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Despite Pandemic Disruptions, India's Renewable Energy Sector Is Still Primed for Growth

Key Auctions Demonstrate Investment Capital Is Available for Renewables Projects

Executive Summary

India is a global renewable energy leader. The government of India's long-term objective of 450 gigawatts (GW) of renewable energy capacity by 2030 has set the country on a path to a modern, low-cost renewable energy-based power system, building energy security and decarbonising in the process.

Key to this ongoing transition in India's power market, aided by the government's long-term ambition, is a significant deflation in wholesale power tariffs of renewable energy sources of wind and solar power globally.

From the fiscal year (FY) 2017/18 India's renewable energy sector saw a dramatic deflation in renewable energy tariffs – achieved through transparent, reverse auctions with well-defined contractual terms and pre-bid registration of qualified participants.

Solar power tariffs as low as Rs2.44/kWh (US$35/kWh) in the Solar Energy Corporation of India's (SECI) Bhadla Solar Park auction in May 2017 reinforced the ambition to accelerate capacity building. More than 90% of the 30GW of renewable capacity installed since the beginning of FY2017/18 and an additional 30-35GW auctioned to date, has been contracted for tariffs of Rs2.36-3.00/kWh with zero indexation for 25 years – 20-30% less than average domestic thermal tariffs of Rs4-5/kWh (US$55-65/MWh). As a point of comparison, NTPC, one of the better thermal power operators with better access to domestic coal linkages, reported an average tariff of Rs3.90/kWh for FY2019/20.) [1]

Given a promising FY2017/18 with 11.8GW of on-grid renewable energy capacity commissioned during the year, capacity additions were expected to accelerate to 15-20GW annually. However, renewable energy capacity growth has been underwhelming with only 8.6GW and 9.4GW of on-grid additions in FY2018/19 and FY2019/20. And with a dramatic collapse in electricity demand due to COVID-19, FY2020/21 has so far been another underwhelming year.

IEEFA notes that a number of policy-related headwinds and slower-than-expected electricity demand growth have impacted the growth of renewables in the last

[1] NTPC. Key Performance Highlights FY2019/20.

couple of years.

The collapse of India's electricity demand growth, in fact, precedes the start of the country-wide lockdown in March. Electricity demand grew just at 0.7% in FY2019/20, significantly below the historic annual demand growth level of 5-6% over the last decade. The pandemic has made a bad situation worse, resulting in significant excess capacity. India's electricity demand growth between April and July 2020 was -10.7% compared to the same period last year.[2]

India is still in the grip of the pandemic and clearly all forecasts of long-term electricity demand growth have been materially undermined. A recent report from The Energy Resource Institute (TERI) predicts India's electricity demand could be 7-17% lower by 2025 than previously expected demand levels.[3]

Thermal power generation has taken the majority of the downside hit of the declining demand during the period between April and July 2020. Thermal power generation was down by 17.8% year-on-year for the above period whilst renewable generation was only down by 1.7%. The downside impact on renewable generation is partly due to higher generation from hydro power, which is up 6.8% on the back of this year's extraordinary monsoon season in India.[4]

Record-low tariffs in the Bhadla Solar Park auction in May 2017 reinforced ambition to accelerate capacity.

Renewables Prove Resilient

The strong performance of renewable generation during unprecedented tough economic conditions provides impetus for India to continue its electricity sector transition.

Integrating 450GW of renewable energy into India's grid by 2030 is going to be a significant challenge, not least with the US$500-700bn investment required to build this out and provide grid transmission and balancing capacity. The significantly lower demand projections also mean that realistically this ambitious target will be downgraded or pushed out, say, 2 years, if as a precursor to the achievement of Prime Minister Narendra Modi's ambition, plans for the retirement of highly polluting, expensive, end-of-life coal-fired power generation capacity are accelerated.

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[2] CEA generation report. July 2020.
[3] TERI. Renewable Power Pathways: Modelling the Integration of Wind and Solar In India by 2030. July 2020.
[4] Times of India. Curious Case of Monsoon 2020: A Peek Into Strange Evolution and Progress of This Year's Monsoon. August 14, 2020.

IEEFA notes that domestic and global investor interest in renewable infrastructure investing remains robust – demonstrated by the very positive outcomes of some recent auctions, despite sluggish progress in renewable energy capacity tendering and commissioning in FY2019/20 and reluctance by discoms to sign even exceptionally low cost new power purchase agreements (PPAs) in the face of legally binding high capacity charges on legacy coal power supply agreements.

We note some of the key auctions from the perspective of India's power sector transition in Figure 1.

Figure 1: Important RE Auctions in India in 2020

	Renewable Energy Auctions	Date	Capacity (MW)	Winning tariffs (Rs/kWh)	Winning Developers
1	**SECI Solar Projects with Module Manufacturing Facility**	Jan-20	4,000	2.92	Azure Power (2000 MW)
				2.92	Adani Green Energy (2000 MW)
2	**SECI Solar Projects with Module Manufacturing Facility (greenshoe extension)** Total 3,000 MW of solar module manufacturing capacity linked	Jan-20	8,000	2.92	Azure Power (2000 MW)
				2.92	Adani Green Energy (6000 MW)
3	**SECI RE + Storage Peak Power Supply** (Peak power tariff - Rs6.12/kWh for Greenko and Rs6.85/kWh for Renew)	Jan-20	1,200	2.88	Greenko (900 MW))
				2.88	Renew Power (300 MW)
4	**NHPC Solar Tender**	Apr-20	2,000	2.55	SB Energy (600 MW)
				2.55	Axis Energy (400 MW)
				2.55	O2 Power (380 MW)
				2.55	Eden Renewable (300 MW)
				2.56	Avaada Energy (320 MW)
5	**SECI Round-the-Clock RE Power Tender** 3% escalation allowed on base tariffs for 15 years (Rs3.59/kwh on levelised basis for 15 years)	May-20	400	2.90	Renew Power (400 MW)
6	**SECI 2GW Solar Auction (ISTS Tranche IX)**	Jun-20	2,000	2.36	Solar Pack (300 MW)
				2.37	Enel Green Power (300 MW)
				2.37	Amp Energy Green (100 MW)
				2.37	Eden Renewables (300 MW)
				2.37	IB Vogt Singapore (300 MW)
				2.38	Ayana Renewables (300 MW)
				2.38	Renew Power (400 MW)
7	**NTPC 1.2GW ISTS Solar Auction**	Aug-20	1,170	2.43	O2 Power (400 MW)
				2.43	Azure Power (300 MW)
				2.43	Tata Power (370 MW)
				2.44	Amp Energy Green (100 MW)

Source: Mercom, IEEFA.

SECI's Solar Plus Manufacturing Auction, January 2020

SECI's solar module manufacturing-linked solar auction has provided an interesting growth opportunity for India's renewable energy industry, as well as signalling clear financial support for the Indian government's 'Make In India' initiative.

Adani Green Energy and Azure Power both won bids to develop 2GW of projects with 500MW of solar module manufacturing capacity. The winning tariff quoted by both companies was Rs2.92/kWh (US$40/MWh) for a period of 25 years with zero indexation for inflation.

The tender also had a 'greenshoe option', allowing the companies to opt for additional capacity to both develop and manufacture. Adani, under the greenshoe

option, offered additional capacity of 1.5GW of solar cell and module manufacturing and 6GW solar capacity.

With the additional capacity, Adani's total allocation comes to 2GW of solar cell and module manufacturing and 8GW of solar capacity, while Azure's is 1GW of module manufacturing capacity and 4GW of solar capacity.[5]

In its investor briefing from January 2020, Azure Power revealed its plan to partner with Waaree Energies – one of India's largest solar cell and module manufacturers with 2GW of annual module manufacturing capacity as of January 2020.[6]

In July 2020 ReNew Power, one of the fastest-growing and largest renewable energy developers in India, announced a mega plan to invest in a 2GW solar module manufacturing facility.[7] The plan to vertically integrate its solar power development business with solar module manufacturing capacity illustrates ReNew Power's ambition to be one of the top renewable energy utilities in the world.

India has approximately 15.5GW of solar module manufacturing capacity and about 3.3GW of solar cell manufacturing capacity.

According to Mercom India Research, India has approximately 15.5GW of solar module manufacturing capacity and around 3.3GW of solar cell manufacturing capacity as of June 2020.

Other domestic module manufacturing players, such as RenewSys and Jupiter, have reportedly revealed expansion plans aligned with the government of India's '*atmanirbhar*' (self-reliant) policy, which promotes domestic industries to help the economy out of the downturn.[8]

SECI's RE Plus Storage With Differentiated Peak Power Supply Tariffs, 1.2GW, January 2020

Given the costs of battery storage remain high, the Indian market is still finding large-scale deployment of utility-scale batteries prohibitive in the absence of a viable long-term peaking power price signal to justify the investment in utility-scale batteries.

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[5] Mercom India. Adani, Azure Win SECI's Manufacturing-Linked Solar Auction, Greenshoe Option Next. January 17, 2020.
[6] Azure Power. Investor Briefing. January 2020.
[7] ET Energy World. ReNew Power Plans to Start Manufacturing Solar Cells, Eyes China-dominated Global Market. July 16, 2020.
[8] Mercom India. Technological Upgrades Imperative for India's Solar Manufacturing to Take-Off. August 31, 2020.

However, in January 2020 India held its first renewable energy (RE) plus storage auction of 1.2GW capacity with a differentiated tariff for peak and off-peak supply and contracted for 25 years as a way to underpin bankability.

Greenko and ReNew Power won 900MW and 300MW of capacity at an off-peak tariff of Rs2.88/kWh (US$40/MWh). The peak-time power supply tariff quoted by Greenko was Rs6.12/kWh (US$86MWh) while ReNew Power quoted Rs6.85/kWh (US$96/MWh).[9]

Greenko will reportedly be using pumped hydro storage and ReNew Power will be using battery storage to provide firmed peak-hour supply.[10]

The resultant firmed peak-time supply tariffs from the auction are still materially higher than average coal-fired power tariffs of Rs4-5/kWh (US$54-68/MWh) in India. These tariffs reflect the first-mover risk the developers are taking on in the absence of prior experience of integrating utility-scale battery storage systems in the Indian market.

In April 2020, a report from the Lawrence Berkeley National Laboratory in the United States (U.S.) estimated solar plus lithium-ion battery costs and resultant tariffs for the Indian market. These estimations are benchmarked from a couple of similar solar plus battery auctions in the U.S. that illustrate the rapid pace of deflation, technology innovation and scaling up of batteries as a strong complement to low cost but intermittent renewable energy.[11]

The report concludes that solar plus storage bids in India (for a battery charged using 25% of the rated solar capacity) could be Rs3.94/kWh (US$54/MWh) by 2020, Rs3.32/kWh (US$45/MWh) by 2025, and Rs2.83/kWh (US$39/MWh) by 2030.

NHPC's Solar Tender, 2GW, April 2020

India's state-owned hydro power generation utility, NHPC (formerly National Hydro Power Corporation) in its first-ever solar auction for 2GW received a tremendous response.

The auction resulted in tariffs at Rs2.55-2.56/kWh (US$33/MWh). SB Energy (SoftBank) (600MW), Axis Energy Venture (400MW), O2 Power (380MW), Eden Renewables (300 MW) and Avaada Energy (320MW) won contracts to develop 2GW solar capacity.[12]

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[9] Mercom India. Greenko, ReNew Win SECI's 1.2 GW Solar, Wind Auction with Storage for Peak Power Supply. January 31, 2020.
[10] Mercom India. Greenko Seeks EPC Contractors for a 1,260 MW Pumped Hydro Storage Project in Karnataka. February 14, 2020.
[11] Lawrence Berkeley Lab. Estimating the Cost of Grid-Scale Lithium-Ion Battery Storage in India. April 2020.
[12] Mercom India. SoftBank, O2 Power, EDEN Renewables, Axis Energy, Avaada Win NHPC's 2 GW Solar Auction. April 16, 2020.

Amidst rumours of exiting the Indian market with potential sale of its renewable energy assets, SoftBank's success in this auction in fact reaffirmed its long-term objective of investing US$20bn over the coming decade in India's renewable energy sector.

Adding to the significance of the auction, SB Energy's CEO Raman Nanda later[13] revealed SoftBank's strategic partnership with a hydro utility as a key step to providing low-cost, round-the-clock renewable energy going forward. The flexible, dispatchable quality of hydro power marries well with the variable nature of solar and wind power generation.

IEEFA notes that NHPC could also use low-cost solar power to optimise the operation of its pumped hydro storage assets.

SECI's Round-the-Clock Renewables Auction, 400MW, May 2020

In May 2020, in another first-of-its-kind auction, this time for 400MW of round-the-clock (RTC) renewable power supply, ReNew Power secured a semi-firmed electricity tariff of Rs2.90/kWh (US$39/kWh).[14]

The auction provided an annual escalation of 3% on the quoted tariff up to the end of the 15th year of the contract. This accounts for the Rs4.39/kWh 15- to 25-year tariff (the last 11 years of the PPA), as there is no indexation after year 15.

SECI's June 2020 2GW solar auction delivered India's lowest-yet renewable energy tariff at Rs2.36/kWh with zero indexation for 25 years.

The tariff escalation provision of 3% in the PPA is lower than India's average consumer price index (CPI) inflation rate of about 5% between 2014 and 2019 (five years).[15]

Incorporating the CPI inflation rate of 5%, IEEFA estimates the levelised tariff (average present value of tariffs from year 1 to year 25) to be Rs2.11/kWh – 27% lower than the year 1 tariff of Rs2.90/kWh.

The PPA mandates an annual capacity utilisation factor of >80% and >70% on a monthly basis.

India's Ministry of New and Renewable Energy (MNRE) further plans to bundle thermal power with renewable power to provide lower-cost, round-the-clock power. Recently, MNRE released guidelines to bid for forthcoming 5GW of bundled

[13] GTM. SoftBank Expects First Gigawatt of US Solar in Operation by Next Year. May 06, 2020.
[14] Mercom India. ReNew Power Wins SECI's 400 MW Round-the-Clock Renewable Tender at ₹2.90/kWh. May 8, 2020.
[15] Macrotrends. India Inflation Rate 1960-2020.

thermal plus renewable round-the-clock power tender.[16]

The tender's guidelines specify that no new greenfield thermal power development will be allowed for this tender. It mandates new renewable energy capacity to be combined with existing thermal power capacity. A minimum 250MW of renewable energy capacity could be tied up with multiple thermal plants.

Key highlights from the guidelines include:

- A single composite tariff to be bid for the power to be supplied (no peak supply tariff differentiation indicated).
- >85% availability should be maintained annually as well as during peak hours by the developers.
- >51% supply must come from renewables and the balance could be provided from a thermal power source.
- Any form of storage can be used, however, no tariff differentiation for peak supply is indicated.
- 25% of the composite tariff shall be indexed and adjusted with the index of domestic coal or imported coal as per Central Electricity Regulatory Commission (CERC).
- The indexed tariff is to be split 50-50 between fixed and variable thermal power charges.

SECI's Solar Auction, 2GW, June 2020

SECI's recent 2GW solar auction delivered India's lowest-yet renewable energy tariff at Rs2.36/kWh (US$31/MWh) with zero indexation for 25 years. We estimate the levelised cost of electricity for discoms for this tender to be Rs1.13/kWh (US$15/MWh) if India experiences 5% annual inflation over the 25-year length of the project.

Spanish developer Solarpack won 300MW of capacity and developers from five other countries were awarded a total of 1.3GW of capacity. They were: Enel (Italy), Amp Energy (Canada), Eden Renewables (France), IB Vogt (Germany) and Ayana Renewable Power (backed by the UK's CDC Group). ReNew Power won 400MW for Rs2.37/kWh.[17]

[16] MNRE. Guidelines for Tariff-Based Competitive Bidding Process for Procurement of Round-the Clock Power From Grid Connected Renewable Energy Power Projects, Complemented With Power From Coal-Based Thermal Power Projects. July 2020.

[17] Mercom India. SECI's 2 GW Solar Auction Gets India a New Record-Low Tariff of ₹2.36/kWh. June 30, 2020.

The record-low solar tariffs reflect 15% year-on-year deflation in solar module prices.[18]

NTPC's Solar Auction, 1.2GW, August 2020

Although NTPC's 1.2GW tender in August 2020 was oversubscribed, only 80% of the total subscribed capacity (1,170MW) was awarded because some technical bids were disapproved. The auction resulted in winning bids at Rs2.43/kWh and 2.44/kWh (US$32/MWh), just 3% above the record-low tariff of Rs2.36/kWh in SECI's June 2020 auction. Winners of the 1.17GW of awarded capacity included major domestic developers O2 Power, Azure Power and Tata Power, along with Canadian developer Amp Energy.[19]

Conclusion

Despite the pandemic and resulting collapse of electricity demand slowing the project commissioning and auction process, renewables are proving resilient. The above auctions represent US$10-20bn of investment commitment in the space of just eight months.

The pandemic has exacerbated structural and financial issues in India's power distribution sector. As of July 2020, the state-owned power distribution companies (discoms) have accumulated total overdue payment liabilities of Rs116,864 crore (US$15bn) to power generators across India.[20] This has increased counter party risk as well as creating a massive liquidity crunch in the sector.

SECI has been struggling to sign PPAs with discoms for its already auctioned 6GW of renewable energy capacity. To make it viable for discoms to buy it, the MNRE has suggested blending tariffs from different auctions to bring the average tariffs down.

IEEFA notes that despite some of the short-term headwinds, renewables' cost competitiveness and continuing price deflation makes them a more viable energy generator than many existing thermal power plants, and all new import power plants. As the pandemic has illustrated, thermal power will bear the maximum impact of the downside risks in a transitioning market given its high marginal cost of production and lack of flexibility.

In IEEFA's view, the amount of capital available for investment exceeds the current opportunity available in India's renewable energy sector. With the right policy environment, India's renewable energy sector will continue to attract international as well domestic investment capital.

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[18] PV-Magazine. Module Price Index. July 2020.
[19] Mercom India. Amp Energy, Tata, Azure, and O2 Power Winners in NTPC's 1.2 GW Solar Auction. August 6, 2020.
[20] PRAAPTI. July 2020.

A green stimulus that accelerates investments into renewable energy infrastructure could help India to emerge from the economic slump by boosting employment, reducing fossil fuel imports and building energy security.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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