power through case I bidding and the solar power tariffs discovered through reverse bidding.

19. Order dated 20 March 2020 in Case No. 30/ 2019 and 31/2019 issued by the BERC titled *Tariff Order Truing up for FY 2018-19, Annual Performance Review for FY 2019-20, Annual Revenue Requirement (ARR) and determination of Retail Tariff for FY 2020-21 for North Bihar Distribution Company Limited (NBPDCL) and South Bihar Distribution Company Limited (SBPDCL)*, https://berc.co.in/orders/tariff/distribution/sbpdcl/2216-tariff-order-of-nbpdcl-for-fy-2019-22.

Ease of doing business, investor attractiveness, facilitation

- Punjab assigned the Bureau of Investment Promotion the task of granting regulatory clearances and fiscal incentive approvals.
- Punjab extended benefits to RE projects under its *Fiscal Incentives for Industrial Promotion Policy, 2013*. It also provided 50 to 100 per cent exemption on stamp duty, property tax, and electricity duty.
- Incentives under the *Uttar Pradesh State Industrial Policy, 2012*, applied to power plants based on solar energy.
- All RE plants set up for commercial sale of power were eligible for an additional 30 per cent tax benefit on the approved project cost.
- Bihar established a Renewable Energy Development Fund under the new policy notified in 2017. This fund was supposed to be capitalised through:
  - a one-time facilitation fee of INR 100,000 per MW, payable during the application process for a project of more than one MW capacity,
  - a RE development cess of 10 paise per unit of power sold in the state by discoms (excluding below poverty line and agricultural consumers), subject to Bihar Electricity Regulatory Commission's (BERC) approval, and
  - a service charge of 7 per cent payable to BREDA for the execution of RE projects. However, this seems to be a proposal in the policy and is not executed in practice yet.

Discoms continue to be tied-up with long-term PPAs and most investors continue to base their business projections on Central and state bidding pipelines.

Image: iStock

6. Looking back to look ahead

With the evolving policy landscape at the Central and state level, we have seen India's renewable energy sector grow tremendously. In 2010, the total installed RE capacity was just about 18 GW, which has grown almost five-fold over the decade.

Recent developments threaten investors' current business models

As our analysis suggests, there were high and low points in this journey. Every time a roadblock emerged, India has been successful in testing and identifying alternate approaches and solutions. Some of these include bundling solar power with conventional power to counter high tariffs in 2010; introducing solar parks when deployment became slow and tough; increasing RPO targets to create the necessary demand; creating and backing SECI to address counterparty risks; accelerating tendering activity to signal a commitment to creating strong pipelines; encouraging solar–wind hybrid parks to improve utilisation factors; introducing protocols and mechanisms such as market-based economic dispatch, a real-time market, and a green term ahead market to optimise grid integration costs. With economics favouring RE, its share in India's electricity mix is only expected to grow.

De-risking investments in project development has unquestionably been the focus of the policies thus far. However, policies have mostly not pre-empted any of the risks but developed through an iterative process that has mostly responded to immediate investor concerns. Hence, non-compliance with RPO targets by the states was met with centralising target setting and making them even higher; the Centre responded to PPA renegotiation attempts by states with intra-se negotiations with the states and financial relief to the concerned states; for addressing payment delays by discoms, the Centre imposed additional financial liability on the discoms by way of the LC mechanism.

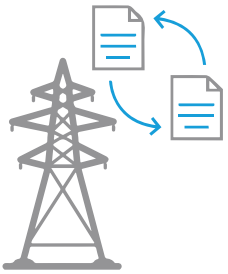
Imminent market disruptions

Further, while CERC and the power exchanges have taken forward looking steps with introducing new market platforms, there has yet been no attempt to create avenues for participation of green/balancing power providers and buyers in these markets. The discoms continue to be tied-up with long-term PPAs and most investors continue to base their business projections on Central and state bidding pipelines. Other developments that threaten the investors' current business model include:

- Expectations of returns have increased since early 2019 that indicates that risk perceptions of investors have also increased (investors expect higher returns for riskier investments).

There are fewer developers who are cornering a greater share of the projects (Dutt, Arboleya, and Gonzalez 2020). This could mean that entry barriers to the sector are increasing and the incumbents will have a high stake in maintaining status quo. Further, the exit of many smaller players by selling their assets indicates that navigating India's policy and governance environment remains a challenge (Chandra 2020).

- Commercial and industrial consumers are increasingly turning to DRE to meet their power needs. The MoP has recently floated a plan to create 'industrial hubs' that will have their own power supplier. This power supplier is likely to be a private entity given the status of a deemed licensee under the EA (Jai 2020). Further, calls for lowering commercial and industrial tariffs are becoming louder in the wake of economic downswing (Financial Express 2020). These developments threaten the principal source of revenue for the discoms and will have a cascading effect on ability of discoms to absorb RE power and invest in grid integration. Poor revenues will worsen their ability make payments under the PPAs.
- The increasing competitiveness of DRE also makes them an important source of supply for the power markets. Discoms are discovering benefits of economising on total power procurement costs by procuring power from the exchanges (Thomas 2020). If given the flexibility, it is likely that discoms would prefer to expand exchange-based procurement rather than signing PPAs for all their projected load.
- The unexpected reduction in wind generation in 2020 by up to 43 per cent during the typical high generation period, due to low wind speeds, caught project developers and system operators by surprise (Singh and Mohanty 2020). Climate change could bring greater uncertainty and variation in weather patterns. Project developers need to be better prepared with rigorous and advanced weather/resource forecasting and tools and techniques to make timely and robust investment and operational decisions.
- End of life waste management is going to be a serious concern very soon. Developers might not have factored this into costs and current policies are unclear as to who will be required to bear these costs. Developers must pre-emptively focus their attention to waste management and not be unpleasantly surprised when the government eventually wakes up to the challenges (Tyagi and Kuldeep Forthcoming).



It is likely that discoms would prefer to expand exchange-based procurement rather than signing PPAs for all their projected load

Policies must pre-empt risks and support transition to a market-driven sector

We are now entering the next decade, which could make India a RE powerhouse. A target of 450 GW of RE by 2030 has been set. However, addressing new and legacy issues of the power sector, cost-effectively managing the operations of existing assets, while also integrating a large quantum of new renewable capacity, are challenges that confront us today.

Centre–state and inter-state alignment requires collaboration not mandates and penalties

Over the last three years, RE costs have fallen significantly. At the same time, regulations allow the transmission of power from a RE-rich state to any other state in the country or the purchase of RECs for an entity to meet its RPO. Despite all the obvious benefits that RE

resources have to offer, states have shown some level of resistance to either deploying or buying more RE power and meeting the national targets. We have seen above that states do push back when it does not make commercial sense for them or they are unable to allocate resources to meet national targets. Policies so far have not resulted in alignment of Centre-state objectives and actions. Further, there is no institutional or political platform to bring together Centre and state representatives for collective problem solving. The Centre has previously determined national capacity and consumption targets unilaterally without previous consultations and engagement.

It appears that the current policies and mechanisms must evolve if the gaps between RE-rich and RE-deficit states are to be bridged. Some approaches to increase alignment may be:

- Account for all the costs, benefits, and co-benefits of achieving national targets. Subsequently, the principles of cost- and benefit-sharing must be established and reflected in Central policies, inter-state regulations, and market mechanisms, to drive states towards meeting national goals and objectives. An example of sharing costs may be, that RE-deficit states support RE manufacturing industry and make it cost competitive globally. This will create a buy-in for RE-deficit states in promoting and adopting RE.
- For long-term clarity, directional uniform RPO targets can be set out for all states. However, states may be given the freedom to choose their own technology/clean energy mix to meet the national target.
- Institutional mechanisms may be devised that bring together the Centre and the states for resolution of issues and greater buy-in of the states towards national objectives.

Addressing counterparty risks will require transformation of RE procurement models

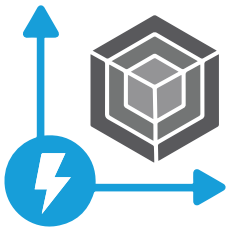
While India's commitment to RE is strong and sustained, the consistent poor financial health of discoms poses significant risks to further growth of the sector. These risks include delayed payments, power curtailment, and contract re-negotiation. We have learnt from our policy experience so far that mandates and higher penalties have limited impact. Project deployment has decreased despite the Centre taking strict and swift action against errant discoms. Fundamental reforms in the distribution sector and market operations will be needed to mitigate these risks. For example:

- Increasing the ability of discoms to access cheaper balancing resources
- Rigorous demand forecasting to identify power purchase requirements under long-term contracts
- Adopting alternate models such as solar power irrigation pumps or using distributed RE for meeting productive and consumptive loads in rural areas to reduce the subsidy/cost burden on discoms or urban micro-grids to manage peak loads (Tyagi, Kuldeep, and Dave 2020)
- Adopting market-based procurement mechanisms for storage capacities, including battery, pumped storage, hydro resources, etc.
- Simplifying and rationalising retail tariff structures and adopting alternate subsidy disbursement mechanisms to ensure revenue recovery

Measures required to improve discom financial health and increase their flexibility in power procurement may not be aligned with the incumbent business models

- Encouraging enhanced participation in new mechanisms such as market-based economic dispatch of power plants, real-time markets, ancillary markets, etc.

However, all these measures that are required to improve discom financial health and increase their flexibility in power procurement, may not be aligned with the incumbent business models. Investors and project developers must adapt to new market contours to stay relevant.



Strong institutions with clear performance standards and a coordination mechanism are essential

Contrasting interests of RE manufacturers and developers must converge

Project developers have viewed policies that have aimed to support domestic manufacturing adversely or indifferently. Developers preferred cheaper thin film modules when DCR was part of the NSM as against procuring locally manufactured crystalline modules. Project activity slowed down when safeguard duty was introduced. Developers have also been arguing against imposition of customs duties that is being demanded by manufacturers.

However, local manufacturing and backward and forward integration of not only generation equipment but also battery storage is essential for RE sector to be future ready and insure against geopolitical risks. Lessons learnt from the COVID-19 pandemic and geopolitical tensions must be internalised. Developers and manufacturers must collectively find solutions that work for them. They can take cues from the initial days of spread of wind technology. Wind technology in India spread through research and demonstration collaborations between countries. Equipment manufacturers also expanded into project development that gave them a stake in project activity as well as manufacturing. More integrated supply chains and linkages must be explored by developers and manufacturers.

Institutional framework – planning, coordination, and analytical requirements

Strong institutions are prerequisites for better performance and coordination. Developers must aim to work with both Central and state institutions to create data sharing and information protocols. For example, there is not enough data to detect reasons for curtailment. As we aim to increase the share of RE in the electricity mix, strong institutions with clear performance standards and a coordination mechanism are essential. The functions, roles, and responsibilities of key power sector institutions need to evolve with national ambitions. For example:

- Strict monitoring and reporting of RE curtailment and the underlying reasons
- Data and information-sharing protocols and analytical requirements for specific institutions
- Instituting processes for bottom-up, integrated resource planning (IRP) to build an optimal and cost-effective electricity system. This will include relevant Central level institutions to develop and disseminate guiding frameworks, toolkits, and processes that any state can utilise to conduct a robust planning exercise
- Coordination mechanism to consistently monitor the implementation of policies, programmes, and plans by institutions

Such new roles and responsibilities must be formally assigned to institutions for reducing

discretion, ensuring greater alignment between the Centre and states, enhancing the ease of doing business, reducing risks for investors, and accelerating the pace of the energy transition.

Accelerating the flow of capital into the sector

To achieve India's ambitious RE targets for 2030, the country would need an additional investment of USD 199 billion (approximately INR 14.6 lakh crore) in generation alone. Investments in transmission and storage will be over and above this (Singh, Dutt, and Sidhu 2020). Most of this requirement will need to be met through debt finance. It is a challenge to raise such enormous amounts of debt capital when our financial institutions are already crossing the regulatory limits of exposure to the power sector. As noted above, the sector is seeing robust secondary market activity. This has become a crucial source of finance for project developers who hive off operational assets to raise funds for fresh investment. Investment trusts in infrastructure (InvIT), that have tax incentives, may emerge to be an attractive model for divestment of assets, especially for divestment to institutional investors who want predictable returns, without managing the assets directly. In the power sector, transmission assets have been structured as InvITs and helped the promoter retain interest in the project while obtaining additional equity investment.

Sectoral and financial policies would need to focus on tapping alternative sources of financing. Research by the Council on Energy, Environment and Water (CEEW) suggests that the issuance of domestic bonds for refinancing loans can unlock the ability of these institutions to lend to new RE projects. According to the research, this option may be operationalised by providing a limited period credit enhancement subsidy for domestic RE bond issuances.

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Unlocking the demand for RE and capitalising on the immense opportunity that it presents requires innovative solutions that account for legacy issues and yet are forward looking.

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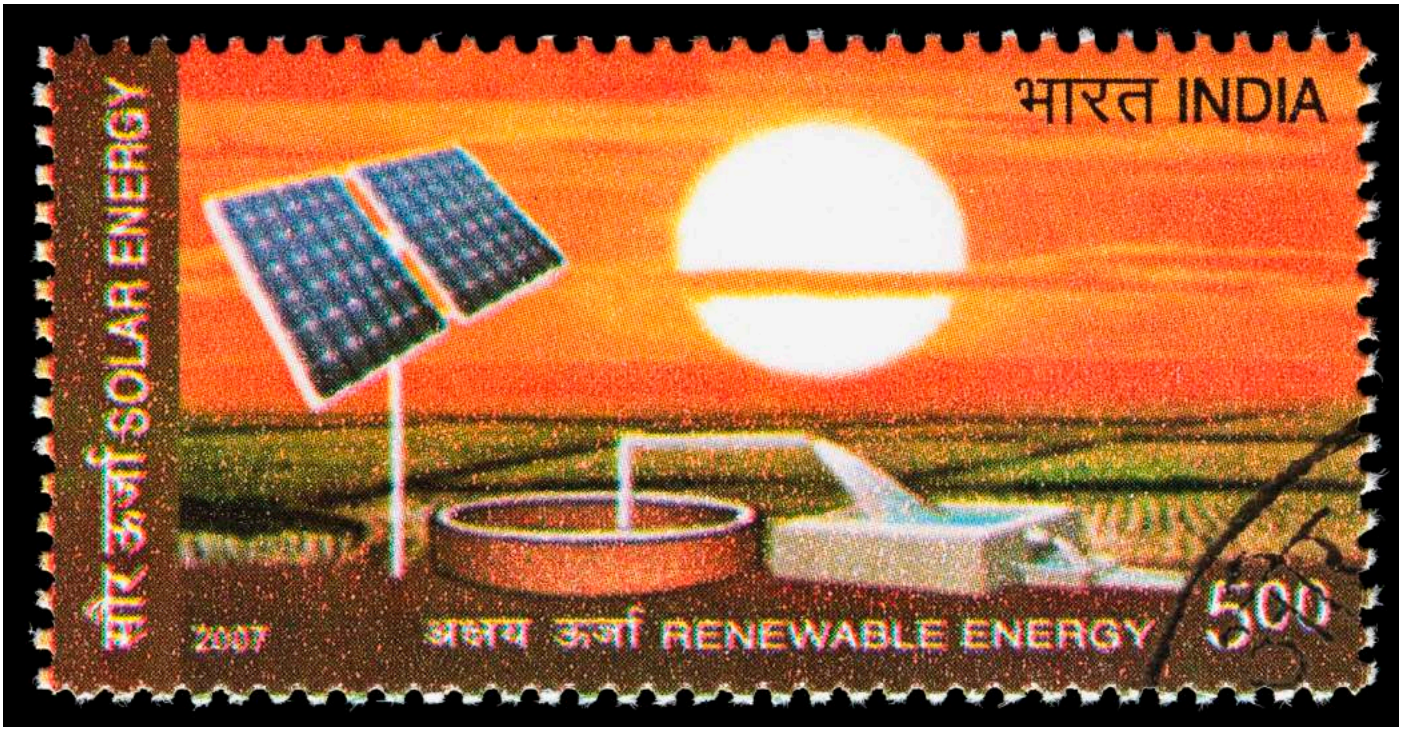

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