India country report

International experiences in designing and implementing renewable energy auctions for sub-Saharan Africa

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Frequently used acronyms and abbreviations

APTEL	Appellate Tribunal for Electricity
ADB	Asian Development Bank
CBGs	Competitive bidding guidelines
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
COD	Commercial operational date
CTU	Central Transmission Utility
CUF	Capacity utilisation factor
Discom	Distribution company
EIA	Environmental impact assessment
GDP	Gross domestic product
GST	Goods and services tax
GW	Gigawatt
ICB	International competitive bid
IFC	International Finance Corporation
ISTS	Inter-state transmission system
kWh	Kilowatt hour
MNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
MW	Megawatt
PPA	Power purchase agreement
PSU	Public sector undertaking/state-owned corporation
RE	Renewable energy
RfP/RfS	Request for proposal/selection
RPO	Renewable purchase obligation
SCD	Scheduled commissioning date
SEB	State Electricity Boards
SECI	Solar Energy Corporation of India
SERC	State Electricity Regulatory Commission
STU	State Transmission Utility
TWh	Terawatt hour

1 Introduction

India has one of the world's oldest and largest renewable energy (RE) auction programmes. As early as 2010, competitive bids were invited for utility-scale solar photovoltaic (PV) projects as part of the country's National Solar Mission, which set out to install 100 GW of solar PV by 2022. Since then, the RE sector has grown fast. Driven mainly by falling costs, renewables accounted for 23.5 per cent of installed capacity and 10 per cent of total power output by early 2020 – increasing from 13 and 5 per cent respectively in 2015.

The auction programme is designed to fulfil two overarching objectives for the sector: to reduce the cost of renewable power and to attract private capital. Large programme size, transparent auction processes and low barriers to entry (including, for example, minimal technical and financial qualification criteria, low bid-bond requirements, and the fact that 100 per cent foreign ownership is allowed) have all been instrumental in attracting leading players from around the world. Several incentives have been put in place to encourage the construction of RE installations, particularly solar PVs. These include must-run status, exemption from inter-state transmission charges, accelerated depreciation allowances, and capital subsidies for meeting local content requirements.

In addition, in 2016, the Indian government launched its solar-power-park scheme that offers developers a 'plug-and-play' option whereby government agencies take responsibility for providing land and help fund the installation of transmission infrastructure. And in 2017, India's Ministry of New and Renewable Energy (MNRE) overhauled the auctions programme to enhance predictability and uniformity, and to introduce competitive bidding guidelines (CBGs) for both solar and wind power projects.

In 2014, the MNRE devised a multi-pronged payment-security mechanism to address the poor financial health of the country's electricity distribution companies (referred to in India as 'Discoms') and the associated off-taker risk. As part of this, the wholly state-owned Solar Energy Corporation of India (SECI) was mandated to act as both a nodal agency and an intermediary procurer in national RE auctions.[1] This provided much-needed clarity for developers.

While SECI is relatively thinly capitalised, and is dependent on tender fees and a power-trading margin for its revenue, developers and lenders have accepted it as a bankable counterpart. SECI has since revised the design of the tender process to improve the availability and predictability of power supply from renewable sources. Accordingly, new tenders based on hybrid and storage technologies require developers to supply power with an annual capacity utilisation factor (CUF) of as high as 85 per cent.[2]

India's government has also taken a number of other steps to make the use of solar PV power attractive for off-takers. For example, thermal–solar power blending was introduced, whereby cheaper coal-based power is blended with more costly solar power under a bundled power purchase agreement (PPA). Incentives and capital subsidies linked to generation and accelerated depreciation have also been made available to reduce the cost of solar power production. However, as solar power achieves grid parity, these incentives are being phased out. In 2010, solar PV power cost US¢17.01/kWh – much more than the average cost of

1 Although SECI's name suggests that their focus is solar power, they manage auctions for a range of RE generation projects.

2 At the time of writing, CUF is a measurement used only in India; it is calculated as follows: energy measured (kWh) / (365 *x* 24 *x* installed capacity of the plant).

supply for distribution companies which was then US¢5.31/kWh. By 2020, the cost of solar PV power had come down to US¢3.15/kWh; this is significantly cheaper than the average cost of supply which was US¢8.12/kWh.

Overall, these measures have secured and sustained strong interest from RE developers. Competition levels remain strong and record-breaking bid tariffs are relatively common. However, while intense bidding has resulted in lower tariffs, it has also negatively affected the financial viability of many projects. With few buffers built into financial models – for increases in equipment costs, adverse forex shifts or policy changes (such as the implementation of import duties or other tax changes) – some less viable projects have been abandoned, and most of the smaller to medium-sized bidders have been squeezed out of the market.

The development of India's renewables market is hampered by a lack of planning and co-ordination. While the government has announced long-term plans, and specified capacity and output targets as a percentage of total consumption, developers are seldom notified of upcoming tenders. In addition, tender schedules are generally dictated more by the government's ambitious targets for the sector rather than by power demand. The resulting oversupply of power has increased the risks attached to PPAs, with some Discoms refusing to purchase even relatively cheap renewable power. A similar lack of planning and co-ordination extends into the procurement of auctioned capacity and the extension of the grid, making access to suitable sites a persistent challenge for developers, even within solar parks.

Nevertheless, India's auction programme can be considered among the most successful and ambitious in the world. It has many important lessons to share. In this report, we focus primarily on the design, implementation and results of RE auctions run by SECI between January 2017 and June 2020. In the next section, we provide an overview of the country's power sector. In Section 3, we describe the RE auction programme and describe the bidding process. In Section 4, we outline the results of the auctions. The main lessons learned and some recommendations are outlined in Section 6, while Section 6 contains our conclusions. The analytical framework used is outlined in Appendix A.

2 Country overview

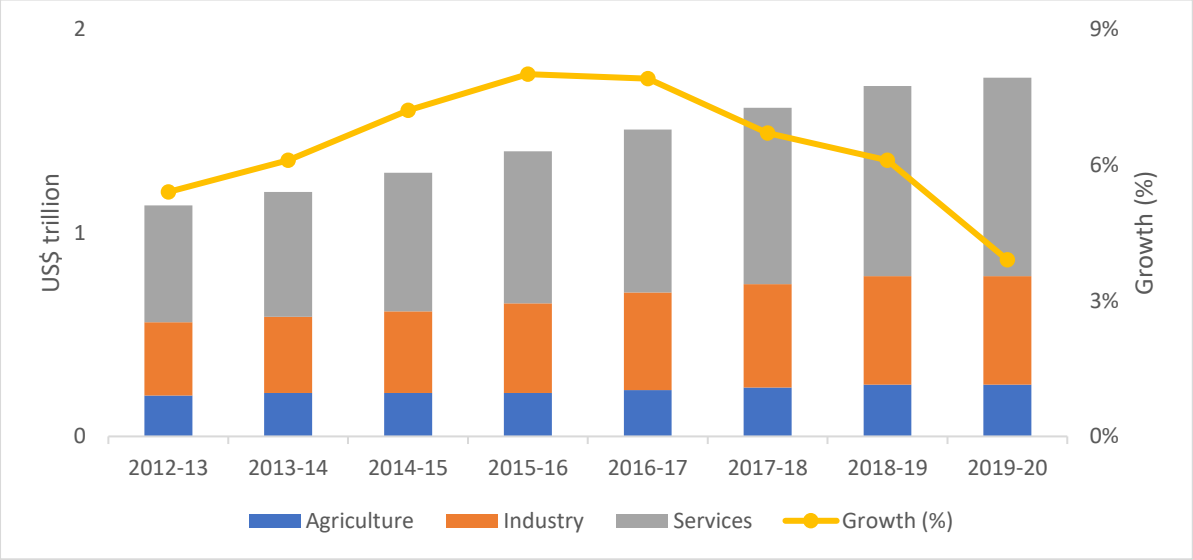
India is the world's second most populous country with an estimated 1.35 billion people in 2018 (World Bank, 2018b). By area, it is the seventh largest country in the world and the second largest in Asia. Politically, India has one of the more stable democracies in the world – with general elections held every five years and the transitions between administrations having been peaceful for several decades. The country has 7 centrally run regions (union territories) that are divided into a total of 29 states. The governance system is federal, with the central and state authorities having defined areas of jurisdiction.

India's economy is seventh largest in the world (World Bank, 2018a). The country's GDP increased from US$1.2 trillion in 2012/13 to US$1.5 trillion in 2016/17[3] at an average annual rate of 6.9 per cent (RBI, 2020). However, between 2012/13 and 2019/20, the average annual growth rate declined by 5.5 per cent (see Figure 1). This reduction is partly related to the demonetisation that occurred in 2016, weakening consumer demand, high leverage in the corporate sector and increasing stress in the financial system (IMF, 2019).

Between 2012 and 2019, monthly average consumer inflation remained relatively low at 5.8 per cent, reaching a maximum of 11.5 per cent in November 2013. In response to low inflation and the weakening economy, the Reserve Bank of India has gradually reduced its benchmark lending rate from 8 per cent in January 2014 to 4 per cent by May 2020 (RBI 2020). Over the same period, the ease of doing business in India improved significantly, and the World Bank ranked the country at 134 in 2014 and at 63 by 2019.

Historically, India has relied on five-year plans for short- and medium-term planning, and for the implementation of government policy. In the power sector, longer-term planning (for up to 30 years) occurs, but tends to lack rigour and detail. Forecasts are often highly optimistic, and are essentially designed to align with government targets for economic growth, industrial investment and tax revenue.

Figure 1: India's GDP and annual growth rate



Data source: RBI (2020)

3 US$1 = INR75.

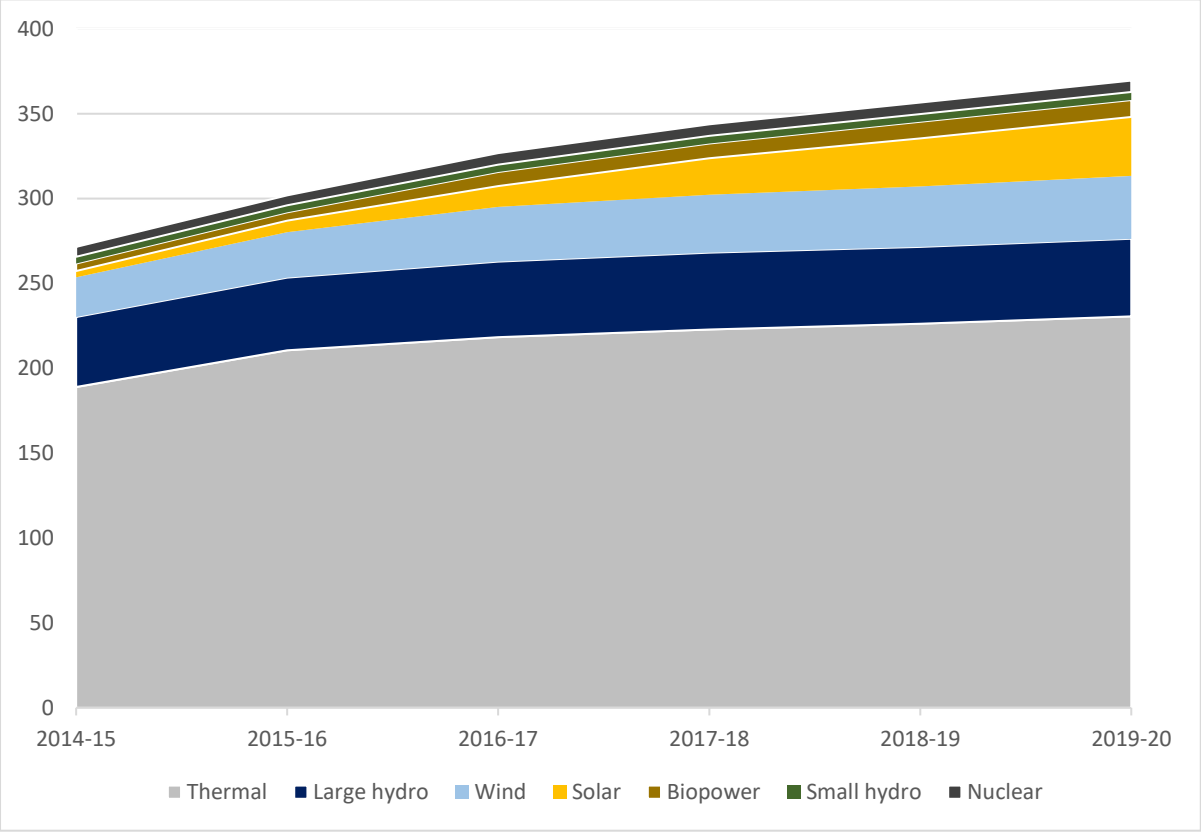
2.1 India's power sector

As of December 2019, India's installed power generation capacity amounted to 369 GW. Fossil fuels (coal and natural gas) made up 62.6 per cent of this capacity, while renewables (including large hydro) and nuclear accounted for 37.4 per cent (CEA 2020a).

Coal is the dominant energy source, accounting for 55.7 per cent (205 GW) of total installed capacity by December 2019. Large hydro projects (each with more than 25 MW of installed capacity) account for 12.3 per cent (45.4 GW); wind for 10.2 per cent (37.5 GW); and solar PV for 9.1 per cent (33.7 GW) (see Figure 2).

Since 2015, RE capacity has increased by 47.1 GW, driven by both strong government support and falling costs. Solar and wind power, at 28.9 GW and 12.4 GW respectively, accounts for the bulk of this capacity (see Figure 3). Meanwhile, the addition of new coal-based capacity has gradually slowed due to weak power-demand growth.[4] The installation of new generation capacity using other technologies has been negligible since 2014 – with nuclear power at 1 GW, large hydro at 2.8 GW, and diesel and gas (combined) at 0.3 GW.

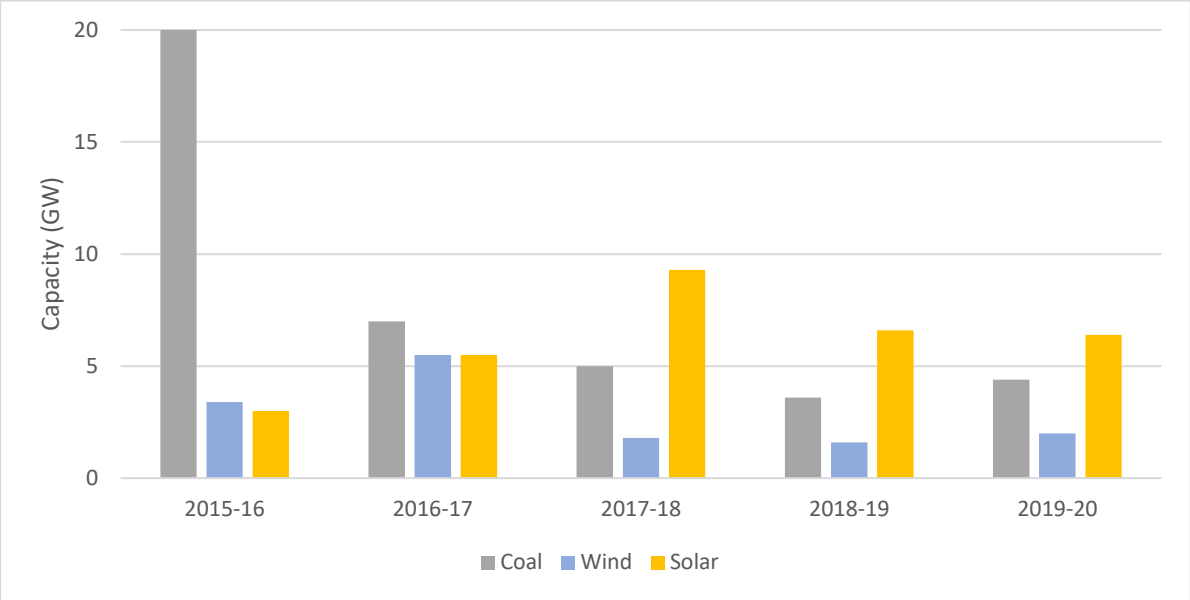
Figure 2: Power generation capacity in India, by GW, 2014–2020



Data source: CEA (2020a)

4 The impact of lower demand on solar and wind power projects is comparatively smaller due to their 'must-run' status and India's renewable purchase obligation (RPO) targets (see Section 2.1.3).

Figure 3: Annual GW added in India, by technology, 2015–2020



Data source: CEA (2020a)

Table 1: Installed capacity in India's power sector

Technology	Capacity 2014/15 (GW)	Capacity 2 019/20 (GW)	Capacity addition 2014/15 to 2019/20 (GW)	Capacity change 2014/15 to 2019/20 (%)
Coal	164.6	205.1	40.5	25
Large hydro	41.3	45.7	4.4	11
Wind	23.4	37.7	14.3	61
Solar PV	3.7	34.6	30.9	835
Gas	23.1	24.9	1.8	8
Biopower	4.4	9.9	5.5	125
Nuclear	5.8	6.8	1.0	17
Small hydro	4.1	4.7	0.6	15
Diesel	1.2	0.5	–0.7	–58
Waste	0.1	0.1	–	–
Total	271.2	370.1	98.9	36

Data source: CEA (2020b)

As noted, fossil fuels still dominate India's electricity generation capacity – at 75.1 per cent in the 2019/20 financial year – but this is gradually changing, having dropped from 80.4 per cent in 2015/16. By contrast, the share of RE (excluding large hydro) increased from 5.6 per cent in 2015/16 to 11.7 per cent in 2019/20. The share of utility-scale solar PV power increased from just 0.6 per cent in 2015/16 to 3.3 per cent by 2019/20; wind power increased from 1.9 per cent to 5.2 per cent in the same period (see Table 1).

India's steadily increasing supply of power has helped satisfy what was once a pent-up demand for energy. That is, between 2005/06 and 2019/20, total power demand grew (at an average annual rate of 7.5% from 631 TWh to 1291 TWh). The reasons for this increasing demand include improved supply, higher per capita incomes (improved affordability), higher business demand and rapid grid expansion. Thus, between 2005 and 2018, India's per capita gross national income increased 2.5 times to US$7 680. Over roughly the same period (2005 to 2019), access to electricity increased from 67 per cent to 99 per cent. Per capita power consumption, while growing at an annual average rate of 4.9 per cent throughout this period,

is estimated at 1 181 kWh per year – far below the international average, which in 2019 was estimated at 3 012 kWh per year.

2.1.1 Power sector structure

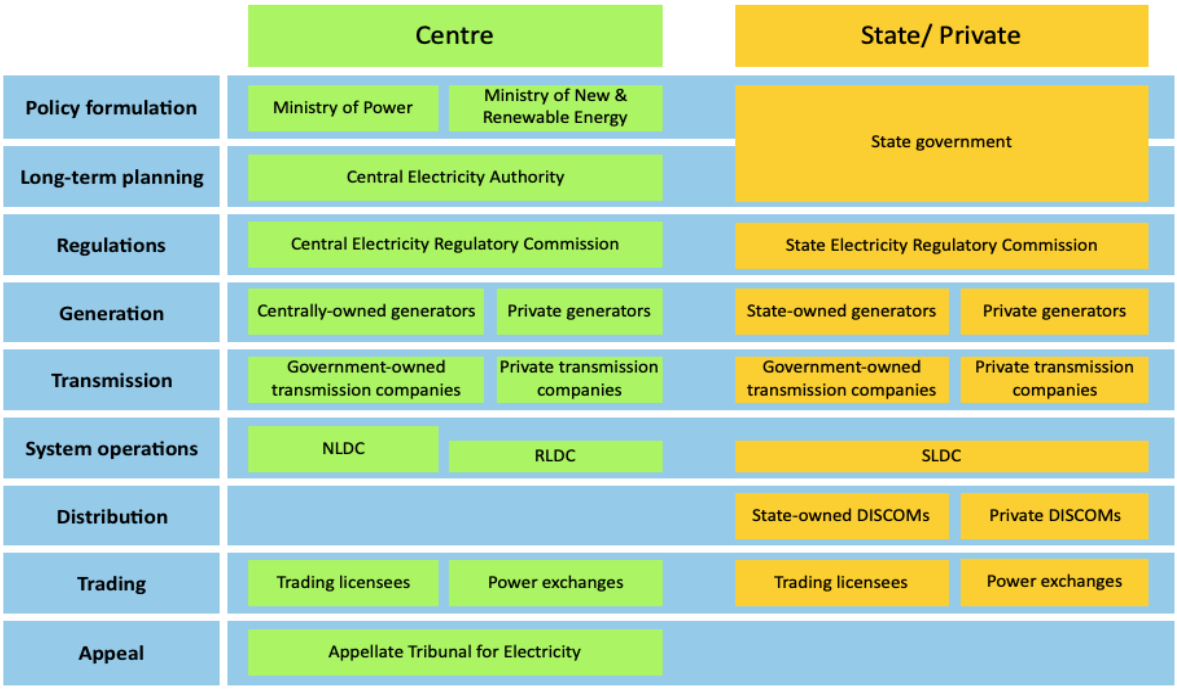
India's power sector structure is complex. Constitutionally, electricity is understood to be a 'concurrent' area. This means that all seven regional and 29 state authorities have powers to formulate laws for the sector. In addition, the states enjoy considerable leeway in deciding whether to enact policies and regulations formulated by central government or to develop their own. The Central Electricity Regulatory Commission (CERC) acts as the national regulator, but each state also has its own independent regulatory structure. Major milestones in the development of India's power sector are listed in Table 2, and Figure 4 provides an overview of the regulatory and market structure of the sector in late 2020.

Table 2: Timeline of major reforms in India's power sector

Year	Reform
1948	Electricity Act passed. State Electricity Boards set up and made responsible for power generation, transmission and distribution.
1964	Five Regional Electricity Boards are formed to ensure grid integration and national power flow
1975	Central power generation companies, such as the NTPC (National Thermal Power Corporation), NHPC (National Hydropower Corporation) and NEEPCO (North Eastern Electric Power Corporation), are set up
1989	Power Grid of India established to manage inter-state transmission projects
1991	Electricity Act of 1948 amended. Private sector participation in generation allowed. Regional grid operators established. 100% foreign investment in power sector allowed.
1992	Regulations to determine power generation tariffs introduced
1998	Private sector participation in transmission allowed
1998	Central and State Electricity Regulatory Commissions (CREC and SERCs) established
1999	First moves to privatise power distribution
2002	Introduction of availability-based tariff
2003	Electricity Act 2003 introduced, leading to the separation of generation, transmission and distribution businesses, the implementation of open access* and captive power generation.
2004	Open-access regulations enforced*
2006	National tariff policy issued and Renewable Purchase Obligations (RPOs) introduced
2008	Power exchanges set up
2010	Market for RE certificates established
2014	Launch of nation-wide rural electrification scheme
2015	Scheme to restructure outstanding debt of distribution companies
2016	Solar and wind power projects supplying power to distribution companies exempted from inter-state transmission charges and losses
2017	Launch of a new scheme to ensure electricity supply to each household
2017	Guidelines issued by MNRE for procurement of solar and wind power via competitive auctions
2019	Guidelines issued by MNRE for procurement of power from hybrid solar and wind projects through competitive auctions

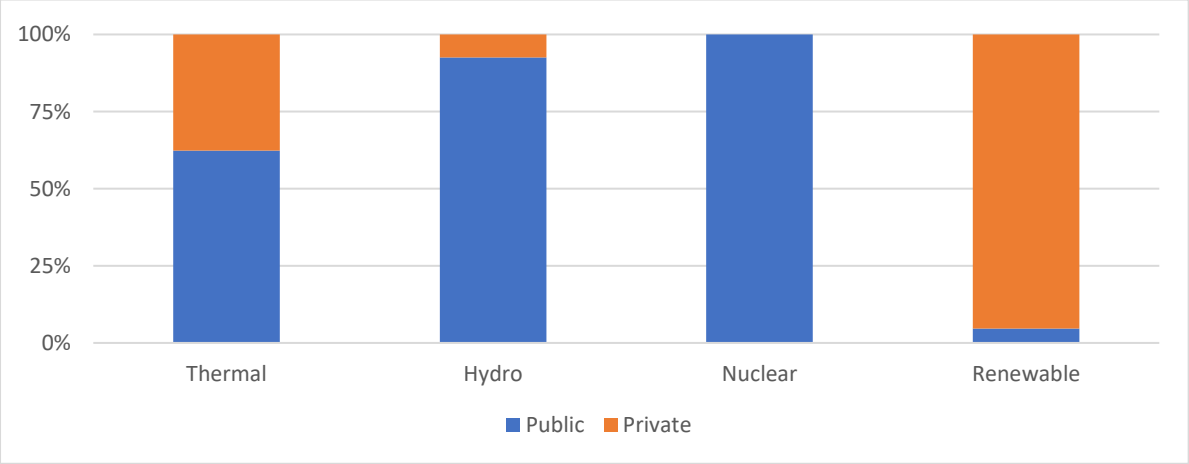
Note: * Open access allows buyers to access distribution and transmission networks to procure electricity from suppliers other than local power distribution utilities.

Figure 4: The regulatory and market structure of India's power sector, 2020



In terms of ownership, 53 per cent (196 GW) of India's power *generation* capacity was publicly owned and 47 per cent (172 GW) was under private ownership by December 2019. In 2010, these figures were at 68 per cent and 32 per cent respectively (see Figure 5). The rapid ingress of private companies has increased competition in the sector and driven project tariffs down.[5] As a result, power generation utilities have become more focused on price and more selective about signing long-term PPAs.

Figure 5: Ownership of power generation assets in India, March 2020



Data source: CEA (2020b)

5 The biggest share of private-sector-based generation is in the RE sector. The lowest tariff bids for solar PV declined from INR10.95/kWh (US¢ 14.6/kWh) in 2010 to INR2.36/kWh (US¢ 3.14/kWh) in 2020. Bidding has been extremely aggressive, with internal rates of return possibly as low as 4 and 5 per cent (rather than the 16 to 18 per cent recommended).

Private ownership of power *transmission* is much smaller – at 7.4 per cent as of December 2019. The balance is owned by public sector companies under central and state governments. However, new projects are now routinely tendered in open competitive bids and the private sector share in such projects is typically more than 50 per cent. Since 2010, India's grid has expanded rapidly (extending to 421 244 circuit kilometres) and is generally regarded as robust. Incidents of congestion have declined sharply in the last decade. Evidence of this is that the volume of electricity traded at power exchanges that could not be delivered due to congestion declined from 17 per cent in the 2012/13 financial year to less than 0.4 per cent in the 2019/20 period (CERC, 2020).

Electricity *distribution* is dominated by around 60 public companies known as Discoms that operate as monopolies in their assigned areas. Private-sector participation in this sector is limited either to franchise agreements or public–private partnerships. Mumbai is the one exception; here, distribution is entirely privately owned.

Key government institutions responsible for India's electricity sector are listed and briefly described in Table 3. The MNRE is the ministry dedicated to the promotion of RE technologies in India. It has a separate budget, which means it has the independence to formulate and implement policies. This has also enabled it to set up institutions such as SECI, which spearheads the country's auction programme.

Table 3: Key state institutions in India's electricity sector, 2020

Ministry of Power (MOP)	Responsible for formulating national electricity policy
Ministry of New and Renewable Energy (MNRE)	Nodal ministry for the promotion and deployment of RE
Solar Energy Corporation of India (SECI)	Nodal agency for facilitating the implementation of various solar and wind energy schemes and for organising auctions for RE projects
Central Electricity Authority (CEA)	Statutory body under MOP that is responsible for preparing a national electricity plan every five years. Also the nodal agency for development of hydro power
Appellate Tribunal for Electricity (APTEL)	Statutory body constituted for the purpose of hearing cases against the orders of the regulatory commissions
Central Electricity Regulatory Commission (CERC)	Statutory body responsible for setting inter-state generation and transmission tariffs. Also creates regulations for power-market operations, grants trading licenses and deals with disputes
State Electricity Regulatory Commissions (SERCs)	Statutory bodies with responsibilities similar to CERC but with jurisdiction for a particular state
National Load Dispatch Centre (NLDC)	National grid operator that supervises all inter-regional power flows
Regional Load Dispatch Centres (RLDC)	Responsible for optimal grid operations at a regional level and supervising inter-state power flows
State Load Dispatch Centres (SLDC)	Responsible for optimal grid operations at state level and for supervising intra-state power flows
Power Grid Corporation of India Ltd	The state-owned central transmission utility (CTU) undertakes inter-state electricity transmission and is responsible for planning and coordinating inter-state transmission systems

2.1.2 Tariff setting and financial sustainability

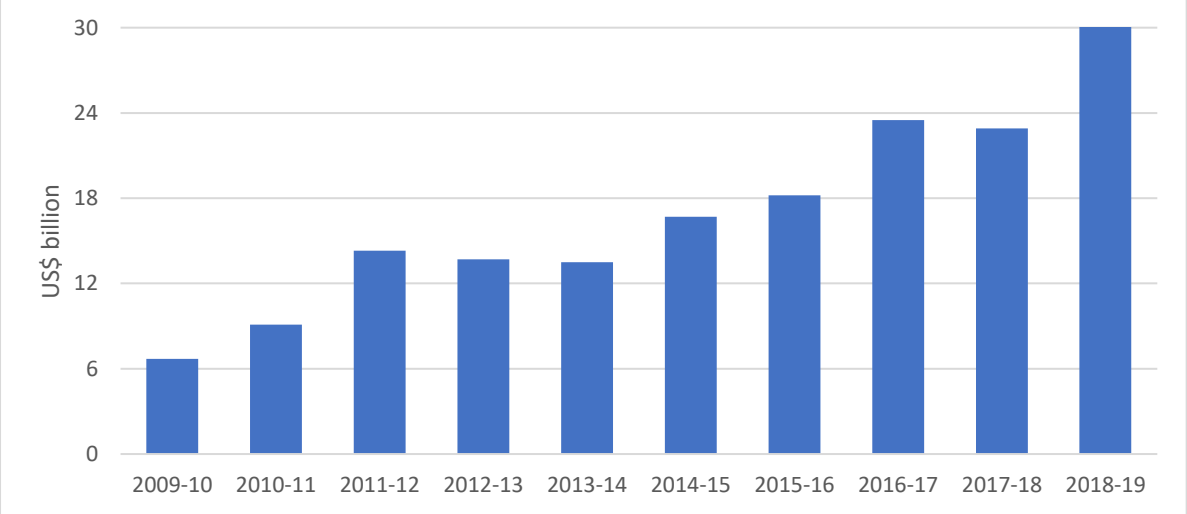
Retail electricity tariff determination processes are subject to various forms of political intervention at the state government level. State regulators are expected to determine tariffs annually using a cost-plus model to ensure full cost recovery for Discoms. In practice, however, the Discoms are rarely able to recover full costs as local governments exert pressure

on the regulators and the Discoms to keep tariffs low in order to appease their electorates.[6] In 2018/19, the average cost of power supply was INR6.09/kWh, but the average tariff was set at INR0.52/kWh lower, even after accounting for a subsidy-inclusive average tariff of INR5.57/kWh by the state governments.[7] Political influence is mainly wielded in the form of cross-subsidisation across consumer categories and the limiting of justifiable tariff increases.[8]

The poor financial health of power distribution companies has been a longstanding concern. Discoms are expected to operate on a cost-plus model but high levels of political interference and poor governance limit operational and financial performance. High technical and commercial losses (22% in 2018/19), and the under-recovery of costs, are also delaying attempts to modernise the network (see PTI, 2019, 2020).

Accordingly, although performance can differ dramatically from state to state, the financial performance of Discoms is generally deteriorating. In the 2018/19 financial year, cumulative losses amounted to US$6.6 billion – up from US$3.9 billion in the previous year. In addition, debt levels increased from US$60.6 billion in 2015 to US$63.7 billion in 2019, and outstanding dues to power producers reached US$26.5 billion in March 2019 – up from US$6.7 billion in 2010 (see Figure 6). The average time taken to clear such dues also increased to five months.

Figure 6: Payments owed by Discoms to power generation companies, US$ billion, 2009–2019



Source: Power Finance Corporation (n.d.)

The MoP and the Power Finance Corporation, with the help of certain external agencies, rank the Discoms annually against various parameters, including operational and financial competence. In 2019, Discoms in only nine of 24 surveyed jurisdictions reported an annual profit. Five of the 24 states surveyed account for 53 per cent of dues outstanding to power

6 State authorities make all decisions regarding the appointment of members of state regulatory bodies. Certain state authorities are known to have exerted direct intervention in the tariff-determination process, but how they assert control over other regulatory decisions is unclear.

7 At July 2020 values, INR 75 was worth US$1.

8 For example, high-income residential, industrial and commercial consumers pay higher tariffs than low-income residential and agricultural consumers. Some residential and most agricultural consumers are supplied with ‘free’ electricity.

producers. Nevertheless, most Discoms were accorded high ratings (Power Finance Corporation n.d.). As long as the ranking process is carried out under the aegis of the government, it seems unlikely that these evaluations will be objective.

2.1.3 Regulatory and policy framework on renewable energy

India's RE programme is guided by its *National Action Plan on Climate Change*, published in 2008 (Government of India 2008). The plan set targets for *RE capacity* at 175 GW and *RE consumption* at 21 per cent by 2022; the latter takes the form of renewable purchase obligations (RPOs).

RPO targets are applicable to all power utilities and bulk power consumers that have captive power plants and/or obtain power from open-access sources. The targets were designed when renewable power was two to three times more expensive than conventional power and have not yet been changed even though RE is now cheaper.

States are also free to set their own RPO targets, and this has led to wide variations between states. Entities that fail to meet their targets are required to purchase RE certificates, that are generated by RE power producers and can be traded on the national stock exchange. In general, however, compliance rates remain low and enforcement processes lax. In 2019, for example, the MNRE reported that 27 states and union territories had met only 60 per cent of their RPO targets. In addition, Discoms are able to ask state regulators to issue dispensations that retrospectively relax RPO targets or carry over their unmet obligations into future years.

2.1.4 Renewable energy procurement through competitive bidding

Apart from the RPOs, India's government has implemented a number of supporting policies and regulations to support growth of the RE sector and to achieve national targets. These include:

- *Competitive bidding guidelines* (CBGs) issued by the MNRE for the procurement of solar and wind power. These provide a framework for the procurement of renewable power by all government agencies and power utilities across the country. The objective is to provide guidance to both procurement agencies and the private sector, and to ensure consistency in procurement across states. Deviations from the guidelines have to be approved by the relevant regulators. Separate sets of guidelines have been issued for solar, wind and hybrid RE projects, covering all the critical aspects of project procurement, including PPA tenor, tariff structure, technical standards, eligibility criteria, and contractual provisions such as termination events, penalties, *force majeure* and legislative shifts. The guidelines are updated frequently in response to evolving market parameters. For example, land acquisition requirements have been amended twice since 2017, so that where developers initially had 7 months to acquire land after signing the PPA, they now have up to 18 months. Project commissioning deadlines have also been amended twice since 2017, so that where developers initially had 15 months to commission solar power projects after signing a PPA, they now have up to 18 months.
- All RE power plants (other than biomass and large hydro plants) have *must-run status* and are not subject to merit-order dispatch. The must-run directive applies in all circumstances, except where the grid has to shut down for technical or safety reasons. However, because no clear protocols exist for determining the presence of 'technical or safety reasons', many states openly breach this requirement when demand is low or cheaper power is available. The MNRE has amended the bidding guidelines to address curtailment risk and allow developers to benefit from a provision for 'deemed

generation' but this has not yet been successfully invoked (see Table 13). Some project developers have therefore challenged regulators though the courts.

- The *solar parks scheme* was launched in 2014 with a target of 20 GW that was later expanded to 40 GW in 2017 (see Section 3.1.3).
- Solar and wind projects in resource-rich states have been encouraged to sell power to other states. Those projects that have been awarded through competitive bidding and that achieve commercial operation before 31 December 2022 are *exempted from inter-state transmission charges*.
- To improve the predictability and integration of variable renewable power into the grid, the government has mandated that solar and wind projects *forecast and schedule their daily power* output in 15-minute blocks. Moreover, penalties are imposed for the over- and under-injection of power under a deviation settlement mechanism (DSM). These regulations were first introduced centrally in 2015, with states following suit over the next few years. By 2020, 15 states had formulated DSM regulations for solar and wind projects. However, several developers are opposed to project-level generation forecasts and penalties. In particular, those that were awarded projects before the implementation of the regulations had not allowed for the financial costs of compliance. They have instead recommended state-level generation forecasting with limited or no penalties for individual project developers.
- The government provides several *financial incentives* to keep RE affordable and financially attractive to purchasers. These incentives include capital subsidies, allowances for accelerated depreciation, a concessional rate for goods and services tax (GST) and a lower rate for income tax. Some of these incentives are gradually being phased out as capital costs have come down and the price of RE has become more competitive with thermal power.[9]
- To *simplify and expedite project development*, several states have waived various permits and approvals required by RE projects. Some states also offer a single-window project-approval clearance, that combines all approvals related to land acquisition and use, environmental impact mitigation, job creation, etc. A foreign direct investment policy has also been created that allows automatic approval to international investors that wish to own 100 per cent equity in projects.

9 For utility-scale projects, capital subsidies have been almost completely phased out. Currently, they are offered only under the PSU scheme, which has a mandatory local-content clause (see Table 5). The maximum capital subsidy offered under this scheme is INR7 million/MW (US$93 300), which is roughly equivalent to the extra cost of using domestically manufactured panels, but is subject to bids by PSUs. The government has not defined any methods for setting the maximum limit.

3 Renewable energy auctions

India held its first solar power auction in 2010. The auction programme was designed to increase transparency in procurement processes, reduce power costs and attract a high level of investment. To improve affordability, the government initially also created various ad hoc schemes, such as capital subsidies and options of blending RE with cheaper thermal power.

Since 2014, SECI, under the aegis of the MNRE, has been the nodal agency for all national-level solar and wind energy tenders (see Table 4). However, companies, such as NTPC (a state-owned thermal power distribution company) and NHPC (a state-owned hydropower company), have also issued national solar and wind energy tenders, and state authorities are free to procure power from central government schemes or run their own auction programmes. In this report, we focus on auctions run by SECI between 2015 and early 2020.

The CBGs cover the procurement of solar and wind power plants (MoP, 2017). They attempt to create a degree of homogeneity in auction processes run by various procurement agencies, and ensure that all developers and investors receive the same treatment. Aspects of the guidelines have since been amended, primarily to address project implementation challenges and to reduce the risks facing developers and investors (MNRE 2019; MoP, 2019a, b).

Table 4: Stand-alone solar and wind power tenders issued by SECI in India, August 2015–June 2020

	Solar	Wind
Number of tenders issued (excluding cancelled tenders)	31.0	8.0
Capacity auctioned (GW)	24.3	11.4
Capacity received (GW)	44.6	17.8
Capacity allocated (GW)	19.1	9.3

3.1 Auction designs and processes

As shown in Table 5, SECI has developed several procurement schemes, taking into account different facets of project development (available resources, transmission options and technologies) as well as the nature of power demand and the government's objectives for the RE sector. Some schemes have been designed specifically to promote the domestic manufacture of solar PV cells and panels, while others have been designed to provide stable power output by combining RE and thermal power.

Procurers usually issue a request for proposals (RfP) that interested investors can obtain online for a nominal fee. The auctions have two rounds – technical and financial; bids that qualify in the technical round are eligible to participate in the financial round (see Section 3.1.4). Bids that qualify are then required to specify capacity and an initial price. The bids are then ranked and stacked in price order, and the cheapest 80 per cent of the bids proceed to an electronic auction round (Section 3.1.5.)

In most auctions held so far, SECI and other central agencies have taken a pay-as-bid approach. However, SECI recently proposed a uniform pricing approach that would have required all developers to match the lowest bid tariff. Following opposition from developers, the proposal was withdrawn.

With regard to timeframes and milestones, the bid guidelines and tender documents define clear deadlines for project execution (see Table 6). However, SECI accepts feedback from stakeholders on proposed timelines and is willing to amend these for specific tenders. For example, if bidders require time to visit proposed project sites, bid-submission deadlines can be extended.

Table 5: Types of renewable energy auctions in India

Energy source	Auction details
Solar, wind and hybrid interstate transmission system (ISTS) projects	Project developers can set up projects anywhere in the country. They retain responsibility for land acquisition and grid connectivity. Most auctions have been run under this scheme.
Solar/RE parks	Project developers are required to set up projects in designated RE parks. Land and transmission infrastructure, usually developed by SECI or other public companies in partnership with state governments, is provided to project developers at a fixed price.
Manufacturing-linked project developments	Developers are required to set up solar PV cell and panel manufacturing facilities, in direct proportion to assigned power development capacity.
Public sector (PSU) schemes	Projects issued under this scheme may be developed only by government entities and publicly owned companies for captive consumption or the supply of power to other public-sector undertakings (PSUs). The developers are given viability-gap funding (based on the bids submitted) and are mandated to use locally manufactured RE equipment.
Solar and wind power blended with fossil fuel	Developers can supply solar and wind power blended with power from coal-based power plants. The minimum share of renewable power capacity allowed is 51%.
Agriculture-focused KUSUM programme*	This is designed to provide solar power to farmers for their own consumption and help them earn an income from the sale of surplus power to local utilities. The programme has the benefit of reducing grid losses in that power is produced closer to where it is consumed.

Note: KUSUM = Kisan Urja Suraksha evem Utthan Mahabhiyan (Farmers' Energy Security and Upliftment Project).

Table 6: Timeline for tender processes across technologies, India 2020

Event	Timeline
Request for proposals (RfP)	—
Pre-bid meeting	Undefined
Bid submission	Usually within 30 to 45 days of the RfP
Auction	Usually within 15 to 30 days of bid submission
Letters of award issued	Within 60 to 120 days of auction date
Signing of PPA	Within 30 to 90 days after letters of award are issued
Regulatory approval	Within 60 days of filing for approval
Financial close	Solar: within 9 months of signing PPA if project located in a solar park; otherwise 12 months Wind: within 7 months of signing PPA
Commercial operation date	Solar: within 15 months of signing PPA if project located in a solar park; otherwise 18 months Wind: within 18 months of signing PPA

In practice, however, given the uncertainties surrounding off-taker demand, as well as access to land and transmission infrastructure, the timeline from the request for proposals RfP[10] to bid submission have become unpredictable. For instance, bids have yet to be submitted for a 7.5 GW solar power auction that SECI announced in December 2018. In this case, a lack of transmission evacuation infrastructure in the proposed location has held up the process. By contrast, the RfP for SECI's Tranche VIII 1.2 GW Solar Power Tender was issued on 3 January 2020, and the auction was completed on 28 February 2020.

10 Note that in India, an RfP is often referred to as an RfS, meaning *request for selection*.

3.1.1 Auction demand

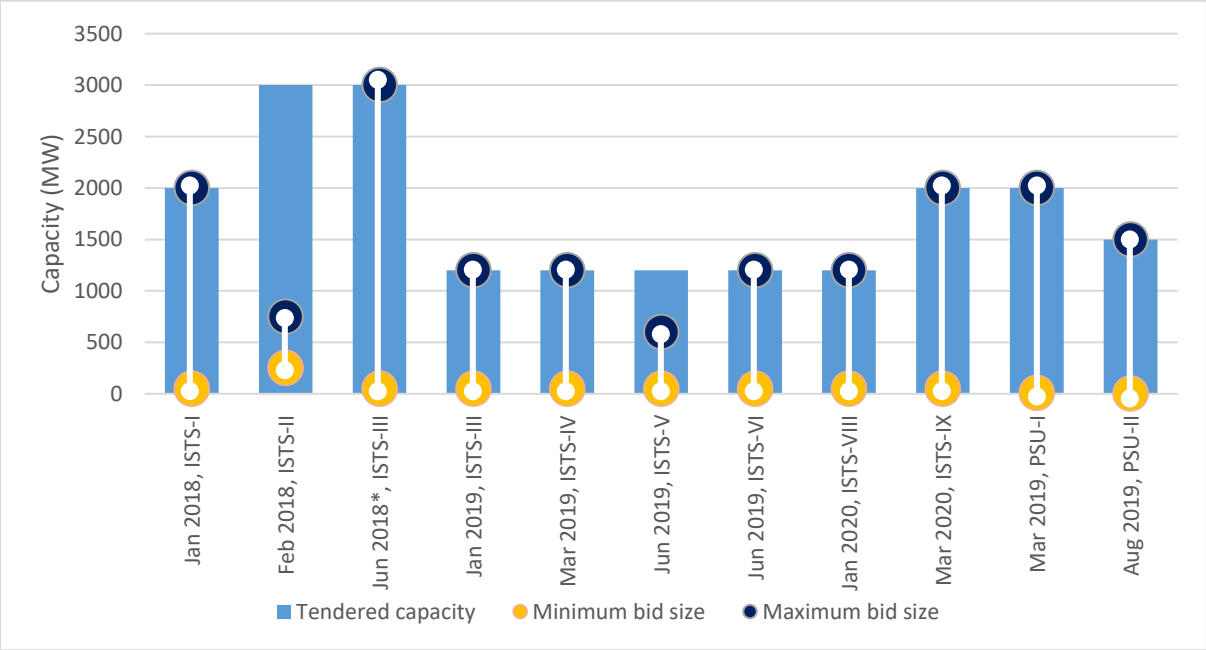
Actual auction demand often tends to diverge from official plans or announcements. In 2017, the MNRE announced a roadmap for the issuing of solar power auctions with a projected capacity of 30 GW in 2018/19 and 2019/20. In fact, in 2018/19, tenders were issued for over 49.5 GW of solar power, and in 2019/20, tenders were issued for 29.8 GW. Similarly, the Ministry of Power announced that wind power tenders of 10 GW would be issued in 2017/18 and in 2018/19. In fact, the wind capacity tendered in 2018/19 was only 6.6 GW and in 2019/20, the capacity was just 3.0 GW.

No clear plan or schedule exists for the issuing of tenders. In practice, this means that bidders don't know when tenders will be issued. SECI seems to issue tenders when under pressure from the MNRE, and based on its assessment of power-demand/supply, the availability of solar/RE-park infrastructure, and the results of previous tenders. While SECI maintains regular dialogue with Discoms across the country, it receives no binding commitments for the purchase of power until after auctions are completed. The lack of firm demand means that even if auctions are successful, projects might fail to find off-takers. This was the case for several auctions held in 2019.

3.1.2 General conditions related to auctions

The bid guidelines state that procurers can invite bids for generation capacity (MW) or energy output (kWh). Thus far, all RE auctions held in India have been for capacity. The minimum bid size has been set at 50 MW and procurers are at liberty to set their own maximums. For solar and solar-park tenders linked to interstate transmission systems, the maximum bid size is usually equal to total offered capacity. The largest project size offered by SECI so far is 3 GW, with the average being around 1.5 GW (see Figure 7).

Figure 7: Bid size and capacity of solar interstate transmission system and public sector auctions, 2018–2020



Note: * Tender cancelled.

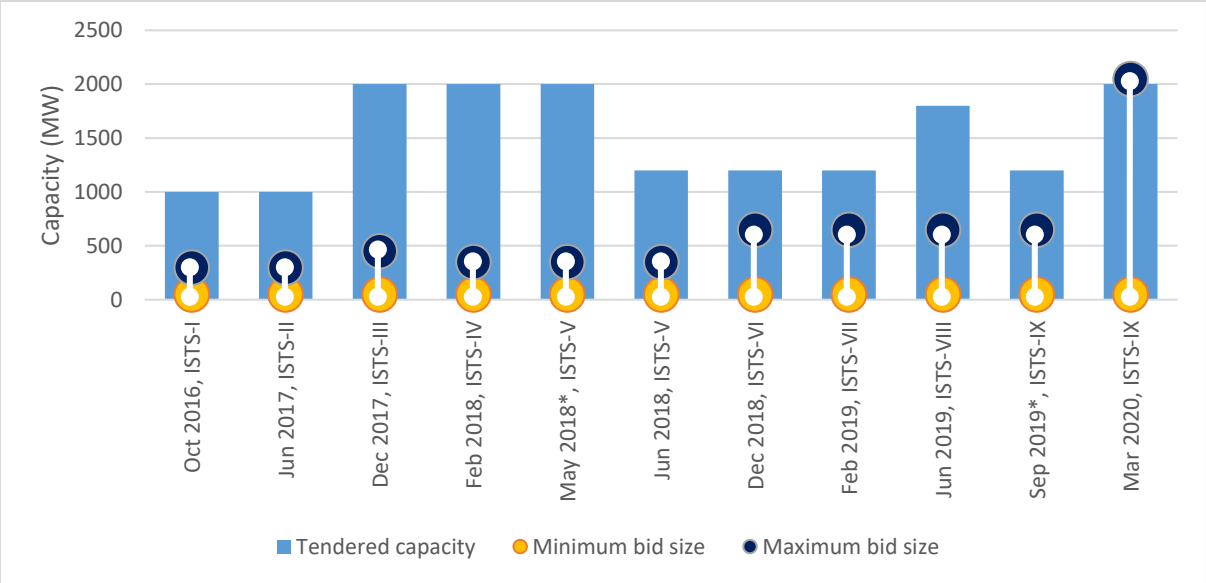
To ensure that no project can walk away with the entire capacity, SECI generally set a maximum project size for wind-power tenders of between 15 to 50 per cent of the tendered capacity. This changed when the wind tender for ISTS IX was issued in March 2020 (SECI, 2020); the maximum project size was set at 100 per cent of offered capacity, which was 2 GW (see Figure 8).

The background to this is that larger developers put pressure on SECI to allow bids for the entire tender capacity, while smaller developers have pushed for smaller caps on maximum bid size. As a result, SECI often tinkers with minimum and maximum bid sizes as they try to balance their wish to attract a large number of developers with their aim of keeping tariffs low and enabling developers to benefit from the economies of scale associated with large projects.

The CBGs allow procurers to set tariff caps but do not specify how these should be determined. Before 2017, caps were set according to generic tariffs determined by CERC. However, CERC stopped its generic tariff determinations in 2017/18. Since then, procurers have been trying to push tariff caps down to reduce the price of power. Developers have resisted this, and several tenders with unrealistically low tariff caps have been undersubscribed and some have even been cancelled. In 2018, SECI responded to calls by developers to increase tariff caps in some tenders (Chandrasekaran, 2018). Understandably, more developers are likely to participate in tenders that have higher tariff caps (see Figure 9).

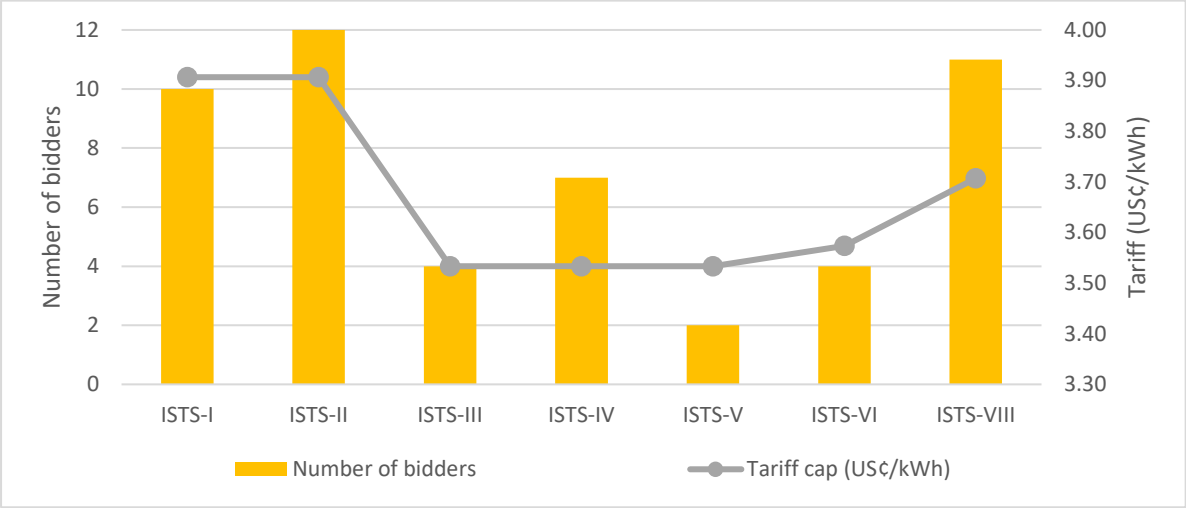
As recently as November 2019, MNRE stated its opposition to the removal of tariff caps (Ramesh 2019). However, by March 2020, poor responses to several tenders and repeated developer demands had forced SECI to remove all tariff caps (Chatterjee, 2020). Interestingly, solar tariffs have fallen anyway because market competition is so intense and because equipment prices continue to fall.

Figure 8: Bid size and capacity in wind interstate transmission system tenders, October 2016–March 2020



Note: * Tender cancelled.

Figure 9: Tariff caps set by SECI in interstate transmission system tenders for solar power projects



As part of standard practice, tariffs set via auctions still have to be approved by the relevant central and state regulatory authorities. However, Discoms and tender-issuing agencies regularly seem to miss deadlines set for securing the necessary tariff approvals from regulators. Some projects have been cancelled as a result.[11]

A feed-in tariff regime is still followed for biomass and biogas, small hydropower (less than 25 MW), as well as for small solar and wind energy projects. State regulators determine these feed-in tariffs annually, using the prevailing standard inputs for project costs, interest rates, operations and maintenance costs, as well as for returns on equity.

Commissioning timelines shown in Table 7, and as specified in the CBGs have been modified following feedback from developers. For wind tenders, procurers are free to set commissioning timelines longer than those prescribed in the guidelines. In a tender issued in March 2020, SECI increased the commissioning timeline to 24 months. This decision was influenced by project execution challenges facing the developers and by the poor response to three preceding wind power tenders that were undersubscribed by between 50 and 100 per cent.

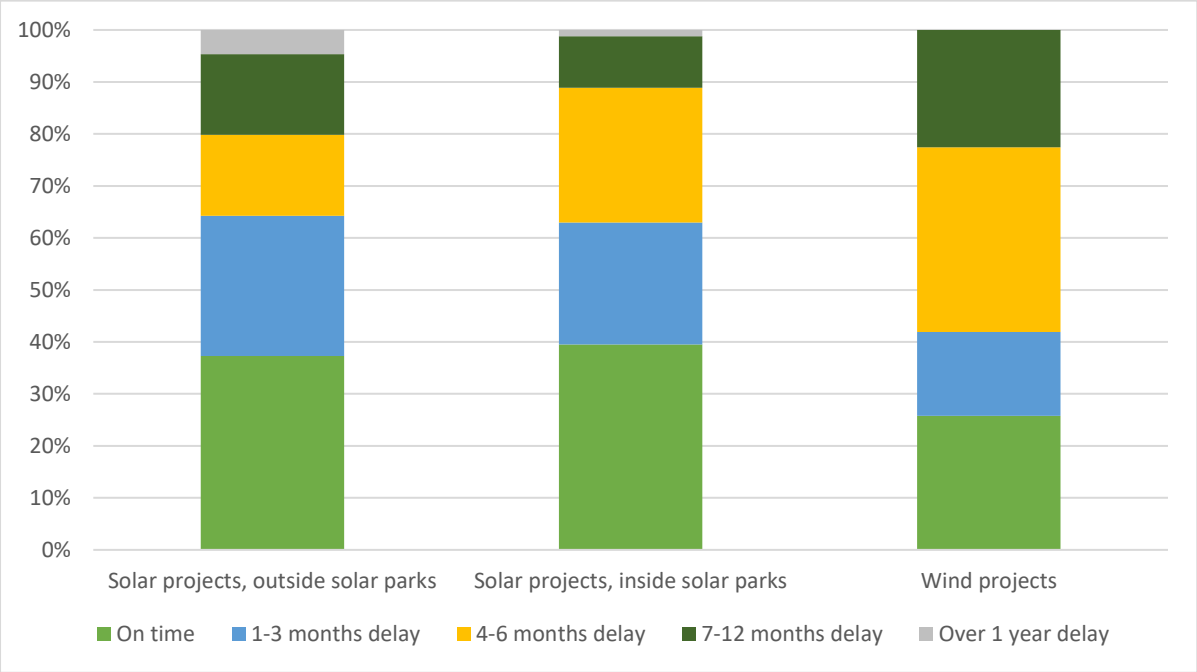
Table 7: Commissioning deadlines for solar power projects, India 2017–2019

2017	Projects inside a solar park: 13 months from date of signing PPA Projects outside a solar park: 15 months from date of signing PPA
2018	Projects inside a solar park: 21 months from date of signing PPA Projects outside a solar park: 24 months from date of signing PPA Additional 2 to 3 months allowed for projects above 250 MW
2019	Projects inside a solar park: 15 months from date of signing PPA Projects outside a solar park: 18 months from date of signing PPA Commissioning deadline can be extended by up to a year in cases where delays occur in the transfer of land by government or the approval of tariffs by regulatory authorities.

Data source: MNRE (2019)

11 In most cases, it seems that Discoms and state governments work behind the scenes to influence cancellations if demand or prices come down and they are no longer interested in buying power at the awarded price. However, if regulators can find cheaper tariffs elsewhere, they have also been known to take a stand and reject agreed tariffs.

Figure 10: Delays in solar and wind project commissioning, India 2020



Between January 2017 and April 2020, 403 solar and 31 wind power projects awarded through auctions were commissioned (see Figure 10). Of these, only 152 solar power projects and 8 wind power projects were commissioned on time. The average delay in the commissioning of solar projects located outside and inside solar parks was 6 months and 4.5 months, respectively. The average delay with regard to the commissioning wind projects was 5 months. However, these delays seem to be getting longer.

In theory, however, the CBGs allow for the partial and early commissioning of projects. Developers have to commission at least 50 MW to claim partial commissioning, and the commercial operation date is declared when the entire project capacity is commissioned, which can be before the scheduled date. The guidelines allow for the sale of power from partial or full capacity commissioned before the scheduled date at 75 to 100 per cent of PPA tariffs (Ministry of Power, 2019a; b).

3.1.3 Access to land and transmission infrastructure

While developers were initially required to prove land ownership before submitting bids, this changed in 2018, and again in 2019 (see Table 8). Given the uncertainties related to tender scheduling and the auction programme, developers were understandably reluctant to commit capital and complete land acquisition prior to submitting bids. The decision was then made to relax ownership requirements to increase competition and allow new and foreign companies to compete for tenders, regardless of whether or not they own land.

Table 8: Initial guidelines, and subsequent amendments, regarding land acquisition

Initial guidelines, 2017	Developers must identify all land required in their bid submissions. They must show possession of 100% of the land within 7 months of signing the PPA.
1st amendment, 2018	Developers are no longer required to identify land in bid submissions but must show possession of 100% of the land within 12 months of signing the PPA.
2nd amendment, 2019	Developers have up to 18 months to show possession of 100% of the land

Data sources: MNRE (2018, 2019); MoP (2017, 2019a, 2019b)

Even so, the completion of land-acquisition formalities within the (now-permitted) project execution timeline of 12 to 18 months remains a major challenge. Non-uniform obligations under state policies, complex acquisition regulations that vary across states, poorly maintained land records, and lengthy approval processes can create complex and gruelling obstacles (Bridge to India, 2015; Kumar & Thapar, 2017). The resulting delays can result in penalties, the calling in of bid bonds, and even the cancellation of PPAs. Some project developers have themselves attempted to terminate PPAs, citing *force majeure* related to delays in land procurement. To address the difficulties with land acquisition and transmission infrastructure, the MNRE announced the development of solar parks and Ultra Mega Solar Power Projects in 2017, along with plans to add 40 GW of solar capacity through the scheme by 2022. Under the scheme, state authorities can acquire land, build transmission infrastructure and offer these to RE developers on a 'plug and play' basis. Similarly, public sector companies that already have large land holdings are being offered incentives to set up solar power parks (MNRE, 2018). In addition, the central government has undertaken to provide financial assistance for the preparation of detailed project reports plus a subsidy of US$0.03 million/MW for the development of infrastructure (MNRE, 2017).

In return, developers are required to pay a mix of upfront and recurring annual charges for the use of solar park sites. The minimum installation size set by MNRE is 500 MW but this can be reduced if contiguous land is not available. The largest solar power park approved so far has a capacity of 5 GW.

The solar park scheme has proven especially popular with international developers, for whom land acquisition was a major hindrance. The scheme has also helped in scaling up project sizes and accelerating project execution – on average, project implementation inside solar parks is shorter by three months. However, the scheme has faced challenges. Developers complain of high charges, poor site conditions and excessive delays, with around 37 per cent of projects in solar parks reportedly missing their commissioning deadlines by more than three months (Seetharaman & Chandrasekaran, 2019).

According to the initial plan, the MNRE hoped to see solar park projects deliver 20 GW of new capacity by 2019 (MNRE, 2018). In fact, our calculations indicate that solar parks were contributing just 9.7 GW by early 2020. The MNRE has therefore modified the scheme to include a financial incentive (US$0.6/MWh for host states that export power to other states), and to remove the obligation on host states to procure at least 20 per cent of the power generated by solar parks. These measures seem to have prompted certain states to host more solar parks, which are now evolving into RE parks (SECI 2019).

Responsibility for the development of deep and shallow transmission infrastructure varies depending on the presence of RE parks. Figures 11–13 show which agencies are responsible for infrastructure development in *intra*state, *inter*state and RE parks. As indicated, where park-related infrastructure is unavailable, developers are responsible for the costs and construction of shallow transmission facilities. In all cases, the state and central transmission utilities (STUs and CTUs) are responsible for developing deep/shared transmission infrastructure. In practice, project construction and the installation of transmission infrastructure are seldom synchronous, resulting in massive delays in some cases, as well as undersubscription to several large tenders (Bridge to India, 2019).

Figure 11: Agencies responsible for setting up infrastructure for *intra*state transmission, India, 2020

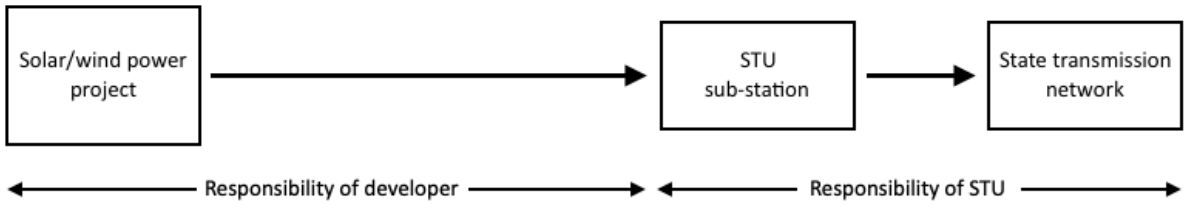


Figure 12: Responsibilities for setting up infrastructure for *inter*state energy transmission, India 2020

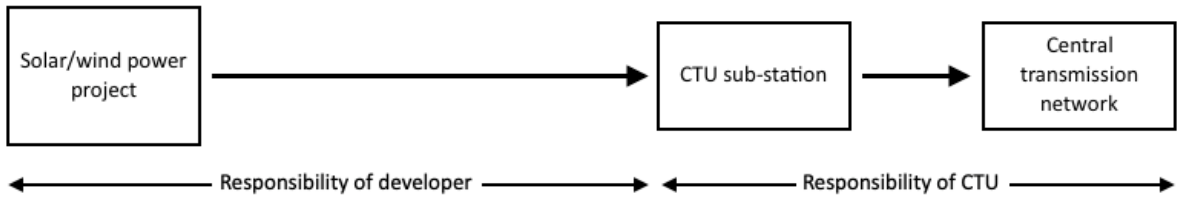
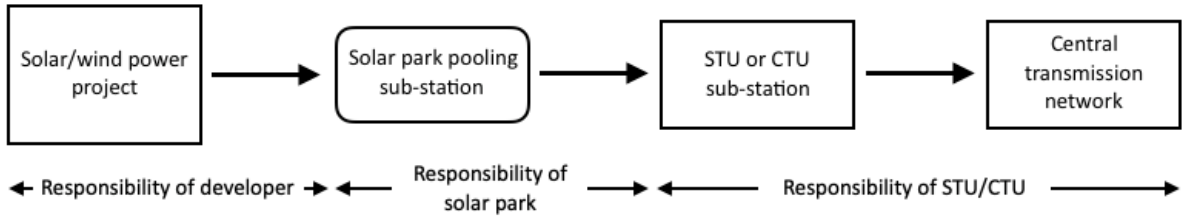


Figure 13: Responsibilities for setting up transmission infrastructure related to RE parks, India 2020



The MNRE has also sought to address the issue of transmission infrastructure delays by amending the bid guidelines such that if delays occur, project developers cannot claim any direct compensation. Instead, to compensate developers for revenue loss, procurers can be required to purchase any power that exceeds the maximum allowed in the PPA over the first three years. Penalties levied on the entity responsible for the construction of transmission infrastructure can also be used to compensate the developers (Ministry of Power, 2019a). In in practice, by early 2020, no compensation had yet been paid to developers.

In cases where transmission infrastructure has been developed on time but RE projects have been delayed, the central or state transmission utilities tend to encash bank guarantees submitted by project developers as part of their transmission connectivity applications (CERC, 2019). Transmission connectivity obligations and approval processes are, however, beyond the scope of the CBGs.

3.1.4 Qualification criteria and bid processes

Tender packs typically consist of the basic RfP, plus drafts of the power-purchase and power-sales agreements (PPA and PSA).[12] Where land or RE parks are available, lease- and implementation-agreement templates are also included. Besides key details, such as total capacity, technology (solar, wind or hybrid) and location, the RfP defines all relevant terms and conditions for the tender, including:

- Eligibility criteria

12 A PSA is a back-to-back agreement, whereby SECI (or other intermediary off-takers) sell power to Discoms.

- Bid submission procedures
- Bid evaluation and auction processes
- Templates for the details that bidders have to submit about their corporate structure, financial viability, technology choices and capital costs
- Tariff-cap specifications
- Minimum and maximum project size
- Obligations to use locally manufactured goods, if any
- Minimum annual CUF to be guaranteed by developer
- Bid-bond requirements
- Project timeline and related penalties
- Required clearances and approvals
- Key contractual provisions regarding legislative changes, instances of excess power generation, transmission (un)availability and grid back-down, etc.

Note that no clearances or approvals are required when the initial bids are submitted. See Table 9 for a list of the documents bidders have to submit as they proceed through the rest of the bid process.

Table 9: Documents RE developers have to submit to participate in an RE auction, India 2020

At bid submission
Documents that prove technical capability
Documents that prove financial resources
Details of project capacity and technologies proposed
Estimated annual generation
Initial financial bid
Earnest money deposit
Initial project cost estimates
Within 70 days of issuance of Letter of Award
Performance bank guarantee
At signing of PPA
Final project configuration
At financial close
Details of debt secured
Detailed project report
Proof of having secured required clearances and permits to generate and supply power
Details regarding ownership and structure of power generating company
At project commissioning
Proof that land arrangements have been secured
Plant layout
Connectivity and transmission agreements
Approval of metering scheme
Project synchronisation certificate from relevant body

Data source: SECI (various)

The CBGs clearly state that developers must apply for all approvals and clearances within 90 days of issuance of letter of award and must continuously follow-up with the relevant authorities. This process tends to be plagued with bureaucratic delays, and clearances typically take up to eight months to secure. On request from developers, SECI will write to concerned authorities to ask them to speed up the process, and in some cases, state governments have waited certain clearances as an incentive to the RE sector. Nonetheless RE project developers are required to obtain a number of clearances and approvals (see Table 10) before construction can begin. In the case of solar parks, the implementing agency can help

developers obtain clearances linked to the solar park area, but developers have to obtain all 'external' clearances, such those related to inter-state transmission, themselves.

Table 10: Clearances and approvals required by solar and wind project developers, India 2020

Project step	Process/ tasks
Land acquisition	Lease or purchase agreement and land-use permission changed to 'industrial'
Clearances and approvals	Consent of State Pollution Control Board Certificate of no-objection from district administrator Certificate of no-objection from village administration authority Approval for water usage (applicable to solar thermal projects only) Permission from chief electrical inspector to lay power evacuation lines Certificate of no-objection from the state energy department Clearance from forest department if project is proposed on forest land Clearance from defence ministry if project is proposed on defence-force property

Source: Pawar (2014)

3.1.4.1 Technical and financial criteria

The CBGs provide no quantifiable technical qualification criteria. To promote competition, tenders issued by SECI and other agencies require only experience in 'commercially established and operational technologies'. Bidders are not required to demonstrate any level of previous RE development or operational experience. Fortunately, this does not seem to have had any materially adverse effect on the sector. RE technology is easily available and, as compared with thermal power plants, the technical/construction requirements are relatively straightforward.

The financial criteria specified in the CBGs are fairly standard, and the thresholds have been kept relatively low to promote competition and ensure high participation from developers. Bidders are required to have a net worth of at least 20 per cent of the generic project cost, and must provide proof of their financial resources in terms of their minimum annual turnover and profit level or a letter of credit.

The industry has persistently and successfully pushed the for relaxation of these criteria to allow developers to bid for larger power plants. In practice, the requisite values have declined anyway in line with reductions in project costs. For example, the net worth requirement for solar power projects has declined from US$0.15 million per MW in 2018 to US$0.11 million per MW in 2020. Similarly, the minimum annual turnover requirement declined from US$0.07 million per MW to US$0.05 million per MW over the same period. In isolated cases, amounts have been lowered for specific tenders in an attempt to attract more bidders. In general, however, as with the technical criteria, the relatively low financial qualification criteria do not appear to have had a materially adverse effect on the sector. So far, developers have been able to raise money relatively easily, subject to project viability.

3.1.4.2 Local content

To help create a market for local manufacturers, the Indian government has pushed for the use of domestically manufactured equipment since its RE auction programme began in 2010. India's first solar power auction required developers to use Indian-made panels.

In 2014, a 750 MW solar power tender was issued, where 50 per cent of the capacity to be awarded was reserved for locally made panels. The United States of American then challenged this stipulation at the World Trade Organisation (WTO). In 2016, the WTO ruled against India, forcing the country to stop taking these measures. In an effort to circumvent the ruling, the Indian government announced the PSU scheme (see Table 4). Projects auctioned

under this scheme must use Indian cells and panels, but the power they generate can be used only by government-owned companies.

India's manufacturing capacity in the RE sector has grown substantially since 2010. By early 2020, solar PV cell and panel manufacturing capacity was at 3 GW and 11 GW, respectively (see MNRE n.d.). So far however, the utilisation of this capacity averages between 2.5 and 3 GW per annum. Part of the reason for the slow uptake of locally manufactured products is that the developers perceive imported equipment to be both cheaper and based on better technology.

To support domestic manufacturers, the government has also imposed safeguard duties on imports of solar equipment. As a result, domestic manufacturers' market share increased from around 12 to 30 per cent between 2017 and 2019 (Ministry of Commerce and Industry, 2020). Further duties are being considered alongside the possible introduction of financial incentives for domestic manufacturers because the government sees the slow development of manufacturing capacity as inconsistent with the aim of growing the RE sector.

The CBGs do not mandate the use of local content in RE projects. However, the MNRE and SECI have made the use of local content a qualifying criterion in several auctions – the PSU scheme being one example. In addition, the CBGs require that solar panels and inverters conform to specifications issued by the Bureau of Indian Standards. Accordingly, the MNRE has published lists of solar PV cells as well as other solar and wind-turbine technologies that conform to these specifications.

3.1.5 Bidder ranking and winner selection

Bidders that qualify in the technical round are invited to bid again in the financial round. To ensure that the process remains competitive, bidders with the lowest tariffs, and who together are bidding for only 80 per cent of the total bid capacity, are invited to participate in this round. No other weighting or preference is accorded to bidders with greater experience in installed capacity or, indeed, in any other regard.

The auction process takes place electronically so that each bidder can see the capacity and tariffs proposed by other bidders on an anonymised basis. The auction window is initially opened for 30 minutes, and is extended by eight minutes each time a new bid is submitted. The auction window can be extended by unlimited number of times. The starting bid for each participant is the price quoted in their original bid submission, but bids are awarded on the basis of the capacity they put forward in the electronic bidding process. In other words, capacity is awarded to bidders in ascending order of tariff amounts submitted (see Table 11).

Table 11: An example of the bucket filling approach to awards where total offered capacity is 1000 MW

Developer	Tariff bid (US¢/kWh)	Bid capacity (MW)	Capacity awarded (MW)
A	3.33	300	300
B	3.35	200	200
C	3.36	300	300
D	3.36	100	100
E	3.37	200	50
F	3.37	300	50
G	3.39	100	0

3.1.6 Buyer and seller liabilities

To bid, developers have meet two separate financial requirements. The first is an 'earnest money' deposit of about 1 per cent of the capital cost of their project as proposed in their bid submission. This is the equivalent of a bid bond and takes the form of a bank deposit, a bank draft or a bank guarantee issued by a commercial bank. These deposits are returned to unsuccessful bidders once the auction process is complete, and are forfeited if successful bidders fail to sign the PPA or to submit the required performance guarantee within the stipulated time. The second requirement is the provision of a performance guarantee, issued by a commercial bank when the PPA is signed. The value of the guarantee has to be 2 per cent of the estimated project cost, and can be encashed by the procurer if a developer fails to achieve financial close, commission projects by the stipulated deadline, or meet guaranteed generation levels.

The value of bank guarantees as a percentage of project cost has reduced sharply in recent years. The RE industry has persistently and successfully pushed for a relaxation in bid-bond requirements to allow developers to bid for larger capacities. In view of the many challenges developers face in obtaining guarantees from commercial banks, SECI has decided to allow bidders to submit a payment on order instrument (POI) instead (Bridge to India, 2020a). A POI is an undertaking by government-owned financial institution to pay the procurer in scenarios where a bank guarantee becomes liable for encashment.

Although project delays are common, bank guarantees are rarely encashed. To date, SECI has been very accommodating of the challenges facing developers in relation to accessing land, transmission infrastructure, necessary permits, etc.

3.1.6.1 Delayed commissioning

The commissioning timetable allows a maximum of six months' extension beyond the specified completion date, and developers are obliged to pay liquidated damages during this period. These damages are claimed by encashing part of the performance guarantee on a per-day basis in proportion to capacity not commissioned.[13] If a developer fails to commission the project six months after the specified completion date, contracted capacity is reduced to commissioned capacity (minimum 50 MW) as per that date.

Again, in practice, developers often approach SECI to seek an extension in scheduled completion dates on the grounds that delays are attributable to factors beyond their control. SECI usually takes a flexible view and issues ad hoc extensions to developers.

3.1.6.2 Generation guarantees and penalties

To date, all RE tenders issued by SECI and other central government agencies have required developers to bid for capacity rather than energy. However, developers are required to guarantee a minimum annual CUF (typically 17 per cent for solar projects and 22 per cent for wind projects). Any shortfall in CUF (and thus generation), makes developers liable for penalties, and these have been set at 25 to 50 per cent of the PPA tariff for the output shortfall.

As part of bid submissions, developers are required to provide annual generation estimates for their projects. They are also required to fulfil minimum annual CUF levels as tendered, and maintain the annual CUF to within +10 and –15 per cent of the figure proposed.

13 The CBGs contain no pre-defined amounts for liquidated damages.

As per the terms of the tender and the PPA, procurers are required to pay bills presented to them by IPPs within the stipulated timeframes. Procurers are given 30 days beyond the due date to clear the dues. After this, a late-payment surcharge is levied at 15 per cent per annum, calculated on a simple interest basis. Procurers must also submit a revolving letter of credit covering 105 per cent of projects' average monthly revenue. This letter of credit can be partially or fully cashed if the procurer fails to clear outstanding dues within the 30-day period. As an intermediary procurer, SECI also has the right to sell power to a third-party if the distribution company (as final procurer) fails to fulfil its obligations.

Provisions made for the sale of excess energy state that the procurer enjoys first right of refusal on the sale of power to other consumers, and can procure surplus power at 75 per cent of the PPA tariff (see Table 12). In theory, developers can sell excess power to other consumers but no such cases have been reported yet. No penalties are levied on developers if shortfalls in power delivery result from an unavailability of transmission infrastructure.

Delays in the commissioning of required transmission infrastructure have led to several projects being deferred. As a result, MNRE has made major changes to the CBGs (Bridge to India, 2018). These include broadening the scope of factors that make compensation payable to developers, and increasing the amounts of compensation payable (see Table 13).

Table 12: Generation guarantees required from solar and wind power generators, India 2020

Technology	Minimum annual CUF	If output is below committed CUF	If generation is above committed CUF
Solar	At procurer's discretion but typically 17%	Generator pays a financial penalty of at least 25% of PPA tariff	Procurer has first right of refusal and may procure excess power at 75% of PPA tariff
Wind	22%	Penalty is at least 50% of PPA tariff (revised down from 75%)	Procurer has first right of refusal and may procure excess power at 75% of PPA tariff

Table 13: Compensation defined as per MNRE bid guidelines, India

Technology	Transmission infrastructure not ready	Grid becomes unavailable while the project is operational	Grid operator asks generator to curtail output
Solar	Generation loss is calculated proportionally at 19% of CUF or committed CUF, whichever is lower. Procurer is liable to purchase excess generation equal to generation loss over the first 3 years of operations	Generation loss is determined on the basis of the number of hours that the grid is unavailable and the average hourly generation in a year. Excess generation equal to generation loss is procured over 3 years at the PPA tariff	No compensation if generation is curtailed to ensure grid security. Deemed generation compensation is paid in all other instances
Wind	No specific clause on compensation in the CBGs or tender documents	Compensation is payable if the grid is unavailable for more than 50 hours in a year. Generation loss is determined by the number of hours that grid is unavailable and average hourly generation in a year. Excess generation equal to generation loss is procured over 3 years at the PPA tariff	No compensation is paid if generation is curtailed to ensure grid security Deemed generation is paid as compensation in all other instances.

In practice, no records are kept of the reasons for grid unavailability. Discoms and state transmission companies are notorious for curtailing power on grounds of 'grid security'. This has become a contested issue with developers, who have made representations requesting that that the reasons for grid unavailability are authenticated. Projects connected to the national grid seldom experience this problem since Discoms don't have the authority to issue curtailment instructions to the national grid operator.

3.1.6.3 Compensation for changes in the law

As part of the PPA, developers can claim compensation if legislative or tax-rate changes impact negatively on project development. To seek such compensation, developers have to approach the regulatory authorities and demonstrate the impact on project costs. Once approved by the regulator, the off-taker and developer usually agree to an annuity plan for the payment of compensation. Developers have successfully sought compensation for increased project costs resulting from the introduction of the goods and services tax (GST) as well as safeguard duties on solar cells and panels.

3.1.6.4 Socio-economic and environmental obligations

Given the fact that RE technologies are intended to cause less environmental degradation, it seems ironic that RE project developers in India are subject to very minimal environmental or social obligations. Neither SECI nor other government agencies require environmental impact assessments (EIAs). At first, developers were required to secure 'consent to establish' and 'consent to operate' from the State Pollution Control Boards (SPCB). These consents were given after evaluating potential environmental impacts of the likely emissions and effluents linked to projects. In 2016, as part of efforts to improve the 'ease of doing business' for RE developers, the government removed the need for developers to obtain SPCB consent. Instead, projects are now required merely to inform SPCBs of the development (Ministry of Environment, Forest and Climate Change, 2016).

The only other environmental obligation mentioned in the CBGs is the 'end of life' disposal of solar panels in accordance with the government's Hazardous and Other Waste Rules published in 2016 (Aggarwal, 2017). In fact, however, these regulations do not even cover the treatment of solar PV waste.

Indian lenders, who provide an estimated 80 per cent of the total primary debt financing in the RE sector, do not require EIAs as part of their due diligence process either. EIAs are therefore undertaken only when international agencies, such as the International Finance Corporation, the Asian Development Bank, the European Investment Bank and the German state's development bank, KFW, get involved in project financing.

3.1.6.5 Termination compensation

Failure to commission projects within stipulated timelines or supply power as per the terms of the PPA terms, along with bankruptcy and changes in project control or shareholding, are considered to be developer defaults. In such cases, procurers are entitled to compensation equivalent to six months of the PPA tariff for the contracted capacity. The procurer also has the right to acquire project assets at 90 per cent of outstanding debt.

In cases of natural *force majeure*, no termination compensation is payable by either party. In case of non-natural *force majeure* events, such as war, strikes or the nationalisation of assets, procurers have to take over project assets and pay the developer's outstanding debts, plus 110 per cent of the adjusted equity.

3.1.7 Securing the revenue stream and addressing off-taker risk

3.1.7.1 Payment security mechanism

India's distribution utilities are in a state of chronically poor financial health, and this has created long delays in paying power generators (refer to Section 2.1.2). Various clauses in the CBGs protect the financial interests of power generators so that if a Discom defaults on payment, a three-pronged payment-security mechanism kicks in (see Table 14).

The Payment Security Fund was initially funded through a budgetary allocation by the central government (ICRA, 2020). However, a 2020 revision of the CBGs created an alternate mechanism to create a corpus for the fund. The revision states that, at the time of bid submission, project developers must pay SECI US$6 667 per MW[14] as a contribution to the fund. Thus, the charges are effectively passed on to the procurers and, ultimately, to consumers.

State-government guarantees can be exercised only after the two other measures have been exhausted (MNRE, 2019). In practice, however, the payment security mechanism does not seem to have been invoked yet; developers probably fear the possible consequences of escalating disputes with Discoms and state governments.

Failure to make timely payments or to honour PPA obligations are the main default events for procurers. In such cases, a procurer can transfer its rights and responsibilities under the PPA to a third party, subject to the approval of the generator. If the transfer is not possible, the procurer is required to either acquire project assets at an amount equal to outstanding debt plus 110 per cent of 'adjusted equity', or pay compensation equivalent to six months of the PPA tariff for the contracted capacity. As of mid 2020, despite the fact that distribution companies owe millions of dollars in outstanding payments to power generation companies, no procurer had transferred its rights, acquired project assets or made any compensatory payment to developers.

Tariffs are denominated in the local currency, and the tariff structure is left to procurers' discretion. A procurer may opt for a PPA with a fixed tariff for its entire duration or set an annual escalation rate for all or part of the PPA term. Setting a fixed tariff for the duration of the PPA is the dominant practice but, if applicable, annual escalation rates have to be mentioned in the RfP. However, escalation rates are generally not linked to any market instruments and the CBGs do not oblige procurers to explain how the escalation rate will be set.

Table 14: Three kinds of payment security for RE power generators

Letter of credit	Payment Security Fund	State government support
A revolving letter of credit equivalent to 105% of one month of average revenues for the project	A cash-funded reserve equivalent to three months of average project revenues	A guarantee from the relevant state government or a three-way agreement between SECI, the Reserve Bank of India and the state government allowing SECI to access monies from state government's share of tax revenue*

Note: * Discoms are required to pay an additional tariff of US¢ 0.13/kWh if a state government cannot provide a guarantee

14 As at July 2020, US$1 was INR75.

3.1.7.2 Project finance

Most of the lending to solar and wind power projects in India comes from public and private non-banking financing companies (NBFCs). In 2018, 75 per cent of estimated RE project funding in India (around US$3.25 billion) was channelled through commercial banks and private non-banking financial institutions (CENFA, 2019). Since then, the share of public NBFCs in total project financing has soared – private financiers have been hit by liquidity crises in the local financial system and concerns about asset quality have increased. Commercial banks have also cut back on their exposure to renewable power. This is partly because of concerns around Discom finances, and partly because banks have suffered huge losses from their exposure to conventional power projects. Multilateral funding agencies such as the IFC and the Asian Development Bank are selectively involved in lending to the sector.

3.2 Auction implementation

As noted, RE auctions in India were initiated in 2010 as part of the country's *National Action Plan on Climate Change* (Government of India, 2008). Initially, solar power was procured using a mix of feed-in-tariffs and auctions. However, in view of various large corruption scandals around allocation of coal mines and telecom spectrum around that time, the central government began to favour auctions as these were seen as more transparent.

Having a separate and dedicated ministry – the MNRE – for the promotion of RE technologies has been critical to the implementation of India's RE auctions. Established as early as 1992, the ministry has had the budget and the freedom to develop long-term policy and regulatory frameworks that promote RE. From this, institutions such as SECI and the National Institute of Wind Energy have emerged, while financial institutions, such as the Indian Renewable Energy Development Agency, have grown stronger. The MNRE also helped implement early financial support programmes, including tax and generation-linked incentives, which were critical to the expansion of RE power generation capacity in India before the auction programmes kicked-in.

In 2015, the RE capacity target was increased from 20 GW to 100 GW by 2022. To achieve this ambitious target, SECI was set up under the direct control of the MNRE as the nodal agency for procurement and programme administration. Designed to be free of any potential conflicts of interest, SECI's core operations are limited to RE auctions. SECI has since become India's main tendering agency for RE projects, and the role of other centrally controlled state-owned entities, such as the NTPC and NHPC has diminished. Several states have cut back on their own procurement schemes because bidders are increasingly reluctant to bid for projects in states where Discoms are a direct risk. Nevertheless, SECI does not hold exclusive rights to hold RE auctions, and no clear rationale or plan exists for the split of tenders between SECI and other public sector agencies.

In running RE auctions, SECI has three key responsibilities. The first is to coordinate input from the MNRE, project developers, off-takers, transmission network planners, grid operators and other stakeholders on the design of new tenders and RE procurement programmes. The second is to issue tenders and then engage with potential bidders through pre-bid meetings where objections and points of clarification can be raised. These meetings are usually unstructured, and no formal notes are issued. (As noted in Section 3.1.1, the timetable from tender issuance to auction is fluid and, according to members of the industry, SECI frequently revises its bid timetables.) The third responsibility is to act as the intermediary procurer between project developers and off-takers (Discoms).

Document submission as well as competitive financial auctions for SECI-issued tenders are conducted online. All documents and bids are electronically encrypted with users required to set their own password. SECI claims that bids cannot be decrypted, even if the tender-opening officers of the buyer organization and the personnel of the e-tendering service provider were to connive (SECI, 2020). The auction results are made publicly available on SECI's website within 30 days of the auction's completion.

While SECI is relatively thinly capitalised, and has comparatively little operational or financial experience, it enjoys a strong credit rating of AA+ by virtue of being 100 per cent owned by the government of India, and because it is the nodal agency for a critical sector. Despite some concerns around SECI's financial capabilities in the earlier years, Indian and international financiers alike now see the agency as a bankable counterpart.

SECI's balance sheet is still relatively small given its commitments in several PPAs. But its 100 per cent government ownership, its tripartite agreements with state governments and the Reserve Bank of India, and its gradually strengthening payment-security mechanisms have made it acceptable to developers as an intermediary procurer. So far, SECI has paid project developers on time even where Discom payment to SECI have been delayed. Informally, SECI has alerted developers that if Discom delays increase, their payments might be less timely in future. So far, this has not resulted in any deterioration in its credit rating.

SECI is almost entirely self-funded. It earns income from bid processing fees (of up to US$0.2 million per project), success charges (US$13.330 per MW) and forfeited bid bonds. It also charges distribution companies a trading margin of up to US¢0.9/kWh when it acts as an intermediary procurer. For the financial year ending 31 March 2019, SECI reported revenue of US$434.7 million, which was up by 178 per cent year-on-year. For the same period It also reported a profit after tax of US$17.3 million (up 101 per cent year-on-year), and a cash balance of US$222.7 million as of 31 March 2019 (SECI, 2019a).

SECI is staffed largely by government officials seconded from other departments and public sector organisations. For example, at the time of writing this report, its managing director was a senior bureaucrat in the government. The technical director has been seconded from the Power Grid Corporation, the national grid developer and operator. The organisations is apparently operationally stretched, and there are rumours of short-staffing, lack of expertise and delayed timelines No external audits of the bidding process or results occur, but SECI itself is subject to general audit by India's auditor general. So far, no bidders or off-takers have accused SECI of mismanagement or impropriety, and no disputes relating to auctions have surfaced.

4 Auction results

Since 2015, SECI has awarded around 43.5 GW of RE generation capacity.[15] The following analysis is restricted to auctions for stand-alone solar and wind power generation only, which account for 28.4 GW of the allocated capacity.

Between August 2015 and June 2020, SECI allocated solar power capacity of 19.1 GW across several states (Table 15). Over the same time period, SECI also auctioned another 9.3 GW of wind energy capacity (Table 16).

Table 15: Solar auctions completed by SECI, India, September 2015–June 2020

Tender issued	Project location	Tendered capacity (MW)	Subscription (x)	Lowest tariff bid (US¢/kWh)
August 2015	Maharashtra	450	2.3	5.91
August 2015	Maharashtra	50	1.0	5.91
November 2015	Uttar Pradesh	390	NA	5.91
January 2016	Andhra Pradesh	400	1.6	5.91
February 2016	Karnataka	1000	1.1	5.91
March 2016	Chhattisgarh	100	1.6	5.91
March 2016	Gujarat	225	NA	5.91
March 2016	Gujarat	25	NA	5.91
April 2016	Odisha	300	1.0	5.91
April 2016	Uttar Pradesh	160	1.6	5.91
June 2016	Maharashtra	50	2.0	5.91
June 2016	Maharashtra	450	2.4	5.91
November 2016	Rajasthan	250	5.6	3.49
November 2016	Rajasthan	500	4.6	3.25
June 2017	Rajasthan	250	5.4	3.31
June 2017	Rajasthan	500	6.2	3.29
January 2018	Andhra Pradesh	750	1.7	3.60
January 2018	Karnataka	200	2.0	3.76
January 2018	Pan India (ISTS)	2000	1.9	3.25
February 2018	Pan India (ISTS)	3000	1.7	3.25
April 2018	Uttar Pradesh	150	1.0	4.39
August 2018	Rajasthan	750	3.2	3.31
August 2018	Maharashtra	250	1.6	3.83
January 2019	Pan India (ISTS)	1200	1.3	3.40
March 2019	Pan India (ISTS)	1200	1.8	3.39
March 2019	Pan India (ISTS)	2000	0.6	4.67
March 2019	Rajasthan (ISTS)	750	1.5	3.33
June 2019	Pan India (ISTS)	1200	0.5	3.37
June 2019	Pan India (ISTS)	1200	1.0	3.61
August 2019	Pan India (ISTS)	1500	1.0	4.67
January 2020	Pan India (ISTS)	1200	3.3	3.33
March 2020	Pan India (ISTS)	2000	2.6	3.15

Note: The lowest tariff is recorded at US¢5.91/kWh for tenders up to June 2016. For all these tenders, the tariff for sale of power to the Discoms was fixed at this level. The bidders were instead required to bid for capital subsidy required to make this tariff acceptable to them. Two similar tenders were issued in 2019 with tariff fixed at US¢4.67/kWh.

15 Prior to this, SECI had issued only one utility-scale tender.

Table 16: Onshore wind tenders issued by SECI, October 2016–June 2019

Tender issued	Project location	Tendered capacity (GW)	Subscription (x)	Lowest tariff bid (US¢/kWh)
October 2016	Pan India (ISTS)	1000	2.6	4.61
June 2017	Pan India (ISTS)	1000	2.9	3.52
December 2017	Pan India (ISTS)	2000	1.9	3.25
February 2018	Pan India (ISTS)	2000	1.5	3.35
June 2018	Pan India (ISTS)	1200	1.8	3.68
December 2018	Pan India (ISTS)	1200	1.9	3.76
February 2019	Pan India (ISTS)	1200	0.5	3.72
June 2019	Pan India (ISTS)	1800	0.3	3.77

Until 2017, almost all SECI tenders were issued on a state-specific basis. Projects were expected to be developed within each state to supply power to their respective Discoms. However, in 2018, the ISTS scheme was introduced to develop projects in the states that have the most solar and wind resources (mainly Rajasthan and Gujarat). The plan is for these projects to supply states, with relatively poor RE resources and/or limited land availability, via the national grid. The scheme has helped to scale up procurement immensely, and tariffs have lowered in response to the large tender and project sizes. With SECI coordinating the procurement process as both the lead agency and intermediary off-taker, competition between developers to build project pipelines has been intense, and investment capital has flowed in from around the world. However, the scheme has also exacerbated challenges linked to the availability of land and transmission infrastructure in states where these projects are located.

4.1 Tariff issues

While bid tariff levels are somewhat volatile, the general trend has been downward. Between January 2017 and June 2020, the lowest solar and wind tariffs declined by 4.8 per cent and 18.2 per cent, respectively. The auctions have helped make RE the cheapest source of power generation. While the average cost of power procurement by Discoms increased from US¢5.49/kWh in 2015/16 to US¢6.31/kWh in 2018/19, the price of RE has fallen from US¢5.91/kWh in 2015 to US¢3.15/kWh in 2020.

The falling cost has attracted increasing demand from Discoms, but also created expectations that tariffs will remain low or continue fall indefinitely. Arbitrary and unreasonably low ceiling tariffs have derailed many tenders. Several auctions have also been cancelled after tariffs failed to meet Discoms' expectations, even though developers explained that their project costs increased because of factors such as poor site conditions, connectivity challenges and tax increases.

Falling tariffs have also created resentment among some of the early procurers of renewable power. The MNRE guidelines allow procurers to sign PPAs of 25 years or more. In practice, most PPAs are limited to 25 years. In rare cases, longer durations are considered as a means of reducing bid tariffs of projects with high capital costs.[16] However, the states of Gujarat, Andhra Pradesh, and Punjab, which established RE installations some years ago, have found themselves locked into agreements with relatively high tariff rates, and have threatened to renegotiate these PPAs. Affected developers have approached the regulators and the courts

16 For example, the proposed PPA for a 7.5 GW solar project in the Ladakh region is for 35 years; in this case, the project's capital costs are higher because integrated transmission works are included.

for protection against these threats. Following intervention from the central government, the state of Andhra Pradesh agreed to honour the PPA tariff. In Gujarat, the state regulator sided with the developers and no changes were made to the PPAs. However, Gujarat has since cancelled a number of tenders after bidders refused to reduce tariffs in the financial bidding rounds. The state of Punjab also recently asked operational projects to reduce tariffs, citing revenue loss linked to reductions in power demand caused by COVID-19.

4.2 Competition levels

As shown in Tables 15 and 16, most tenders were heavily oversubscribed in the period 2015 to 2018. Competition has since waned somewhat, with several large tenders in 2019 and 2020 being undersubscribed. Of the 32 solar tenders awarded between August 2015 and March 2020, 22 were oversubscribed, 4 were fully subscribed and 6 were undersubscribed. Of the 8 wind tenders awarded by SECI since October 2016, 6 were oversubscribed and 2 were undersubscribed.

In the face of the multiple challenges involved in RE tenders, most small and mid-sized RE developers have left the tender market. Factors contributing to their exit include: falling returns; delays in project commissioning; tighter working-capital conditions (caused by delays in processing of 'change in law' claims linked to higher taxes and duties); decreasing availability of debt financing; delayed payments from Discoms; aggressive ceiling tariffs, and increases in minimum project size.

4.3 Tender design and issuance

Weakening power-demand growth and poor enforcement of RPOs mean that Discoms are increasingly reluctant to procure additional renewable power plants. Simultaneously, many Discoms are complaining about the variability of renewable power output and the higher transmission and balancing costs that this creates. Furthermore, the inability of RE generation to meet the evening peak load forces Discoms to buy expensive power from the exchanges. In spite of these problems, SECI is under pressure to meet political targets, and has therefore pushed through new tenders. This has created a misalignment between RfPs and demand from Discoms, leaving several tenders in limbo.

Although many proponents current RE technologies prefer to avoid mentioning this problem, MNRE and SECI have had to find ways to meet peak demand and provide round-the-clock power. One solution has been to blend RE with energy storage and thermal power installations. Hybrid projects that harvest both solar and wind resources are also gaining popularity because they have the potential to deliver a more even supply of power. Tenders for stand-alone solar and wind power generation projects seem likely to disappear as Discoms acknowledge that these technologies are unable provide the availability and predictability that users have come to expect.

4.4 Shifts in the businesses involved

Just ten RE developers account for 68 per cent (28.4 GW) of the solar and wind power capacity awarded in India between 2015 and 2020 (see Table 17). Of this, the top two companies, Renew Power and SB Energy, account for 26 per cent of awarded capacity. Both companies are backed by foreign investors and are therefore equipped to raise capital for large projects. The average bid sizes submitted by Renew Power (212 MW) and SB Energy (265 MW) are substantially larger than those submitted by other project developers, which average out at 133 MW.

Table 17: Concentration of stand-alone solar and wind power capacity awards, India, August 2015–March 2020

Developer	Awarded capacity (MW)	Share of awarded capacity (%)
Renew Power	3 815	13
SB Energy	3 704	13
Adani Green Energy	2 410	8
Acme Cleantech	2 085	7
NTPC	1 952	7
Azure Power	1 860	7
Hero Future Energies	1 000	4
Eden Renewables	900	3
Ayana Renewable	850	3
Sembcorp	800	3

Although many smaller developers no longer participate in RE auctions, new developers continue to enter the market. Leading international investors have committed large amounts of equity capital to India's RE sector. In 2019 alone, these included: pension fund managers (CDPQ and CPP Investment Board); sovereign wealth funds (ADIA, GIC, Temasek, Masdar, the CDC Group, DFID, Norfund); oil and gas companies (Total, Shell, Petronas); energy utility companies (Engie, EDF, JERA, Sembcorp, CLP, Enel, Fortum); and private equity funds (Actis, Global Infrastructure Partners, and the Everstone Group). Several new development platforms have been created and the overall investment mood remains buoyant.

4.5 Bidding and commissioning timelines

As noted, several uncertainties surround tender and project commissioning timelines. Thus, by early 2020, only a quarter of the solar power capacity awarded by SECI since August 2015 had been commissioned. Indications are that construction delays even more serious for wind projects. In some instances, Discoms are not coming forward to implement power sale agreements even though auctions have been successfully completed and letters of award sent out. Rough estimates, based on informal communications, are that up to 15 000 MW of RE generation is affected by these issues.

The lack of power demand from Discoms, combined with SECI's constant tinkering with project sizes, location, technology mix in auction designs, uncertainties about import duties and growing site-related challenges, mean that project construction is generally delayed. So far, the government has granted ad hoc extensions to developers and contractual penalties have seldom, if ever, been enforced.

5 Lessons learned

5.1 Auction implementation

The formulation of CBGs has been immensely helpful in ensuring transparency and predictability of the programme. Backed by strong central government support and ambitious targets, India's RE programme has attracted substantial investment.

The central government's ongoing engagement with off-takers and project developers – to update and modify rules in ways that address market concerns, and playing the role of mediator and arbiter – has been invaluable. Although some organisations have expressed concerns about the SECI's organisational capability and staffing levels, the auctions have run reasonably smoothly so far. This is especially notable given the size of the programme and the amount of interaction required with state and central governments, including the departments finance, transmission, industry, labour and the environment.

Other important lessons learned so far can be summed up in three main points.

- SECI plays a crucial role. SECI's role as intermediary off-taker has shielded project developers from direct Discom risk, and has been instrumental in addressing off-taker concerns. This is evident in the fact that participation levels in SECI tenders are higher than in tenders issued by Discoms. SECI's involvement as a bankable counterpart is critical in attracting bidders.
- More planning and co-ordination would solve a raft of problems. Tender issuers, transmission network developers, regulators and off-takers tend to plan in separate silos. This creates delays in the construction of transmission networks, the identification of off-takers, the identification and acquisition of suitable sites and in tariff adoption by regulators. Measures taken to mitigate these challenges include the development of solar parks and the involvement of tender issuing agencies in transmission planning. Provisions for compensation to developers where power evacuation systems are delayed have also been strengthened. However, integrated planning remains necessary to address the uncertainties related to project implementation.
- Detailed schedules and further safeguards would benefit the sector. So far, neither SECI nor any other tender-issuing agencies have published tender schedules. It seems that this is at least partly designed to maintain high levels of competition between developers. What it means, in fact, is that developers have little time for strategic planning; instead they are forced to participate in bid processes that occur at ad hoc and erratic intervals. Many developers bid aggressively for of fear of missing out, but then fail to commission projects on time, and/or later seek to cancel PPAs. The sector as a whole would benefit if tender agencies provided basic information about tender schedules and put stronger safeguards in place against awards being made on unrealistic bids. Possible safeguards could include higher bid bonds, as well as independent evaluations of proposed tariffs and project viability.

5.2 Auction design

The Indian government's view is that since renewable power is a mature and a relatively simple technology. For this reason, very low technical and financial qualification criteria were set for developers. Initially, this attracted large number of bidders, and created high levels of competition with aggressive tariffs proposals. As the sector matured and project sizes increased, smaller developers have tended to exit the auction programmes, leaving only large and well-funded developers to bid.

The tendering schedule has been dictated more by the government's ambitious targets for the sector than by power demand. Thus, while power demand has slowed, and Discoms are reluctant to sign new PPAs because they have excess supply, SECI and other government agencies have continued to issue large new tenders. Many projects have been cancelled or delayed as off-takers fail to sign PPAs and regulators refuse to approve tariffs. These problems could be prevented if tendering agencies were obliged to obtain reliable information about power demand in specific states before issuing new tenders.

The CBGs provide considerable flexibility on certain key bidding parameters, including technical and financial qualification criteria, ceiling tariffs, project size. They also make provision for legislative changes. Frequent and ad hoc changes to these parameters have created fluidity in tender schedules and given developers the latitude to lobby SECI to make changes in their favour. The resulting uncertainties that now prevail must be addressed; that is, bidding parameters must be set consistently and ad hoc changes should no longer be allowed.

6 Conclusion

India was among the first countries in the world to launch an RE auction programme in 2010. The programme is also among the world's largest, and its capacity targets are ambitious. So far, the auction programme has been worked well; combined wind and solar power capacity grew from 18.4 GW in March 2012 to 72.2 GW in March 2020.

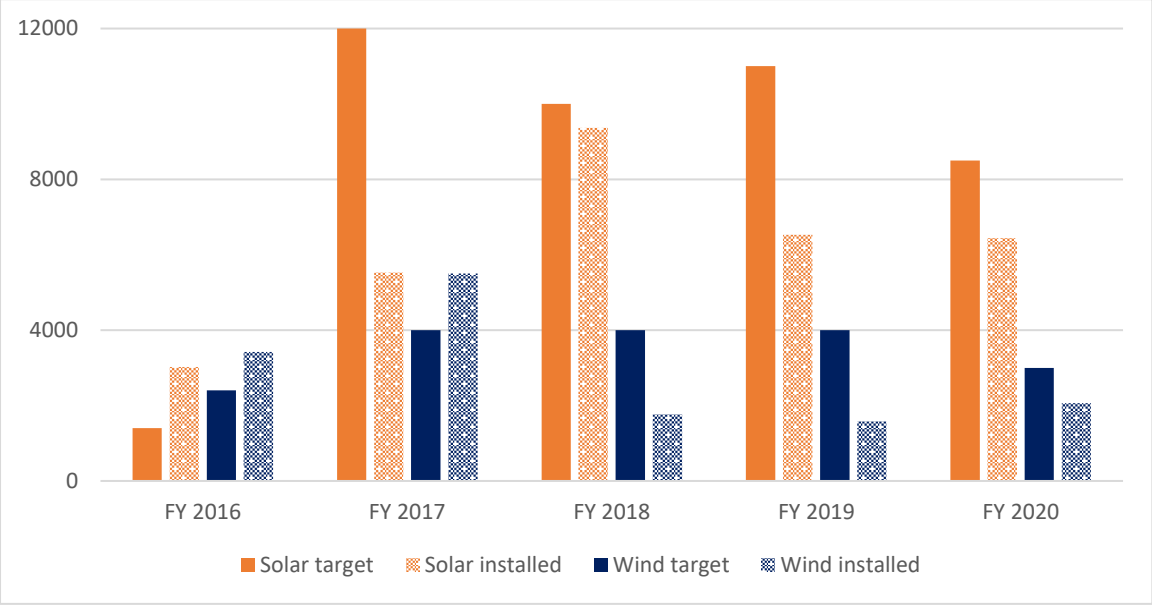
India's auction programme has been designed to achieve two primary objectives – to reduce the cost of renewable power and to attract private capital to the sector. Judged on these two parameters alone, the programme has been very successful. Aggressive bidding has led to a sharp decline in tariffs, while transparent bidding rules, above-board processes (important in a country prone to corruption) and the scale of the programme have attracted leading players from around the world.

The programme has evolved significantly as a result of issues facing developers and off-takers, as well as changes in the technologies. As Figure 14 shows, sectoral growth has been uneven, indicating the impact of various challenges related to project implementation.

At the heart of many of these challenges is the tension between the ambitions of central government and realities at state level. India's central government adopted an ambitious renewable capacity target and backed it up with a slew of policy measures, but the state governments and Discoms have to focus on actual power demand and the relative costs of different generation options. As a result, enthusiasm for RE among state authorities is more low key. Many of the critical decisions and regulatory processes, including the terms of PPAs, site availability and RE park development, are determined at state level. Tensions between the priorities of central and state governments is creating significant policy conflict and uncertainty on the ground.

At the same time, SECI has been instrumental in dealing with many of the off-taker concerns expressed by private sector developers. Thus, although many states run their own auctions, developers clearly prefer SECI-run auctions, and this has substantially increased the role that SECI and other central government agencies play in RE auctions.

Figure 14: Solar and wind capacity additions in India by MW, 2016–2020



Data source: Compiled from MNRE reports released for each year

The other notable feature of the auction programme and the CBGs is their fluidity. The government has formally amended the CBGs several times to address challenges in project execution and respond to changing market conditions. In addition, various other parameters have been altered in seemingly ad hoc and experimental ways. Changes in manufacturing policies and the structure of import-duties and tax rates, for example, combined with shifts in financial markets due to macro-economic weakness, have adversely affected the sector.

Consequently, tender and project implementation schedules have been delayed. Many tenders have been cancelled outright because of low subscription rates, and some projects have been abandoned after auctions either because the Discoms did not come forward to sign PPAs or because developers found that projects were unviable. The government's decision to issue tenders without being certain of demand, and its unwillingness to evaluate project viability as outlined in bid proposals have been major failures. To improve RE project execution and operation, integrated planning across concerned agencies must be undertaken.

Finally, the programme's strong focus on tariff reductions has led to two major changes in tender design. The first is that tender and project sizes increased over time because the economies of scale achievable by larger projects are believed to result in lower tariffs. The second is that more projects are being located in the two or three states where RE resources are good, land is cheaper/more available and cost-efficient connections to the national grid are achievable. The high concentration of capacity in particular states has exacerbated some of the execution challenges related to the availability of land, grid connections, water and other resources necessary for project construction and operation. It can be argued that the promotion of smaller projects across the country would be beneficial for grid resilience and job growth, while reducing transmission losses.

To sum up, India's RE auction programme has had mixed success. The programme has resulted in massive RE capacity additions at very low costs. However, its implementation has also created stress in the sector, especially for smaller companies, and highlighted tensions between the state and central governments' various priorities. For example, the government has been prevented from encouraging domestic manufacturing in order to keep import tariffs low and secure higher tax revenues. Perhaps for this reason, private investors across the value chain cite instability in the policy framework as one of the key challenges facing the sector.

Appendix A: Analytical framework

The analytical framework used in this report represents a widening and deepening of the work done by Eberhard and Gratwick (2011) and Eberhard et al. (2017) in their analyses of factors contributing to the success of IPPs in sub-Saharan Africa. These authors identified a host of factors, at both country and project level, that influence the success of such projects. In particular, they emphasised the importance of competitive procurement processes (Eberhard et al. 2016), without making explicit recommendations concerning the design and implementation of procurement programmes (largely because the most of sub-Saharan Africa's IPP capacity has been tendered through direct negotiations, often initiated by unsolicited proposals).

How to best structure and manage procurement interactions between the public and private sectors is a key concern for the development of successful new renewable generation capacity. RE auction design is a field of growing scholarly and practitioner interest. The work of, for example, Del Río (2017); Dobrotkova, et al. (2018); Hochberg and Poudineh (2018); Kreiss, et al. (2016); Kruger and Eberhard (2018); and Lucas et al. (2013; 2017) offers a useful body of literature for developing a deeper understanding of how choices made during the design of procurement programmes can influence bid and energy prices, investment outcomes, and so on. Eberhard and Naude (2016) as well as Eberhard et al. (2014) have also shown how choices related to procurement programme implementation can play a role in determining outcomes.

The analytical framework used in this study attempts to combine lessons from the literature on IPP success factors, with those on auction design and implementation, to offer a better understanding of the factors that have influenced the outcomes of four RenovAr auction rounds. Factors investigated and assessed in the study are outlined in the table below.

Factors	Details
Country level	
Stability of economic and legal context	Stability of macroeconomic policies Extent to which the legal system allows contracts to be enforced, laws to be upheld, and arbitration to be fair Debt repayment record and investment rating Previous experience with private investment
Energy policy framework	Framework enshrined in legislation Framework clearly specifies market structure and roles and terms for private- and public-sector investments (generally for a single-buyer model, since wholesale competition is not yet seen in the African context) Reform-minded 'champions' to lead and implement the framework with a long-term view
Regulatory transparency, consistency and fairness	Transparent and predictable licensing and tariff framework Cost-reflective tariffs Consumers protected
Coherent sectoral planning	Power-planning roles and functions clear and allocated Planners skilled, resourced, and empowered Fair allocation of new-build opportunities between utilities and IPPs Built-in contingencies to avoid emergency power plants and blackouts
Competitive bidding practices	Planning linked to timely initiation of competitive tenders/auctions Competitive procurement processes are adequately resourced, fair and transparent

Factors	Details
Programme level	
Programme design	Bidder participation is limited to serious, capable and committed companies Contracts are bankable and non-negotiable Balance between price (competition) and investment risks/outcomes is appropriate Programme is linked to and informed by planning frameworks (volume, transmission etc.) Investment risks and costs are allocated fairly Design takes local political and socio-economic context into consideration Transaction costs (bidders and procuring entity) offset by price and investment outcomes Qualification and evaluation criteria are transparent and quantifiable Design allows for multiple scheduled procurement rounds Measures to create local capacity/market are built in through local currency PPA, shareholding requirements, etc.
Programme implementation	Both the programme and the procuring entity have appropriate and unbiased political support, as well as an appropriate institutional setting and governance structures The procuring entity is capable, resourced and respected Co-ordination between various government entities is effective The procurement process is clear, transparent and predictable
Project level	
Favourable equity partners	Local capital/partner contributions are encouraged Partners have experience with, and an appetite for, project risk A DFI partner (and/or host country government) is involved Firms are development minded and ROIs are fair and reasonable
Favourable debt arrangements	Competitive financing Local capital/markets mitigate foreign-exchange risk Risk premium (demanded by financiers or capped by off-taker) matches country/project risk Some flexibility in terms and conditions (possible refinancing)
Creditworthy off-taker	Adequate managerial capacity Efficient operational practices Low technical losses Commercially sound metering, billing, and collection Sound customer service
Secure and adequate revenue stream	Robust PPA (stipulates capacity and payment as well as dispatch, fuel metering, interconnection, insurance, *force majeure*, transfer, termination, change-of-law provisions, refinancing arrangements, dispute resolution, etc). Security arrangements are in place where necessary (including escrow accounts, letters of credit, standby debt facilities, hedging and other derivative instruments, committed public budget and/or taxes/levies, targeted subsidies and output-based aid, hard-currency contracts, indexation in contracts)
Credit enhancements and other risk management and mitigation measures	Sovereign guarantees Political-risk insurance Partial risk guarantees International arbitration
Positive technical performance	Efficient technical performance (including availability) is rates high Sponsors anticipate potential risks (especially related to O&M and budgeting) and mitigate them
Strategic management and relationship building	Sponsors work to create a good image in the country through political relationships, development funds, effective communication, and managing contracts strategically, particularly in the face of exogenous shocks and other stresses

Source: Adapted from Eberhard et al. (2016)

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