India Wind Outlook Towards 2022

Looking beyond headwinds

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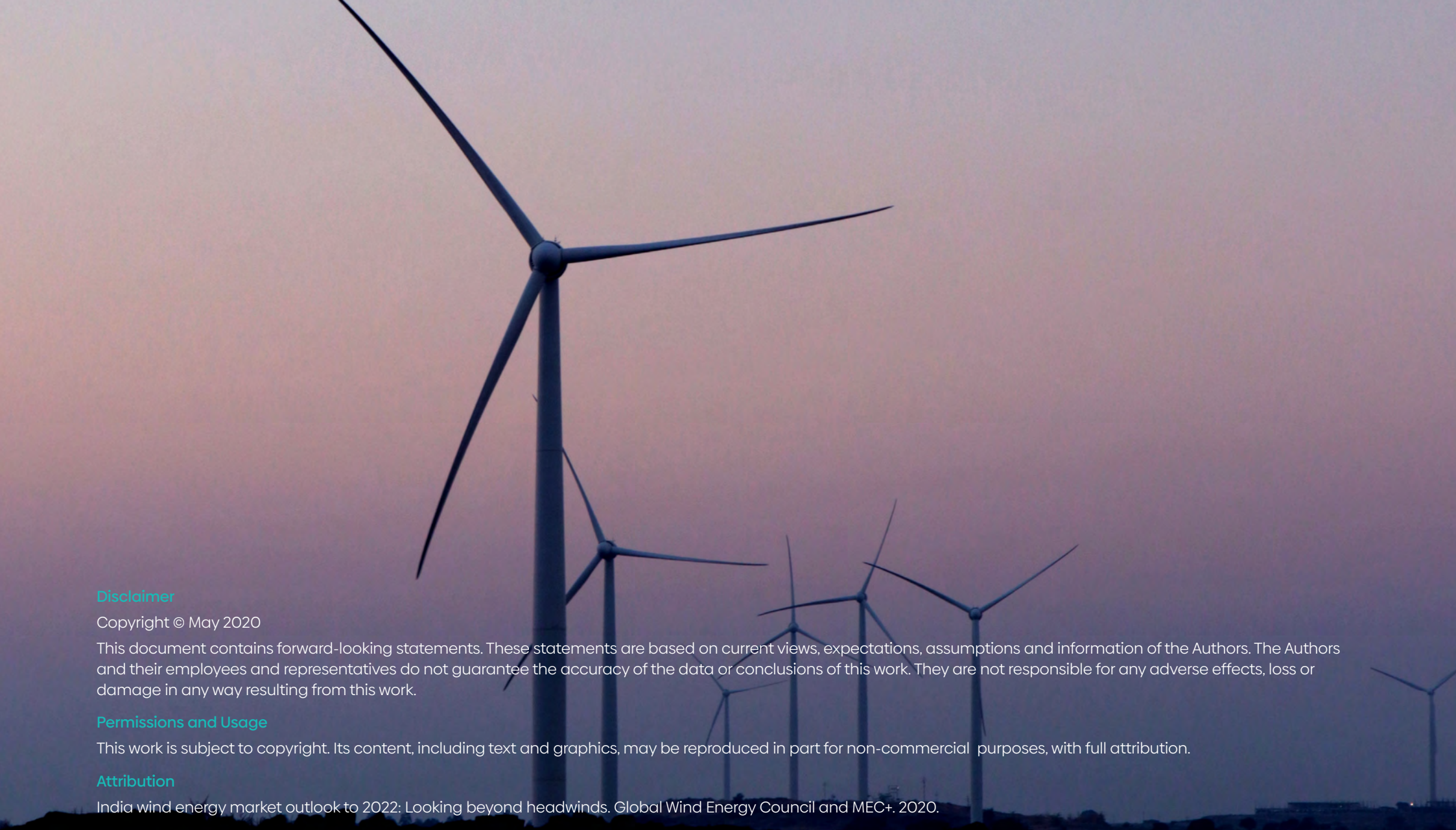

Attribution

India wind energy market outlook to 2022: Looking beyond headwinds. Global Wind Energy Council and MEC+. 2020.

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About GWEC

The Global Wind Energy Council (GWEC) is the global trade association for the wind power industry. Our mission is to ensure that wind power establishes itself as the answer to today's energy challenges, providing substantial environmental and economic benefits. We work closely with national governments, policy makers and international institutions to give them transparent information about the benefits and potential of wind power, enabling them to make informed decisions about national energy policies.

The members of GWEC represent over 1,500 companies, organisations and institutions in more than 80 countries. Our members are also all of the national wind industry trade associations, from both established and emerging markets, including the world's largest markets of the US, all the European markets, India and China.

GWEC is actively engaged with emerging markets to unlock their wind potential with proven successes in Latin America, Africa and also South East Asia. GWEC also works at the highest international political level to create a better policy environment for wind power.

Working with the UNFCCC, REN21, the IEA, international financial institutions, the IPCC and IRENA, GWEC advocates for policies to help wind power reach its full potential in as wide a variety of markets as possible.

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Global Wind Energy Council

About MEC+

MEC+ is a consulting firm focused on the wind and renewables sector for 10 years and is based out of India and Denmark. MEC+ offers insights and strategy support to CXOs, clients include largest global wind OEMs, European utilities, Global Supply chain players, Equity funds, and Independent Service Providers.

MEC+ has done more than 30 cases on facilitating entry, cost benchmarking for localisation, business development within the India wind market or using India as a base. The advisory is driven by fact-based analysis and in-house proprietary models on availability of land and grid infrastructure; policy, demand and regulatory risks; power pricing scenarios, and M&A valuations.

MEC+ helps OEMs build technology roadmaps, tap both Utility and C&I demand, develop launching plans of new products and services.

For supply Chain, MEC+ supports in developing business case for localisation, developing strategy to get into new areas such as hybrid plants, storage projects.

Within Investors and Utilities clients, MEC facilitates M&A targets identification, conducting commercial due diligences, driving customer segmentation for profitable opportunities, building KPI targets for securing sales and managing the business/ culture related risks in strategy implementation.

MEC+ has participated in due diligence of some of the largest deals in India within the renewables sector.

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ABBREVIATIONS

AP	Andhra Pradesh
APPC	Average Power Purchasing Cost
C&I	Commercial and Industrial
DISCOM	Distribution Company
EOI	Expression of Interest
EPC	Engineering, Procurement and Construction
ESS	Energy Storage System
FiT	Feed in Tariff
FOWIND	Facilitating Offshore Wind in India
GW	Gigawatt
IPP	Independent Power Producer
ISTS	Interstate Transmission System
LCoE	Levelised Cost of Energy
LiDAR	Light Detection and Ranging
M&A	Mergers and Acquisitions
MNRE	Ministry of New and Renewable Energy
MW	Megawatt
OA	Open Access
OEM	Original Equipment Manufacturer
PPA	Power Purchase Agreement
RPO	Renewable Purchase Obligation
S/s	Substation
SCoD	Scheduled Commercial Operation Date
SECI	Solar Energy Corporation of India
WTG	Wind Turbine Generator

FOREWORD

Ben Backwell
CEO, Global Wind Energy Council

The dual priorities of mitigating climate change and promoting sustainable development are driving forward the energy transition around the world. Over the last decade, India has experienced sustained growth of GDP, along with the rise in per capita power consumption which accompanies increasing prosperity and urbanisation. These trends are placing enormous demand on India's energy resources – and are a key driver for the Indian government's mission to increase renewable energy capacity to 450 GW by 2030.

India has more than 300 GW of onshore wind potential at 100-m hub height, and a further 195 GW of fixed and floating offshore wind potential, according to estimates by the National Institute of Wind Energy (NIWE) and World Bank Group. With enormous wind resource potential, it is imperative that India builds momentum and accelerates the deployment of wind and renewable energy to meet its targets as it undertakes economic expansion and industrialisation.

The government has been prioritising renewable energy development through its Intended Nationally Determined Contribution (INDC) targets under the Paris Agreement. Official targets have already been set for 175 GW of renewable energy capacity by 2022, including 60 GW of onshore capacity and 5 GW of offshore capacity. This clean generation will help to maintain the country's energy security as power consumption grows by more than 7 per cent annually through 2022, and exceeds the electricity needs of all of Europe by the late 2030s.

However, ambitious targets alone are not enough. The economics of India's energy market are clear that wind energy is now one of the two most cost-competitive power sources on the grid (along with solar PV), priced nearly 35 per cent below conventional fossil fuels. Yet, wind installations have been slowing down. A raft of market barriers is preventing renewable energy auctions from functioning well, approved projects from being executed and wind energy from being deployed at the necessary pace to meet public targets.

With 37.5 GW of onshore wind power installed at the end of 2019, India may fall short of its 2022 targets due to challenges around pricing, payment risk mitigation, transmission capacity and land use. As outlined in this report, even in a best-case scenario wherein these bottlenecks are resolved, the cumulative installed base of onshore wind would reach only 54.2 GW by 2022.

Wind energy will be one of the key technologies to reduce harmful carbon emissions in India, and replace the coal-fired generation which currently dominates the power mix. But demand-supply outlooks have not sufficiently accounted for the declining load factor of coal plants and the risk of stranded assets, while auctions have not recognised the system value of energy, including transmission and balancing costs. The recent removal of price caps in future wind tenders is a positive step, but stronger, decisive efforts by government at local, state and federal level are needed.

Renewable energy ambitions must be aligned with market and financial realities. The key takeaways in this report should translate into proactive measures, which will transform the rate of project execution on the ground. Building upon the critical challenges and opportunities identified in this report, GWEC will aim to accelerate wind project installations at pace with technological, economic and infrastructure change, in order to build a clean and resilient power system in India.

These priorities will be at the centre of GWEC's efforts in India over the next few years, mirroring our larger mission to enable and accelerate the global energy transition.

PREFACE

Sidharth Jain
Founder and CEO, MEC+

India is the fourth-largest market in the world with respect to global cumulative wind installations and the second largest wind manufacturing hub. India market has been going through turbulent times and the installations have been muted for the last 2 years. The objective of the report, being published with GWEC, is to objectively analyze and discuss the fault lines which has led to the current situation and analyze the impact on future market development.

The main theme that the report explores in detail is that by inherent nature India wind market is lumpy or uneven. As in case of any lumpy deployment, the market exposes its fault lines as activity increases; these fault lines can be in terms of grid availability, land availability or payment availability. The prospective participant in the market must account the nature in their planning and must plan for 3-year horizon, rather than year on year planning.

In a brief outline of the report, India has been a traditionally large market - fourth-largest in onshore installations and wind is one of the most competitive generation sources on grid today. However, market activity has been hit in last two years. The market has recently been split into three market segments – central auctions, state auctions and C&I market. Each market has unique bottlenecks, which challenges new installations and creates unevenness in the market. Towards 2022, market is expected to install 11 to 17 GW of new capacity, majority concentrated in 2022, in two states and in central tenders.

The report has been broadly structured into four sections:

- **Section I: Market Background** – Briefly describes the historical development and targets in the market
- **Section II: Wind competitiveness** – Compares the generation costs from wind and other dominant electricity generation sources in India, today and in future
- **Section III: Current market activity** – Discusses progress on auctions and challenges in deployment
- **Section IV: Future Installations** – Discuss drivers and inhibitors in each market segment and their impact on installations towards 2022, along with MEC+ forecasts

The insights in the report have been derived from multiple bottom-up analysis and proprietary models & databases (LCoE model for wind, solar & coal; project pipeline tracker; C&I business case calculator and others) with MEC, built from public and exclusive sources over the years. We would like to thank the academia and India power sector experts from University of Petroleum and Energy studies, as well as various regulatory & policy making agencies in India for their valuable inputs in the report, at various points in time.

Hope you find the report an insightful read, for more insights on India visit MEC+ India Expertise page. For queries reach out at info@mecintelligence.com

EXECUTIVE SUMMARY

India is one of the top wind markets in the world, but will face uneven growth in the coming years

As the world's fourth-largest onshore wind market by installations, India has 37.5 GW of wind capacity as of 2019. Two fundamental drivers are in place to sustain market growth: rising energy demand and political ambition. Over the next 10 years, electricity demand is set to double in the country of 1.35 billion people. Accordingly, India's government is targeting 175 GW of renewable energy capacity by 2022, of which 60 GW will come from wind energy, and a whopping 450 GW by 2030, of which 140 GW will be wind-based generation.

In the last decade, this scale of activity attracted multinational utilities, investors and supply chain players to India's wind market. An influx of capital and technology initiated a downward slide in prices, with levelized cost of energy (LCoE) of wind declining by 40% from 2015 to 2019. As a result, wind is now the second most cost-competitive power source on the grid after solar at INR 2.81/kWh, and priced nearly 35% lower compared to conventional fuels.

Meanwhile, project installation is deflating. Only 2.3 GW of wind capacity was installed in 2019 – nearly half of the 4.1 GW installed in 2017. While more than 17 GW of capacity has been auctioned across the country by various power purchasing agencies in last three years, nearly one-third went unsubscribed or was cancelled post-award due to various factors: stringent tender conditions; low tariff caps; off-taker risks; unavailability of grid; and/or land availability. More than 80% of awarded projects have been delayed by 6-12 months.

Clearly, steep pricing competition has come at a cost. Central government tenders[1] have lost steam, following a decision to use the extremely low prices (INR 2.4-2.8/kWh) captured in the first six auctions as a benchmark for an upper price cap in the last two auctions. Such tariffs were not feasible to meet in the face of exhausted grid infrastructure and changes to local land use criteria for awarding new sites.

Furthermore, the seven states which manage wind procurement themselves have seen a major decline in activity. Orders by these states contracted by 60% from 2017 to 2019. Auctions are severely undersubscribed due to the offtaker risk associated with the weak financial position of state distribution companies (DISCOMs) and chronic payment delays to projects installed pre-2017. Facing financial pressure, most of these states have moved to central auctions to hedge their payments with federal guarantees.

1 Under India's highly federalised structure, the seven states with strong wind resource manage their own procurement, while the central government handles procurement for the 20 other states.

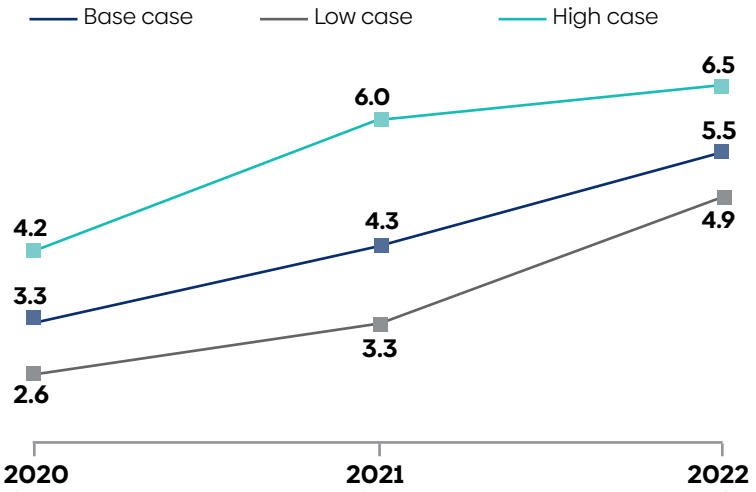
The market is expected to be lumpy in the next three years due to these supply and demand realities, adding 11-17 GW of wind-based power to the installed base. On the supply side, the time required for grid enhancement and site development will likely backload installations to around 2022. Accelerating project timelines would require more expensive land or lower-resource sites; the increased capital requirements would in turn drive wind prices upward. On the demand side, prices that exceed DISCOM-sanctioned budgets will face delays in approval.

The government must maintain realistic price expectations in future auctions and ensure the market – particularly at state level – is sufficiently liquid. Efforts by the government to lower barriers around pricing, grid and land infrastructure must be intensified, in order to revive auction appetite and resolve the execution challenges facing India's wind market.

For analysis on the impact of the ongoing coronavirus pandemic on the Indian wind energy market, see "Note on the impact of COVID-19."

WIND INSTALLATION FORECAST & SCENARIOS

Y-o-Y new wind installations in India 2020-22
GW



	Cumulative wind capacity until 2022	Scenario Definitions
High case	54.2 GW	In high case, grid gets augmented by 2021; availability of investments in market and activity in state auctions increases
Base case	50.6 GW	In base case, grid gets partially augmented while investments and state activity continues to be the same
Low case	48.3 GW	In low case, grid continues to be a problem; multiple projects are cancelled with limited investments and no state activity

2020	2021	2022
Market activity remains limited with extensions provided to projects delayed due to grid, land allotment and investments	Market can vary substantially depending upon the augmentation of grid at Bhuj in 2021	Retirement of ISTS charge waive-offs and easing of grid issues in 2022 creates rush for installation

Source: GWEC; MEC+ Analysis

NOTE ON THE IMPACT OF COVID-19

GWEC and MEC+ recognise the impact of the ongoing COVID-19 pandemic may be far-reaching across the wind industry and the wider economy in India and beyond. The content of this report is current as of Q1 2020; due to the dynamic nature of the pandemic, the forecasts and market outlook herein have not been adjusted to factor in the potential consequences of the virus. However, the report should be read with a view to the following points:

- **Outlook for 2020:** The impact of COVID-19 will impose a drag on market growth in 2020, due to extended project timelines and supply chain disruptions, compounded by the non-availability of grid and land challenges already impacting installations. Beyond 2020, uncertainty around new tendering and the overall business environment may prolong the impact.
- **Project timelines extended:** All renewable energy projects under construction will be granted an extension of commissioning deadlines, due to the nationwide lockdown imposed on 24 March 2020. The total active pipeline under implementation is around 8.6 GW. Nearly 3 GW of this was scheduled to be commissioned in 2020, 5.2 GW in 2021 and the remaining 0.4 GW in 2022. The extension is expected to be more relevant for projects due to be commissioned in Q3/Q4 2020.
- **2020-2021 installations:** We estimate nearly 0.7-1.1 GW of projects due to be commissioned in 2020 may shift forward to 2021, which shrinks the base case forecast from 3.3 GW to 2.2-2.6 GW in 2020, much closer to the earlier low case. We expect that projects to be commissioned in 2021 will remain on-track, as most have power supply agreements.
- **New volume at risk:** The lockdown is expected to impact new project tendering. In total, nearly 3.5-4 GW of wind capacity was expected to be tendered in 2020 and 2021. Currently 3.2 GW of tenders have been notified by the government (2 GW SECI Wind Tranche IX and 1.2 GW Hybrid Tranche III); however, no closure date of the tenders can be ascertained. A delay in new tenders in 2020 could lower total forecast installations to 11.5-12 GW for the period to 2022, compared to 13 GW projections in the base case. In addition, India was struggling with weak balance sheets of its lending companies before the pandemic – which could now exacerbate the risks to new projects to be tendered in the coming few months or those yet to achieve FID.

Supply chain disruption: Although limited O&M activities have continued amid the nationwide lockdown, in order to ensure security of supply, the manufacturing of wind power components has been suspended during this time. The MNRE has announced that supply chain disruptions due to the spread of coronavirus will fall under a force majeure clause; however, the enforceability and application of this clause is yet to be seen. As India is the largest wind turbine production base after China in the Asia-Pacific region, and is also a significant producer of gearboxes globally, the suspension of OEM activity will have adverse impacts beyond the Indian market.

Economic relief package: The government approved an economic relief package for the power sector, focusing on state-owned electricity DISCOMs. The package includes a three-month moratorium on payments by DISCOMs and waives penalty fees for late payments. The government also issued guidelines to grant renewables 'must-run' status and instructed renewable power producers to issue electronic invoices to DISCOMs during the lockdown. This came after a number of state DISCOMs invoked '*force majeure*' to suspend procurement of renewables and defer payments, increasing the risk of non-payment of dues and the potential for stressed assets.

Prepared: April 2020

1. INDIA WIND ENERGY SECTOR: BACKGROUND

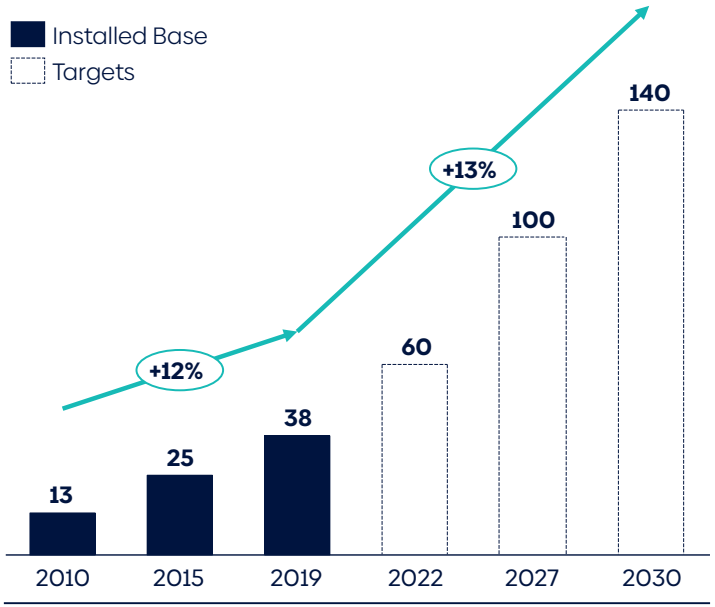
India's electricity grid has a total installed base of 370 GW, as of March 2020. Of this capacity, 54% comprises coal-fired generation and 23% comprises renewable energy. In the last 10 years, the share of renewables in the power system has increased from 5% to nearly one-quarter of total capacity.

Within the global wind energy sector, India has the fourth-largest installed base of wind power plants, reaching 37.5 GW at the end of December 2019. Nearly three-fourths of this capacity was installed in the last 10 years under a feed-in-tariff (FiT) regime, at an annual average of 2-3 GW and with installation peaking in 2017. In 2017, India introduced an auction mechanism in addition to FiTs. The market has been adjusting to the new procurement scheme in the last two years, and capacity deployment has since reduced.

Looking towards 2030, India is among the world's fastest-growing electricity markets, with power demand expected to double. Plans are in place for a massive installation of 460 GW of new installed capacity to fulfil this upcoming demand. The new installation plans are heavily inclined towards renewables, with three-quarters of new power generation deriving from wind and solar, and 100 GW exclusively from new wind installations. Under these targets, cumulative wind power installations would grow to 140 GW.[2]

FIGURE 1 | HIGH GROWTH IN WIND INSTALLATIONS EXPECTED

Installations vs targets for wind 2010 to 2030
GW



Source: CEA; Newspaper articles; MEC+ Analysis

2 According to the draft optimal generation mix – 2030 published by Central Electricity Authority of India (CEA).

2. WIND COMPETITIVENESS

The competitive landscape for renewable energy in India will intensify in the future

The increasing role of renewable energy in fulfilling future demand is mainly driven by low costs.[3] An influx of both capital and technology within renewables has led to a steep decline in LCoE over the last four years.

As of December 2019, wind is the second most cost-competitive resource on the grid after solar. Variation in wind LCoE is seen across the country due to variable resource availability and development costs.[4] On average, wind LCoE is roughly 35% cheaper than the majority of coal plants present in the country.[5]

As illustrated in the graph below, the gap between the cost of generation from renewable energy and conventional sources widens towards 2022, due to the continuing decline in technology cost of wind and solar energy and the increasing cost of equipment and raw materials for coal-based power plants.

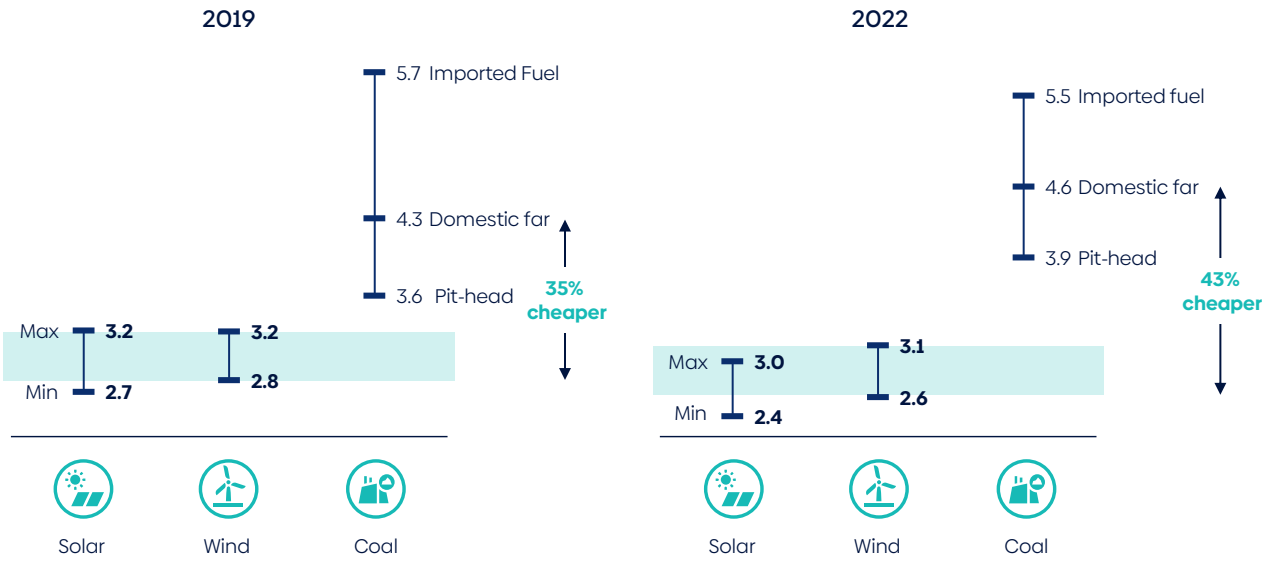
The costs of wind and solar energy are expected to decline by 7% and 11% by 2022, respectively, driven by the reduction in technology costs and operating expenses. Solar costs are expected to experience a steeper decline due to the removal of import protection duties.

3 Wind, solar and conventional costs are exclusive of the transmission and firming costs.
4 Optimal sites in the country have wind speed above 7.5 m/s, while wind-based plants are also located on sites with wind speeds between 6 to 6.5 m/s.
5 Referencing coal-based plants typically located 500 km from domestic coal mines but using domestic coal as fuel.

Coal, on the other hand, is expected to get costlier by 9% in the next three years majorly driven by increased equipment costs[6] to meet new environmental standards and escalating domestic raw material costs. These dynamics put wind and solar energy in a preferred position in terms of market value, prompting the government to adopt a blended approach to coal and renewables.

FIGURE 2 | RENEWABLES ARE CHEAPEST RESOURCE ON GRID , TODAY AND IN FUTURE

LCoE comparison of sources (new vs new), 2019 and 2022
INR/kWh



Note: Wind and solar LCoE calculations done at 11% internal rate of return while coal calculations done at 16% return on equity
Does not include transmission and distribution charges for any source
Pit-head are coal plants using domestic coal and located near the mine; domestic far plants also use domestic coal but are located far from the mine (~500 km); Imported fuel plants make use of imported Australian coal

Source: CEEW; BNEF; Lazard; MEC+ analysis

6 Equipment costs are increasing due to addition of flue-gas desulphurisation systems that have been mandated by the government.

3. CURRENT MARKET ACTIVITY

Market activity has slowed down in recent years

Despite high capacity targets for wind energy and its strong cost-competitiveness, new installations in the market have declined by 50% in the last two years. Government has put more than 17 GW of capacity up for auction since 2017, however, nearly one-third was either unsubscribed or cancelled/ abandoned after being awarded.

From 2017 to 2018, auctions were oversubscribed by 30-35% on an average, and tenders fully awarded. However, activity has severely declined in the last year with nearly 60-70% of volume unallocated in auctions.

By 2019, authorities decided to use the extremely low prices (INR 2.4-2.8/kWh) captured in the first six auctions as a benchmark for an upper price cap in the last two auctions. Developers were not able to meet these price expectations and issues around infrastructure availability held them back from participating in these recent auctions.

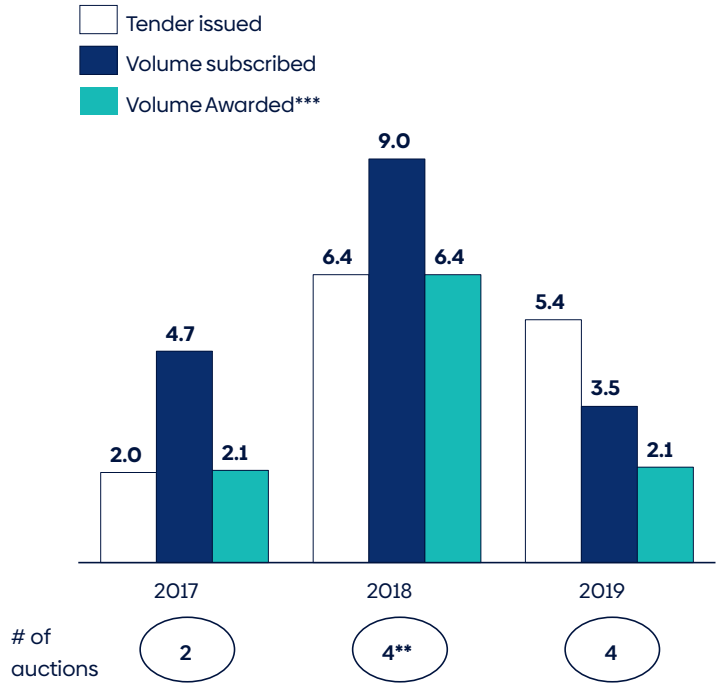
Of the 12 GW awarded within auctions in the last three years, 80-85% have been delayed by 6-12 months.[7] These projects have either been granted extensions by government agencies or have applied for the same. On top of this, 1-1.5 GW of projects have been cancelled or are at risk of cancellation due to issues in the availability of land, grid or power purchase agreement (PPA) signing delays.

Hence, the present installation pipeline is highly uncertain, with projects getting delayed or cancelled and new auctions being heavily under-subscribed.

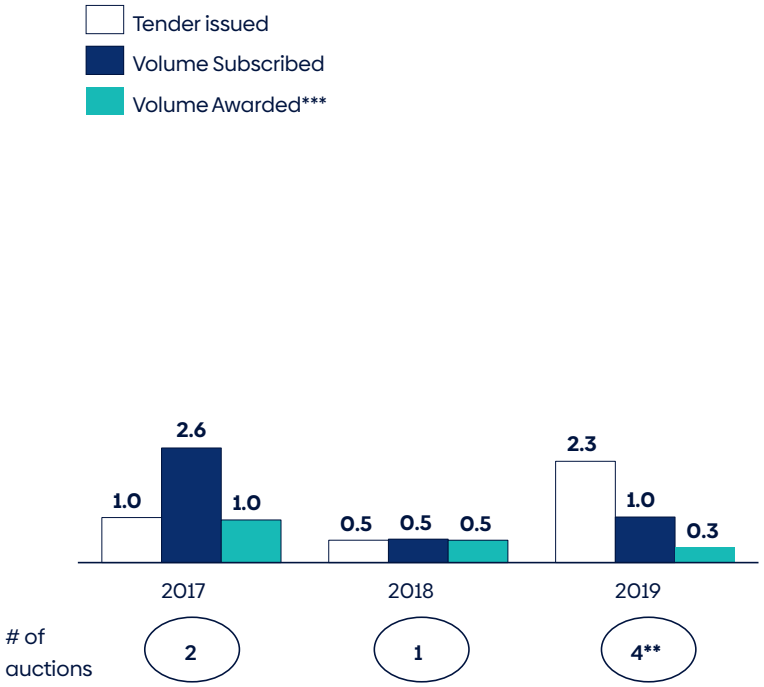
7 As on 30 January 2020.

FIGURE 3 | AUCTION PARTICIPATION HAS DECLINED OVER THE YEARS IN INDIA

Federal -Total tender announced vs capacity awarded
GW



States* - Total tender announced vs capacity awarded
GW



Note: Does not include Hybrid auctions
* Includes Maharashtra auctions which were issued for procurement from existing wind projects with expired PPAs
** Auctions retendered with changes in design have been considered as single auctions (Applicable on SECI V and Gujarat II)
*** Projects abandoned at a later stage after contract award are a part of volume awarded

Source: SECI; GUVNL; MSEDCL; TANGEDCO; NTPC; MNRE; MEC+ analysis

4. FUTURE INSTALLATIONS

Installations are concentrated around 2022

India is expected to install 11-17 GW between 2020 and 2022, taking the cumulative installed base of wind power in India to 54 GW by 2022, in the best case.

Demand is partially driven by non-solar renewable purchase obligations (RPO); within non-solar renewable resources, wind is the most cost-competitive resource.[8] Beyond RPOs, there are three market mechanisms for the procurement of wind, each of which have separate drivers and challenges: central auctions; state auctions; and the commercial and industrial (C&I) market.

Seven states in India have availability of wind resource.[9] These have been the traditional wind procurers and have been doing their own procurement. For the rest of 20+ states and Union Territories, the central government-initiated auctions for wind in 2017. Around 80-85% of new installations are expected from central procurement in the next three years.

On top of the demand for wind from states and central government, C&I are allowed to set up their own wind power plants. These entities usually have high demand and have the option of buying power from outside of DISCOMs,[10] and will account for a small yet consistent market share of 5-10% between 2020 and 2022.

8 Separate solar and non-solar RPOs exist in India for all states ensuring that wind and solar have their individual demand drivers and do not compete. Wind, small hydro and biomass are typical resources used to meet non-solar RPOs; as compared to small hydro (INR 6-7/kWh) and biomass (INR 8-10/kWh), wind is most competitive on a cost basis.

9 States where average wind speed at 100m hub height is above 6m/s.

10 State DISCOMs are responsible for procurement of power from generators and distributing it to the consumers.

i. Central auctions

Central auctions are driving the market, despite infrastructural challenges

States without the availability of wind resource have never procured wind power, despite having the power demand and financial resources. Central auctions were introduced to activate this demand at an acceptable price point. However, the execution of the auctioned projects has been challenged due to grid and land related infrastructural bottlenecks. New installations under the central auction mechanism are expected to vary between 9-13 GW in the next three years, depending on the extent to which the challenges are resolved.

Demand

Nearly half[11] of electricity demand in India stems from 21 states which can only procure wind through central auctions.

Of these, 14 states are major demand centres. The 2022 RPOs of these states vary between 6-9%, which translates to nearly 10 GW of new demand for wind procurement. Central government intermediaries aggregate this demand to conduct auctions towards fulfilment of these RPOs.

11 As of March 2019

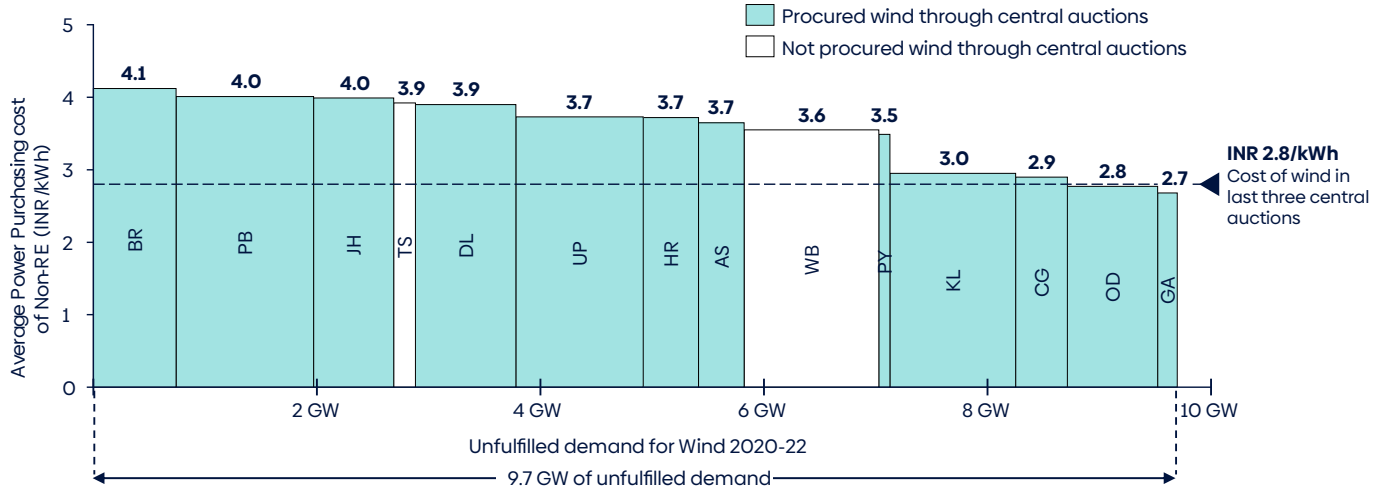
Economics

Most states without wind resource have an average power purchasing cost (APPC) 30-40% higher for wind than in central auctions. The cost feasibility of these projects is ensured by the central government through waive-off[12] of inter-state grid transmission charges[13] (ISTS) for a period of 25 years.

Substantial demand for wind procurement is visible towards 2022 in the mentioned states, which can be procured at pricing levels lower than APPCs. The central government has conducted nine auctions towards fulfilment of this demand. However, execution of awarded projects has been challenged due to infrastructural bottlenecks on the ground.

FIGURE 4 | SIGNIFICANT DEMAND FOR WIND IS VISIBLE IN CENTRAL AUCTIONS AT CURRENT PRICING LEVELS

Unfulfilled demand for Wind 2020-22 vs APPC (Non-RE)



Note: Demand from non-solar RPO taken as demand for wind
Source: CERC; ARRs; RPO Documents; Newspaper articles; MEC+ analysis

12 Waive-off present for RE projects commissioned before 31 December 2022 and provided power is being procured through central auctions for meeting RPOs of DISCOMs.

13 Given that location of power generation is different from location of power consumption in central auctions, by design generators must pay grid charges for using inter-state grid for transmission of power

Grid availability delays

Grid is planned to support installation but is expected to be delayed in availability

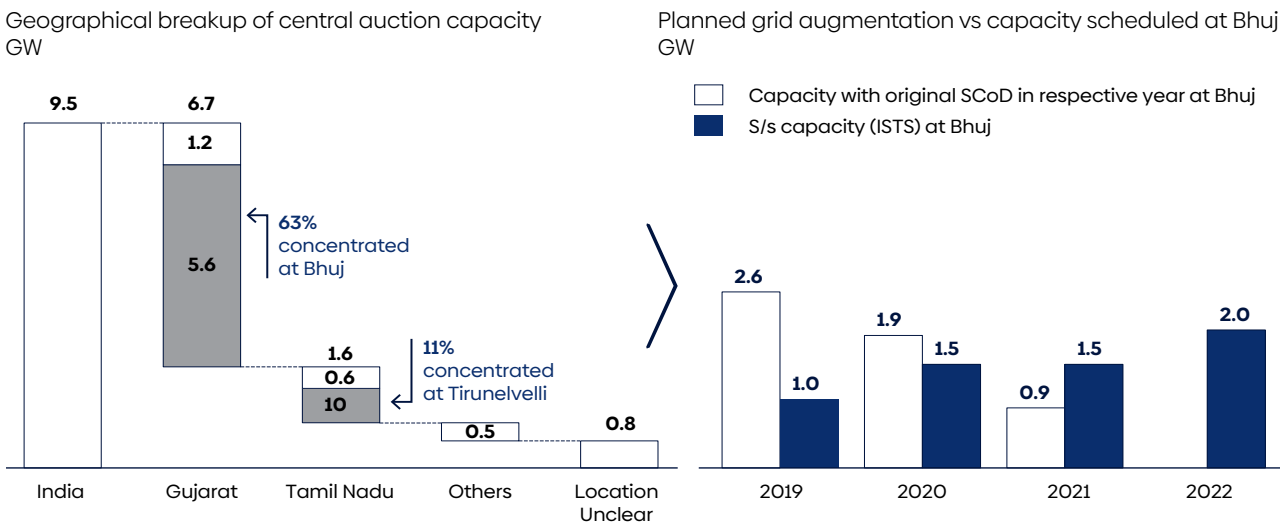
Nearly 26 substations have been allocated to evacuate wind generation in India. However, the projects bid in central auctions have gravitated towards two substations – Bhuj in Gujarat and Tirunelvelli in Tamil Nadu. The former was preferred by developers due to availability of cheap revenue land.[14] Sites in Bhuj region thus, allowed developers to engineer lowest cost bids utilizing high resource sites and cheap revenue land, resulting in concentration of nearly 60% of awarded capacity at the substation.

Currently, 5.6 GW of projects are connected or planned for connection at Bhuj, against the existing and planned evacuation capacity of 6 GW at the substation. However, planned grid augmentation has a gestation period of 36-48 months, which is longer than the project timelines of 18-24 months. As a result, the capacity scheduled for commissioning at Bhuj continues to exceed the available and planned augmentation capacity until 2021 and, consequently, projects are delayed.

For new bidding activity, short-term grid visibility is challenged. Out of 26 substations for wind evacuation, only six substations are viable for new bids as the rest are either at uncompetitive wind resource sites or are fully booked by the existing pipeline. Out of the six, three substations are yet to be budgeted due to lack of advanced-stage project activity, making them very risky for bidding projects given their availability before 2022 remains uncertain.[15] Bid participation is expected to be restricted unless construction of the three substations is prioritised.

The mismatch in project and grid augmentation timelines is delaying projects in India and restricting the installations for 2020 and 2021. Also, limited visibility of additional substations is creating flexibility issues for developers to submit bids – as a result, central auctions in 2020 are expected to be under-subscribed, unless construction of selected substations is prioritised.

FIGURE 5 | EXISTING PIPELINE CONTINUES TO FACE GRID BOTTLENECK UNTIL 2022



Note: Grid for 0.75 GW auctioned capacity not available
1 GW of cancelled projects not included
Source: CEA; PGCIL database; SECI; Newspaper articles; MEC+ Analysis

14 Government land that can be allocated to developers for wind project development. Revenue land is typically 60-70% cheaper than privately held land in India.

15 The central transmission utility in India budgets substation construction after projects exist at the substation which have committed 50% of the CAPEX indicating actual ground level project activity

Land policy change

Local policies regarding land availability have changed creating delays

Changes in local land policies in the state of Gujarat and Tamil Nadu have impacted the timelines and cost of 93% of the projects awarded under central auctions for these states.

Revenue land in Gujarat is owned and allocated by the state government. The local authority changed its land allocation policy, retrospectively impacting the central auction pipeline in the state. New allocation of revenue land for projects that bid under central auctions was stopped in mid-2018 and new policy for future land allocation within designated 'wind parks' was introduced in 2019.

Following intervention by the Ministry of New and Renewable Energy (MNRE), Gujarat allocated revenue land at desired locations for projects that had bid before the state initiated its policy change; for the rest of the projects, the land was planned to be allotted strictly within the designated wind parks.

The allocation of land at state-mandated locations in Gujarat created uncertainties around resource, land development and grid costs for project developers. Nearly 3.2 GW capacity faces uncertainty on land allotment and is likely to relocate to private land in Gujarat.

On the other hand, in Tamil Nadu, the latest construction bill has increased the minimum land requirement per MW of wind plant. The change will create delays in acquiring additional land for projects in the state.

Given the ambiguities at the provided wind parks in Gujarat and increased land requirement in Tamil Nadu, their project pipelines are likely to be delayed for re-planning sites and acquisition. This will have an adverse impact on the project costs and timelines.

Going forward, the execution challenges in central auction projects are expected to be resolved towards 2022; however, uncertainty of grid and land availability creates variance within 2020 and 2021 installations. In the latest tender guideline issued in March 2020, the government has removed pricing caps for all future bids, for developers to account for the impact of infrastructural bottlenecks.

Installation related to central auction projects are expected to vary between 4.3 to 7.7 GW in these two years.

ii. State market

State markets have slowed down since the introduction of central auctions

The seven states with wind resource have been traditional demand centres and are responsible for most of the installations to date in India. Over the last decade, these states have established well-defined processes for infrastructure creation and allocation. However, project activity has declined in the last two years, following the introduction of central auctions. Going forward, installations are expected to remain muted, driven by continuing payment issues. Net capacity addition varies between 1 GW in the low case and 2.5 GW in the best case.

Demand

The seven states which have high wind resource contributed nearly 52% of India's electricity demand in 2019. These states have continuously had the highest RPOs in India and target 9-13% of non-solar procurement towards 2022. These aggressive targets are expected to generate demand for roughly 10 GW of wind procurement in state markets towards 2022.

Economics

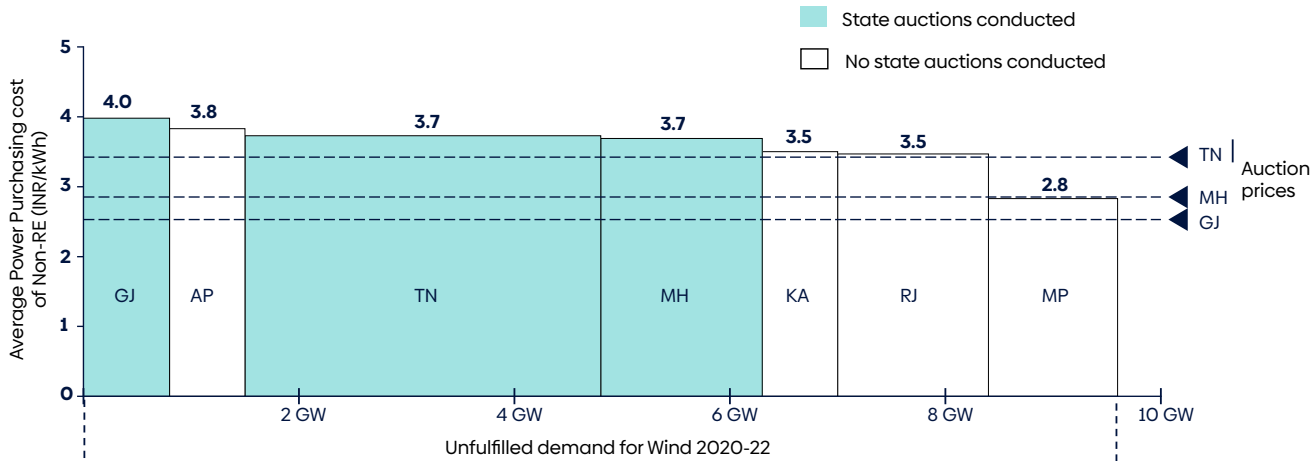
Given the presence of competitive wind resource sites in respective states, wind power procurement is most suitable for fulfilment of non-solar RPOs. The average power procurement cost is 10-40% higher than the cost of wind in all seven states, apart from Madhya Pradesh.

However, after central auctions were introduced in the last two years, activity in state markets has been muted. Three (Gujarat, Maharashtra and Tamil Nadu) out of the seven states have tried their hand at conducting their own auctions[16] but apart from Gujarat, states have failed to generate developer interest.

The biggest challenge for state markets is DISCOMs' inability to make timely payments to developers. As a result, developers have steered away from state auctions. The remaining four states are now in a state of flux, and have procured no new power in the last two years.

FIGURE 6 | DEMAND FOR WIND IN STATE MARKETS IS HIGH AT CURRENT PRICE

Unfulfilled demand for Wind 2020-22 vs APPC (Non-RE)



Note: Demand from non-solar RPO taken as demand for wind
Source: CERC; ARRs; RPO Documents; Newspaper articles; MEC+ analysis

16 Gujarat and Maharashtra have conducted three auctions each, while Tamil Nadu has conducted two auctions.

Payment delays

Payment risks remain high and are not yet managed for state auctions

DISCOMs in India have been financially distressed for many years, with debts mounting to INR 300 billion due to cost of supply exceeding per-unit revenue. This has affected their ability to make timely payments to generators. DISCOMs of seven states with wind resource have a total of INR 75 billion outstanding payments to all renewable generators with a payment delay of up to 18 months.

Unlike the central auctions, state markets do not have payment guarantees in place.[17] PPAs that were signed before introduction of the auction mechanism did not have any guarantees. while PPAs signed through auctions require a letter of credit but are not stringently implemented.

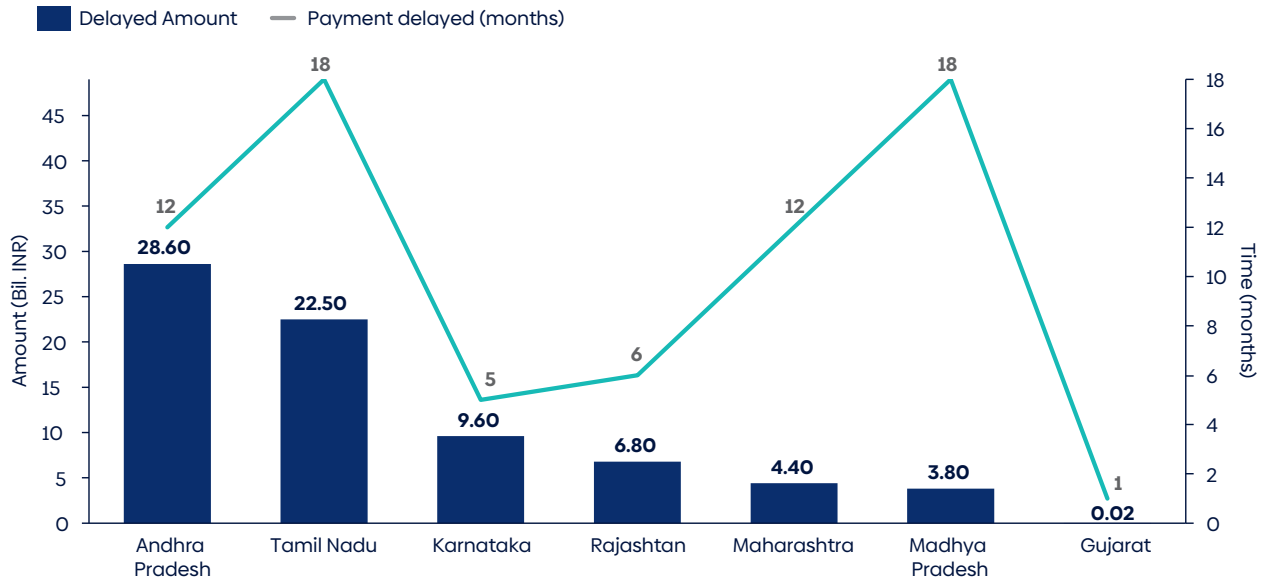
Out of the three states that have conducted auctions, only Gujarat has been successful in terms of pricing and subscription. The prices in Maharashtra and Tamil Nadu parallel auctions with central auctions and were higher by INR 0.4-0.6/kWh. The second auction of each of these two states saw minimal to no participation due to perceived risk of payments by developers. As a result, Tamil Nadu is procuring through central auctions and Maharashtra has adopted a hybrid strategy combining state and central procurement.

Currently, Gujarat is the only state continuing its own auctions. The remaining states (Karnataka, Rajasthan, Andhra Pradesh, and Madhya Pradesh) are yet to outline their plans.

Going forward, poor financial position continues to restrict the ability of the states to conduct new auctions and secure interest from developers. Wind power procurement is expected to remain uncertain in state markets, depending on when and in what quantum the demand opens. New installations in state markets vary from 1-2.5 GW in the next three years. In the worst case, further deterioration in financial position can lead to cancellation of auctioned projects, while higher installations pivot on the opening of auctions in states with pent-up RPO targets.

FIGURE 7 | RE GENERATORS FACE DELAYED PAYMENTS FROM STATE DISCOMS

Total Outstanding dues to renewable generators by state
Billions INR



Note: All data according to Praapti as on 30-11-2019
Source: CEA; Praapti; Newspaper articles; MEC+ Analysis

17 Central intermediaries provide payment guarantees to generators through a letter of credit and agreements with India's central bank, in case of payment default by the DISCOM.

SANCTITY OF PPAS

In May 2019, the newly elected Andhra Pradesh (AP) government decided to review, negotiate and bring down the tariff of all renewable projects signed by the previous government, citing that tariffs were much higher than the rest of the country. AP DISCOMs were financially unable to buy electricity at such high rates. To enforce the new rates, DISCOMs withdrew all the new PPA contracts under approval and started curtailing power from renewable energy generators. The AP High Court ruled that the state government did not have the power to renegotiate contracts and that procured wind power had to be paid at INR 2.43/kWh until the issue is resolved.

As a result, MNRE intervened and a three-point resolution was set:

1. It was re-established that PPAs are sacrosanct and prices are non-renegotiable
2. AP DISCOMs arranged competitive loans from government institutions
3. ISTS charges were waived off for excess power generated and sold by DISCOM or wholesale market

However, the AP government cited a need for additional financial support from the federal government.

As of December 2019, the federal and state governments have been considering a solution that is politically and commercially viable to all stakeholders. The central government has maintained that PPAs are sacrosanct and price renegotiation is not possible. Currently, AP DISCOMS have started paying back dues at INR 2.43/kWh and the central government expects the AP government to revert to original PPA rates with due clearance.

iii. C&I market

Small in volume, but consistent in procurement

The C&I sector, including the private and public sector like Steel Authority of India (SAIL) and Oil and Natural Gas Corporation (ONGC), is the largest power consumer in India, contributing roughly 50% of overall demand. Primarily the sector is dependent on grid power, however ~35-39% of the segment's power needs are estimated to be fulfilled by self-procurement.[18] India has installed nearly 65 GW of captive and third-party PPA projects as of December 19, of which 12 GW is renewable-based (excluding rooftop solar). Wind contributes nearly 8 GW of this capacity, most of which is derived from captive wind installations. Only 10-20% of the 65 GW comes from third-party PPAs.

Going forward, C&I procurement is expected to remain a small yet consistent market, varying between 0.7-1.4 GW in the next three years.

Demand

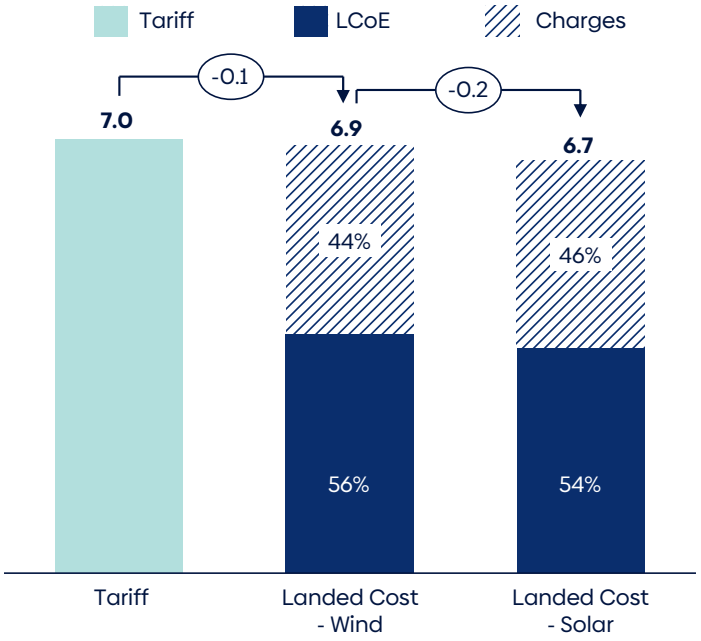
Growing urbanisation and industrialisation continue to drive demand of electricity in India. Towards 2027, electricity demand in the C&I sector is expected to increase by 66%, according to the national electricity plan, creating a strong driver for corporate procurement. The demand for corporate procurement is facilitated by presence of an open access (OA) regulation in India which enables all entities with demand greater than 1 MW to procure power on their own. Additionally, certain C&I consumers are bound to meet RPOs.[19]

Economics

With renewables becoming the cheapest source of grid power, C&I consumers have a strong financial incentive to switch to clean energy. C&I consumers typically pay 30-40% more per unit as compared to the other categories, and their tariff majorly ranges from INR 6-10/ kWh. With the cost of wind and solar dropping significantly, a head-to-head comparison of C&I tariffs and cost of generation from renewable energy indicates a substantial cost differential between the two.

FIGURE 8 | REGULATORY CHARGES IMPACT BUSINESS CASE FOR C&I DEMAND

Tariff vs landed cost for corporate procurement of wind and solar
GW
Discussing a case of Karnataka



Source: MEC+ Analysis

18 According to MEC+ estimates compiling data from CEA and other state and industry authorities.

19 Industrial consumers with thermal captive generation capacity above 1 MW (to 5 MW, dependent on the state) need to procure a certain percentage of their demand from renewable generation.

Regulatory barriers

Despite the cost differential, the uptake of C&I procurement in renewables and specifically wind is inhibited by unwillingness of DISCOMs to allow open access, high regulatory charges on open access transactions and lack of policy certainty.

The regulatory framework at the state level restricts the growth of corporate procurement. There has been a continuous pushback from DISCOMs for corporate procurement as C&I consumers are their largest revenue centres.

The business case for C&I procurement is challenged by the implementation of heavy charges on corporate procurement. The quantum of these OA charges includes: wheeling charge[20], cross-subsidy surcharge[21], additional surcharge[22] and banking charge[23] which varies from state to state. However, the net impact on landed cost remains significant, varying between INR 2-5/kWh.

Not only are OA charges high but they are also amended as and when the state desires. The majority of DISCOMs notify developers about OA charges on an annual basis, providing limited visibility to create a long-term business case for projects.

Competition with solar

In all seven states with wind resource, solar resource availability is also high and no preferences are extended to wind. Therefore, wind competes head-on with solar to capture the C&I market.

As a result, unless further regulatory support and long-term policy clarity is provided by the government, C&I is expected to be a small and geographically niche market dependent on the comparative business case in states.

20 Wheeling charges are levied by the DISCOM for usage of distribution grid.

21 Cross-subsidy surcharge is levied on C&I consumers for balancing the subsidy provided to residential and agricultural consumers.

22 Additional surcharge is levied on C&I consumers to compensate DISCOM for the payment of fixed charges to conventional PPAs which were tied up for meeting C&I demand.

23 Banking charges are levied for banking of power with DISCOM; banking of power is defined as virtual storage of excess generation with DISCOM which can be utilized at any other given point of time within a stipulated timeframe.

iv. Wind energy market forecast: 2020-2022

India is expected to install up to 13.1 GW of wind in the next three years, with uneven annual distribution

The interplay of all these factors across markets leads to uneven pathways for wind installations. which are expected to vary between 11-17 GW.

The base case sees a net installation of 13.1 GW between 2020 and 2022, with investments continuing at the current pace, given that federal auctions are driving the market. The high case sees an installation of 16.7 GW driven by increased investments in the market and activity in state auctions. On the other hand, in the low case, 10.8 GW of wind is expected to be installed, which may be impacted by economic slowdown in the market, leading to low activity in both central and state auctions. The low case also sees multiple projects undergoing cancellations due to financial constraints.

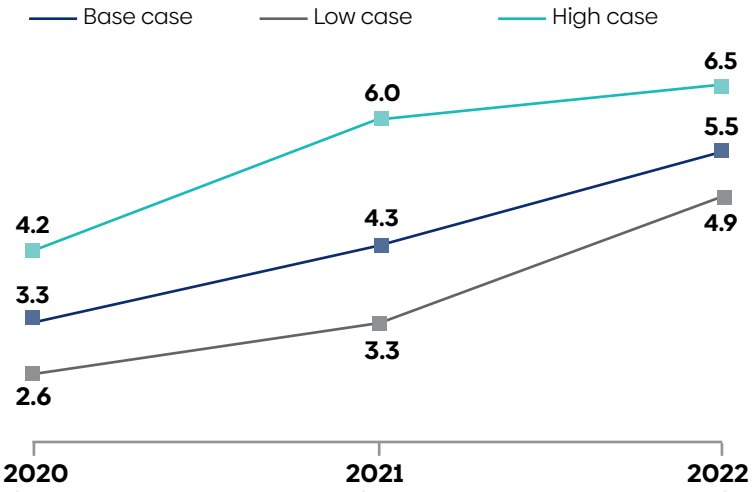
In addition, the market has an inherent lumpiness with uneven distribution across years and geography of installations.

In all scenarios, 2020 is expected to be a slow year in terms of market activity and installations are expected to be concentrated around 2022. Issues pertaining to non-availability of grid and land as well as low state auction activity impact installations in 2020. Nonetheless, the market scales up in 2021 as the issues are resolved and further volumes peak in 2022 due to retirement of incentives.

Given the resource availability and pipeline concentration in two states, installations are concentrated in Gujarat and Tamil Nadu. Installations outside the states are expected to be limited to 1-2 projects, possibly in Maharashtra and Karnataka.

FIGURE 9 | WIND INSTALLATION FORECAST & SCENARIOS

Y-o-Y new wind installations in India 2020-22
GW



Cumulative wind capacity until 2022	Scenario Definitions
54.2 GW	In high case, grid gets augmented by 2021; availability of investments in market and activity in state auctions increases
50.6 GW	In base case, grid gets partially augmented while investments and state activity continues to be the same
48.3 GW	In low case, grid continues to be a problem; multiple projects are cancelled with limited investments and no state activity

Market activity remains limited with extensions provided to projects delayed due to grid, land allotment and investments

Market can vary substantially depending upon the augmentation of grid at Bhuj in 2021

Retirement of ISTS charge waive-offs and easing of grid issues in 2022 creates rush for installation

Source: GWEC; MEC+ Analysis

5. LOOKING BEYOND 2022

Despite the 140 GW target for 2030, the retirement of the ISTS transmission charge waiver post-2022 removes a key external stimulus, putting the market in a state of flux. As a result, annual installation volumes post-2022 are expected to shrink.

However, long-term drivers are strong as the market is undergoing multiple long-term structural reforms. The major ones are: separation of wire and content business[24] in the Electricity Act Amendment; privatisation of financially stressed DISCOMS; and migration to merit order-based dispatch in the market. These interventions favour economic power plants and wind economics fit the cut.

While 2023 can be expected to be a transition year with lower activity, the market is expected to stabilise thereafter at roughly 5 GW installations annually in the long term.

24 Retail distribution of electricity will be separated from owning, operating and maintaining distribution grid.

SUPPLIER CONSOLIDATION

Five WTG OEMs dominate the market and further consolidation is expected

Supplier dynamics

During the FiT regime, the Indian wind sector housed 13+ active OEMs, most of which were domestic players. However, after the introduction of the auction mechanism, only 6-8 players remain active as of December 2019. This is a result of the sharp decline in wind power prices, leading to steep reductions in the profit margins of the OEMs accompanied by low volumes in the market. Volume in the market has been roughly 2 GW for the past two years, against an annual wind turbine manufacturing base of 10 GW (roughly 7 GW currently active) in the country. putting excessive pressure on WTG OEMs' operations.

The Indian wind sector has been largely globalised with the acquisition of local players by global majors in the past two years, for instance Senvion acquiring Kenersys, Nordex acquiring Acciona and Siemens acquiring Gamesa.

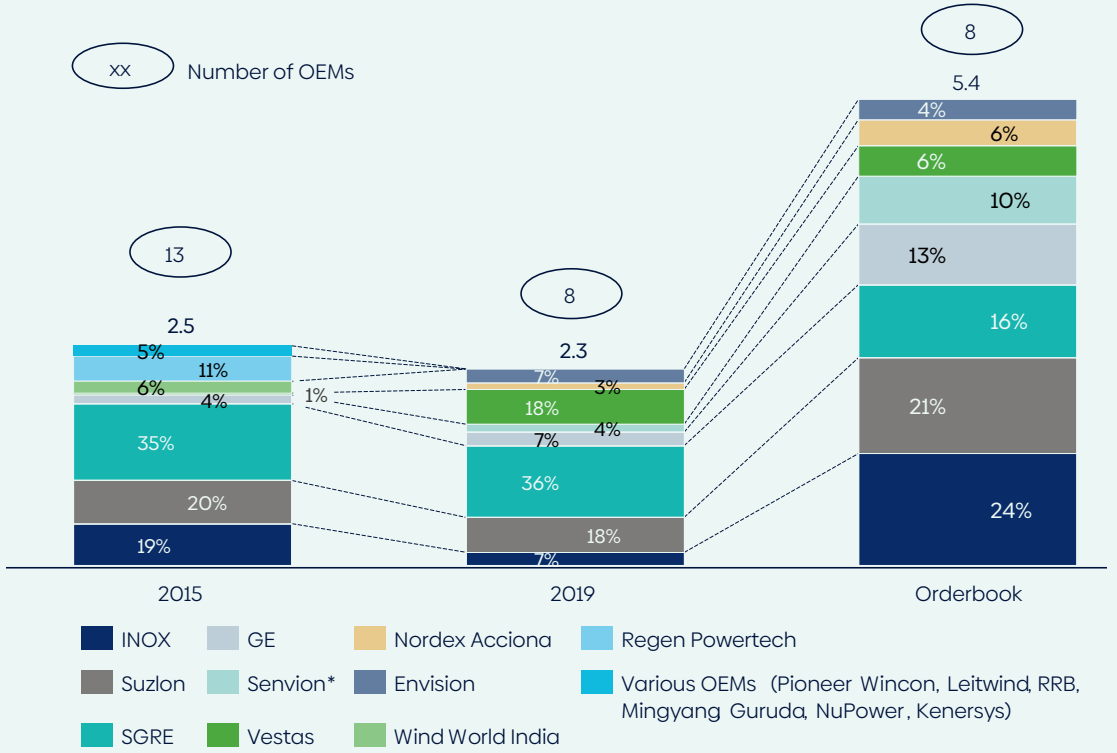
Future consolidation expectations

Smaller OEMs in India have not been able to sustain business under increasing cost pressures, visible through contraction in the number of suppliers in 2015 versus 2019. While smaller OEMs have moved out of market, larger domestic OEMs and global have struggled to keep their Indian operations profitable.

The total revenue of these players (including Suzlon, Senvion, Vestas, Siemens Gamesa Renewable Energy, Nordex and others) has declined while debts have increased in last two years. A major impact is seen on Suzlon and Senvion, which are undergoing debt restructuring. Risk to their financial positions is also visible with contracts of Suzlon and Senvion being re-contracted in the market. The pressure on OEMs and need for capturing volume can lead to further consolidation.

FIGURE 10 | OEM'S MARKET SHARE HAS BEEN CHANGING CONTINUOUSLY AND CONSOLIDATING

Installation by OEMs – 2015 vs 2019 vs order book
GW



Source: Calendar year data on the basis of publicly available information and approximation
Values of 1% or less are not indicated on the graph
*Senvion has agreed to sell Indian business in April, 2020; due to non-clarity of buyer, order book currently shown under Senvion
Source: GWEC Market Intelligence, April 2020; MEC+ analysis

NEW OPPORTUNITIES

New opportunities open in India where wind has a role to play

Offshore wind

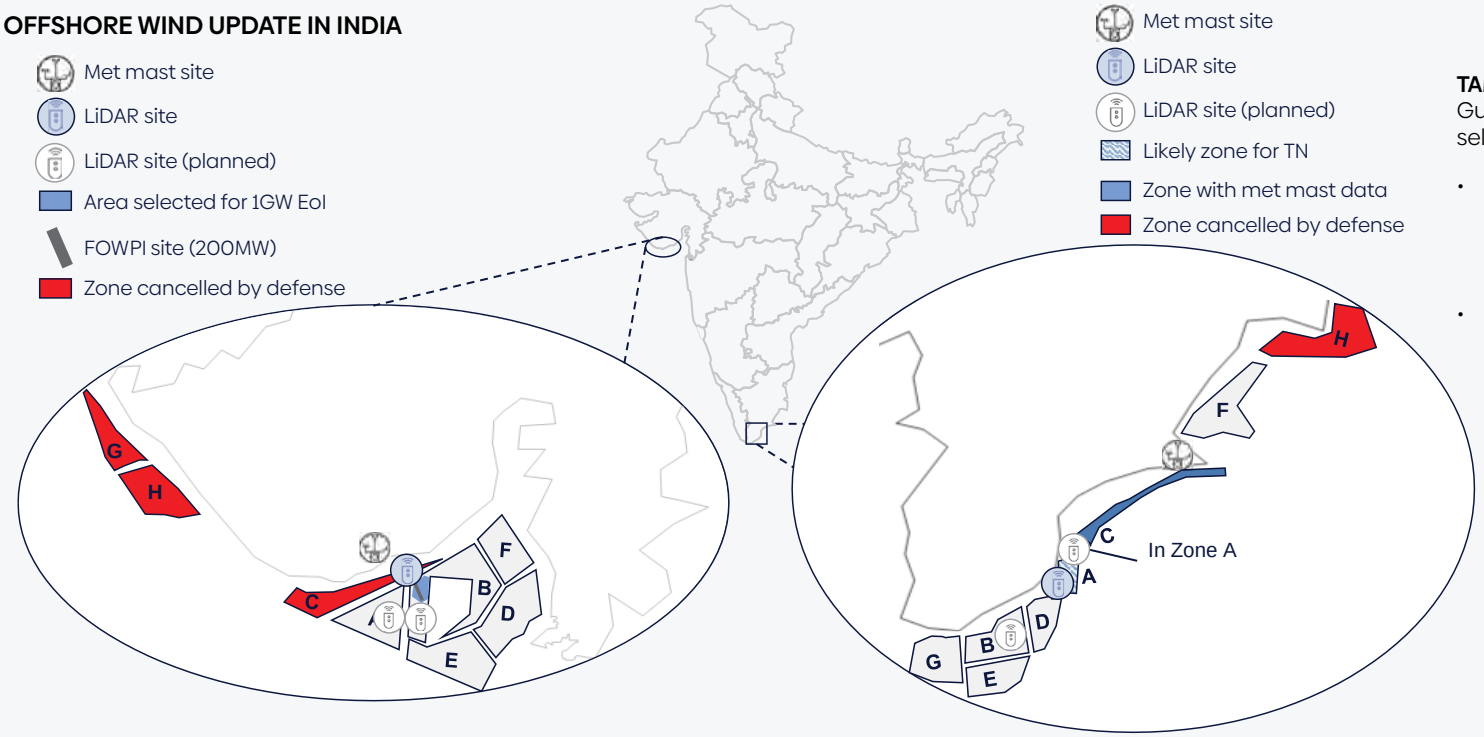
In 2018, the Indian government announced ambitious targets for offshore wind (5 GW by 2022 and 30 GW by 2030). Offshore wind activity in India started in 2013 with the installation of the first nearshore met mast at Dhanushkodi in Tamil Nadu. However, concrete steps towards commercialisation were taken in 2018 when India announced a 1 GW Expression of Interest (EOI) for a prospective project off the Gujarat coast in the Gulf of Khambat. Forty participants responded to the EOI, including major offshore wind players.

For a 1 GW offshore project in Gujarat, light detection and ranging (LiDAR) measurements and geotechnical/geophysical investigations have been completed, and preliminary permits have been secured. Moreover, PPAs have been agreed with Gujarat State Distribution Company (GUVNL) and viability gap funding is currently under review with the Ministry of Finance for one-time capital expenditure support subsidy.

FIGURE 11 | LATEST OFFSHORE WIND UPDATE IN INDIA

GUJARAT
Gulf of Khambhat selected zone

- Zone B has been selected by FOWPI* and by NIWE for the 1 GW tender
- New LIDAR planned in Zone A and additional LIDAR in Zone B; areas with an indicative installable capacity of 4 GW.



TAMIL NADU
Gulf of Mannar selected zone

- The tender for LIDAR planned for zone A has been released.
- Additionally, 1 LIDAR is planned for Zone A & B each covering 3.4 GW of indicative installable capacity.

Note:* FOWPI: A 200 MW site in zone B that was being developed by COWI India along with Windforce Management Services since Dec'15; Funded by European Union
Source: FOWIND Pre-feasibility Study for GJ; FOWPI; MEC+ analysis

However, there is no clarity on the tender issue timeline currently. Apart from this, tender for LIDAR installation and geotechnical investigation of 800 MW – 1 GW offshore wind in Tamil Nadu has been invited, while prospecting has been proposed for roughly 6 GW of projects in Gujarat and Tamil Nadu.

The 'Facilitating Offshore Wind in India' (FOWIND) project led by GWEC provided a boost to the development and feasibility assessment of offshore wind in India. Other consortium partners include CSTEP, DNV GL, GPCL and WISE. The project conducted various studies for offshore wind in India, focusing on resource assessment, feasibility and supply chain.

Hybrid Plants

To increase the reliability of renewable energy, SECI started conducting solar/wind hybrid auctions in 2018. Until December 2019, around 1.6 GW of renewable energy has been awarded in the first two auctions and another 1.2 GW tender is notified. Bid prices have ranged between INR 2.67-2.7/kWh over the first two auctions. The key technical criterion in the tender is the lower cap on the capacity contribution of each technology i.e. both wind and solar need to be minimum 25% of the net project capacity.

Ultra-mega renewable energy parks

Gujarat's latest land policy has marked 30 GW separate area for wind projects under central auctions. Land is to be allocated for these projects within designated wind parks in Khavada region. This area is remote with no grid accessibility and has marshy land, which means high land development and grid costs for the developers. In order to resolve this, government has taken up development activities in the region by announcing 25 GW of ultra -mega wind, solar and hybrid wind parks, where land and grid is provided by the government.

Another 25 GW ultra-mega renewable energy park is being developed in Rajasthan, however, this is expected to be dominated by solar/ hybrid technology since wind resource is sub-optimal here.

Round-the-clock renewable energy

SECI is conducting a 0.4 GW round the clock auction to solve the mismatch in load peak compared to solar or wind peak which also affects grid stability. This tender by SECI is unique in design for round-the-clock demand and could pave the way for better renewable energy integration. Under this auction, developers can choose to use standalone or combination of solar, wind, and hydro projects. Bidders are expected to quote a single first-year tariff under this auction, which would increase by 4% annually, up to the end of the 15th contract year in the PPA and would subsequently be fixed thereafter for the remaining term of the PPA.

Another 5 GW round-the-clock auction is planned which requires the blending of coal plants with renewable energy.

Peak power dispatchable renewable energy

To solve the peak power supply problem, SECI recently conducted a 1.2 GW peak power supply auction which was oversubscribed by 420 MW. In this auction, a project should have at least two components. One will be the energy storage system (ESS) component and the other can be either a solar photovoltaic system, a wind energy system or a hybrid system of both technologies.

Projects selected under this auction will be eligible for two-part tariffs: Peak Tariff and Off-Peak Tariff. Energy generated during the off-peak hours is to be remunerated at a fixed-tariff of INR 2.88/kWh while the tariff for energy generated during the peak hours was decided through an e-reverse auction which received a minimum bid of INR 6.12/kwh.

KEY TAKEAWAYS

The onshore wind sector in India will continue offering opportunities across greenfield and brownfield wind assets. The key trends emerging in the market are outlined below. For analysis on the impact of the ongoing coronavirus pandemic on the Indian wind energy market, see "Note on the impact of COVID-19."

The market continues to be large and lumpy in volume

Current market trends will persist in the next three years. India is expected to install nearly 13.1 GW of wind from 2020-2022, and these installations will actualise in an uneven annual distribution. Issues of land, grid and clearances continue in 2020. Installations increase in 2021 due to pent-up commissioning. This is followed by a peak year in 2022, as incentives on transmission charges retire in December and projects rush for delivery.

Wind projects become complex, requiring new capabilities

Projects and tenders in India are becoming complex; they are targeted towards meeting certain demand characteristics. Several tenders can be seen such as peak power supply and round-the-clock supply. A combination of wind with solar, thermal and energy storage will be needed to meet tender requirements. Developers and suppliers are diversifying business segments and building capabilities to cater to the future tech-neutral supply requirement.

Consolidation is expected to continue from the demand and supply sides

On the demand side, the market has already undergone a wave of consolidation with 4-5 developer acquisitions (largest being ReNew Power's acquisition of Ostro, KCT, India Wind and Greenko's acquisition of Orange, Skeiron). Multiple stressed assets are expected in the market due to continuous payment delays experienced by pre-2017 projects and aggressive bidding in the last two years. With players looking to expand portfolios, further consolidation can be expected in the market.

On the supply side, original equipment manufacturers (OEMs) of wind turbine generators (WTGs) suffer from low actualisation of pipeline in the market, reduced margins and high-cost base (manufacturing facilities) creating financial stress. The stress is visible on the pipeline with selected WTG OEMs unable to execute their order book. This creates undercurrents in the market for mergers and acquisitions (M&A) to tap into the existing order books and capture maximum share in the low activity market.

Market composition has changed towards IPPs and foreign participation has increased

Over the last decade, the Indian wind market has seen considerable evolution of ownership of assets. Until 2012-13, captive players owned 75-80% of the wind market. The FiT regime saw a transformation of ownership in the country with 70-75% share belonging to Indian independent power producers (IPPs), and roughly 20% to captive players and foreign participation was limited to CLP. Conducive and easy participation through auction design and long-term targets have promoted the entry of multiple foreign IPPs in India.

After 2017, 25-30% of assets are with these global IPPs, 60-65% with domestic IPPs and up to 10% with captive players. Foreign participation, especially in the form of investment is expected to continue to increase towards the future.

Asset-owners experiment with business models for cost-competitiveness

Asset owners can be seen taking greater control of the development process and experimenting outside of turnkey contracts for expanding project margins. Several leading developers like ReNew, Sembcorp and Greenko have expressed intent to multi-contract and keep asset development in-house while managing different engineering, procurement and construction (EPC) vendors and WTG OEMs.

Asset optimisation of the installed portfolio has also emerged as a focus area for asset-owners in the past two to three years. Asset owners have been actively building capabilities in asset management and supervision. Multiple asset-owners in India now have the scale to benefit from implementation of digital and cloud based performance management and monitoring. This creates opportunity for service providers within data analytics and digital offering to target the market. Multiple players (ReNew, Sembcorp, CLP) have built extensive in-house teams for monitoring assets.

As portfolios consolidate further and tariffs become competitive, in-house management of contracts and asset management will become a major focus area for revenue optimisation.

Emergence of large-scale wind parks

Governments announcement of ultra-mega power parks for wind can change the deployment model of wind going ahead. The two major risks faced by developers – land and grid – are provided by the government and therefore hedged through these parks. This also leads to a drop in the costs borne the developers. On top of this, a 25 GW wind park gives long term visibility to investors, generating confidence in the market.

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