

India's Renewable Energy Open Access Market: Trends and Outlook

Demand from Commercial & Industrial Sector is Helping the Market Grow Despite Policy Hurdles

Executive Summary

The renewable energy open access (OA) market is growing in almost all key renewables-rich states. Nearly two-thirds of the current 10 gigawatts (GW) renewable energy OA capacity came online in the last five years. Increasing awareness and demand from Commercial & Industrial (C&I) customers was a key driver of growth. The central government's Green OA Policy in 2022 was a significant positive regulatory development for the renewable energy OA market. However, state-level hurdles, such as delayed approval of projects, withdrawal of waivers on various charges for OA projects and increased penalties for power schedule deviation, continue to affect the market. We believe the correct and timely implementation of the Green OA Policy by the states will help ease some of these issues. Overall, we expect the renewable energy OA market to keep growing and be a major contributor to India's clean energy target of 450GW by 2030.

With the falling costs of clean power and the decarbonisation goals of Commercial & Industrial (C&I) consumers, uptake of renewable energy open access (OA) electricity has continuously increased.

From around 300 megawatts (MW) in 2009, the market size of renewable energy OA grew to ~10 gigawatts (GW)¹ by the fiscal year (FY) 2022. Two-thirds of the 10GW capacity came online in the past five years (FY2018-FY2022) alone.

C&I consumers procure OA power from three kinds of renewable energy plants – third-party owned, wholly owned (captive) or owned by a group of consumers (group captive). Of late, state-level OA waivers have made group-captive the most financially viable option for procurement and, therefore, the most popular.

Lately, several independent power producers (IPP) active in the utility-scale renewable energy market are vying to enter the OA market. Key reasons for their emergence include maturity of OA financing, increasing awareness of C&I consumers and slowing central- and state-level tender activity.

Despite several regulatory hurdles and price increases, the market has grown organically. In FY2022, landed costs for renewable energy OA projects increased in almost all the key renewables-rich states. This increase has been because of a

¹ JMK Research

combination of rising project costs (rise in solar module prices) and a hike in OA charges in the past year.

The OA market growth in India depends on policies and the regulatory environment at both the central and state level. Last year saw some positive developments in terms of regulations even as a few hurdles persist.

The Green OA Policy, issued in June 2022, has the potential to completely reform the renewable energy OA market landscape. The policy provides long-term clarity regarding OA charges and banking as well as reduces the eligibility limit to make green OA more accessible to C&I consumers. Additionally, the Supreme Court ruling regarding additional surcharge (AS) was a big boost for the OA developers. This ruling provided relief to the developers from state authorities incessantly targeting the viability of captive/group-captive.

The OA market growth in India depends on policies and the regulatory environment at both the central and state level.

Despite these positive policy developments, hurdles, such as delays in the approval process for group-captive projects, remain. Other roadblocks include unfavourable banking provisions and increased penalties for deviation in power schedule.

Along with policy and regulatory hurdles, supply-side constraints have been significant headwinds for the Indian renewable energy OA market. Solar module prices have been increasing for the past 18-20 months owing to supply chain constraints and rising raw material prices, such as polysilicon, thus affecting the project viability. In addition, India-specific challenges, such as the imposition of basic customs duty (BCD) of 40% on imported modules and paucity in domestic manufacturing capacity of high-wattage modules, are exacerbating an already worrying situation. An added risk is the forthcoming implementation of the approved list of models and manufacturers (ALMM) for OA developers from October 2022.

The wind-solar hybrid OA market is also increasingly becoming popular owing to its better capacity utilisation factor (CUF) and role in maintaining grid stability. Gujarat has the most favourable policy of all states with wind-solar hybrid installed capacities. Gujarat's wind-solar hybrid policy, including the associated tariff framework, offers clarity regarding banking, OA charges, project design etc.

Developers also have new energy trading platforms specifically for the renewable energy market, i.e., green term ahead market (GTAM) and green day ahead market (GDAM). Green power markets (GTAM, GDAM etc.) have taken off in India, with 7,660 million units (MU) traded until April 2022. They provide an additional

revenue stream and safety for the developers, especially in states with restrictive banking provisions or in case of delayed OA approvals. C&I consumers and developers are also actively exploring other business models, such as renewable energy+storage, virtual power purchase agreement (VPPA) and international renewable energy certificates (IRECs).

Correct and timely implementation of the Green OA Policy across states will be vital in unlocking India's renewable energy OA potential. However, with electricity being a concurrent subject, litigation between the centre and states may be a hurdle during implementation. All key states should implement a multi-year tariff structure in India to provide better long-term clarity to developers/investors. In addition, all states should ensure that they do not impose further restrictive measures on banking, at least until they achieve the central government's renewable energy targets.

With the OA market steadily maturing in India and the increasing awareness of C&I consumers about green OA, we expect the market to grow further. The renewable energy OA segment will likely be a major contributor to reaching the national clean energy target of 450GW by 2030.

Glossary of Terms

Abbreviation	Definition
ACP	Average Clearing Price
ALMM	Approved List of Models and Manufacturers
AS	Additional Surcharge
BCD	Basic Customs Duty
BESS	Battery Energy Storage System
C&I	Commercial and Industrial
CAPEX	Capital Expenditure
CERC	Central Electricity Regulatory Commission
CSS	Cross Subsidy Surcharge
CTU	Central Transmission Utility
CUF	Capacity Utilisation Factor
DISCOM	State Electricity Distribution Company
DOC	Date of Commissioning
DSM	Deviation Settlement Mechanism
ED	Electricity Duty
ESG	Environmental, Social and Governance
EV	Electric Vehicle
FY	Fiscal Year
GDAM	Green Day Ahead Market
GERC	Gujarat Electricity Regulatory Commission
GHG	Greenhouse Gases
GNA	General Network Access
GTAM	Green Term Ahead Market
GW	Gigawatts
InSTS	Intra-State Transmission System

Abbreviation	Definition
IPP	Independent Power Producer
IREC	International Renewable Energy Certificate
ISTS	Inter-State Transmission System
KERC	Karnataka Electricity Regulatory Commission
kW	Kilowatts
kWh	Kilowatt-hour
LDC	Load Dispatch Centre
Mono PERC	Monocrystalline Passivated Emitter and Rear Contact
MU	Million Units
MW	Megawatts
O&M	Operations and Maintenance
OA	Open Access
OPEX	Operational Expense
PPA	Power Purchase Agreement
PSP	Pumped Storage Plant
REC	Renewable Energy Certificate
RERC	Rajasthan Electricity Regulatory Commission
RPO	Renewable Purchase Obligation
SEBI	Securities and Exchange Board of India
SERC	State Electricity Regulatory Commission
STU	State Transmission Utility
T&D	Transmission & Distribution
UI	Unscheduled Interchange
VPPA	Virtual Power Purchase Agreement
VRE	Variable Renewable Energy
Wp	Watt-peak
YoY	Year-on-Year

Table of Contents

Executive Summary	1
Glossary of Terms	3
1. Introduction	6
2. Renewable Energy OA Installation Trend	8
3. New Entrants	11
4. OA Landed Cost	12
5. Policy and Regulatory Updates	13
6. OA Market Trends	23
7. Non-regulatory Challenges in Renewable Energy OA market	30
8. Way Forward	32
9. Conclusion	35
About the Authors	37

Table of Figures

Figure 1: Options for Renewable Energy OA Power Procurement	7
Figure 2: Cross-Subsidy Surcharge Trend from FY2018 to FY2022	7
Figure 3: Annual Renewable Energy OA Installation Trend (FY2018-FY2022)	9
Figure 4: Top Five States – Renewable Energy OA Capacity (Operational)	10
Figure 5: Leading Renewable Energy OA Developers – Operational Capacity	11
Figure 6: Renewable Energy OA Portfolio of New Entrants	12
Figure 7: OA Landed Cost Across States for Captive/Group-Captive	13
Table 1: Summary of Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022	14
Table 3: Summary of “CERC Deviation Settlement Mechanism and Related Matters Regulations, 2022” for Renewable Energy Generators	19
Figure 8: Summary of Banking Provisions Across Key States	20
Table 4: Summary of Group-Captive Issues Across States	21
Table 5: Summary of Exemptions on OA Charges	22
Figure 9: Key Players setting up Wind-Solar Hybrid Open Access Projects in India	24
Figure 10: Trading Price v/s Net Price in Green Power Market	26
Figure 11: Green Energy Tariff Across States	28

1. Introduction

Typically, consumers in India had to procure power from state electricity distribution companies (DISCOMs). However, to increase competition and efficiency, the government, through the Electricity Act 2003, allowed consumers with a load requirement of 1 megawatt (MW) to buy electricity directly from power generators.

The act introduced open access (OA), a non-discriminatory access of transmission and distribution (T&D) infrastructure to any energy consumer/generator. The biggest beneficiaries and users were commercial and industrial (C&I) consumers.

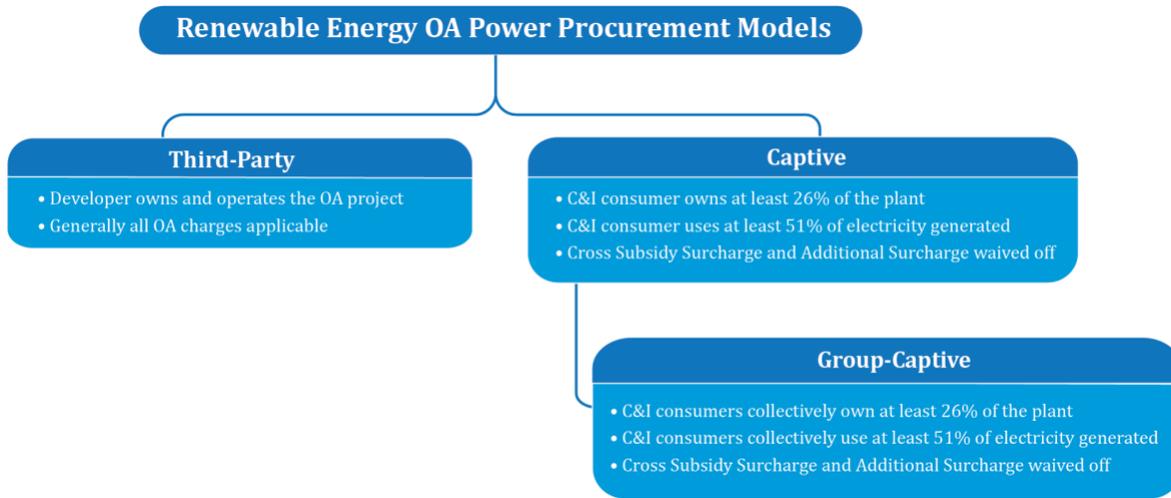
In the past decade, the rise of renewable energy has also helped its OA market grow significantly. From around 300MW in 2009, the size of the renewable energy OA market grew to ~10GW as of fiscal year (FY) 2022.

**In the past decade,
the rise of renewable
energy has also helped
its OA market grow
significantly.**

C&I consumers had three options to source OA power. They could either buy it from third-party power plants, captively owned power plants or power plants owned by a group of consumers, also known as group-captive plants.

When buying from third parties, C&I consumers typically sign power purchase contracts with clean energy developers wheeling electricity from their offsite renewables plants. Thus, the renewable energy OA market is also known as the “offsite renewable energy private power purchase agreement (PPA) market”.

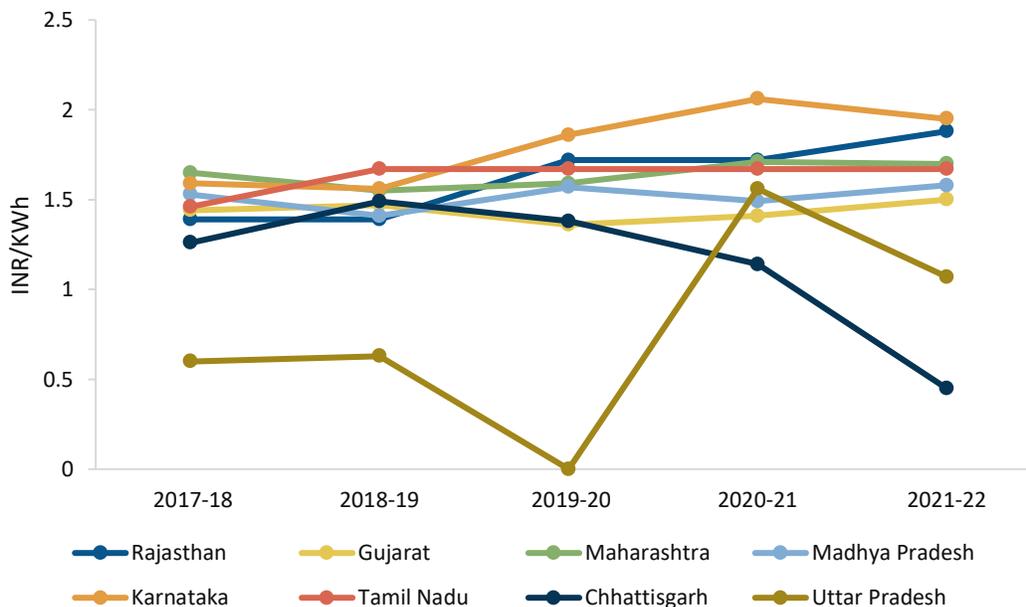
Figure 1: Options for Renewable Energy OA Power Procurement



Source: JMK Research

Unlike developed economies, in India, C&I consumers pay higher tariffs to cross-subsidise agricultural and residential consumers. To do this, C&I consumers, the largest electricity buyers in the country, pay a cross-subsidy surcharge (CSS). The surcharge accounts for the largest share (40%-50%) in landed tariff for C&I consumers availing of renewable energy OA. According to National Tariff Policy, the CSS in each state should go down every year. However, Figure 2 shows this is not the case across key renewables-rich states in the past five years.

Figure 2: Cross-Subsidy Surcharge Trend from FY2018 to FY2022



Source: Tariff regulations of various State Electricity Regulatory Commission (SERCs), JMK Research

For most leading renewable energy OA states, CSS has either stayed the same or increased in the past five years. During this period, CSS increased most in Uttar Pradesh and Rajasthan, by 78% and 35%, respectively. As mandated by the National Tariff Policy, Chhattisgarh is the only state where CSS decreased.

Additionally, in the past couple of years, DISCOMs have imposed several restrictions to prevent the migration of high-paying C&I consumers to cheaper renewable energy OA power. Ever-increasing CSS and implementation of unpredictable additional surcharge (AS) are the main reasons why third-party procurement has become unviable in most states. The group captive model is currently the preferred option for OA procurement in India as CSS and AS are waived under this model, per the Electricity Act 2003.

Efforts by C&I consumers to lower electricity costs and meet sustainability goals, such as net-zero, are driving their uptake of renewable energy. This is why India's renewable energy OA market has continued to grow despite all the hurdles and a lull in development in 2019 and 2020.

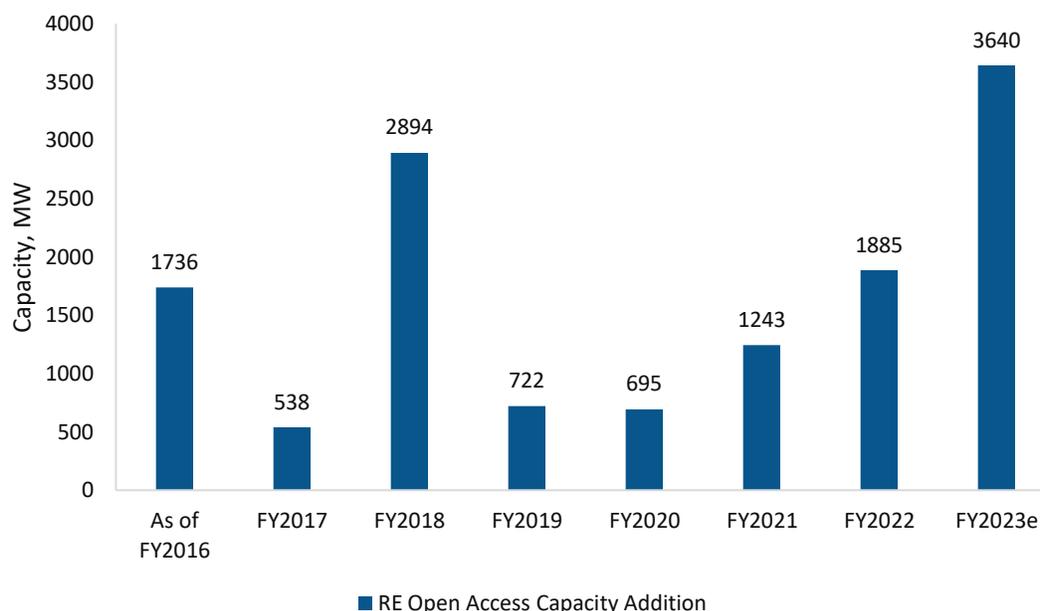
Efforts by C&I consumers to lower electricity costs and meet sustainability goals, such as net-zero, are driving their uptake of renewable energy.

2. Renewable Energy OA Installation Trend

Most of the total renewable energy OA capacity (~10GW), approximately two-thirds, went online in the open access market in the last five fiscal years (FY2018–FY2022).

The Indian renewable energy OA market witnessed robust annual capacity addition beginning as recently as FY2017. At 2,894MW, the installation in FY2018 is the highest annual capacity addition to date (see Figure 3). In fact, the period between FY2016-17 to FY2017-18 was when the market truly flourished. The prime driver for the capacity boom was the highly favourable policy of Karnataka, namely, the Karnataka Solar Policy 2014-21. This policy granted a 10-year exemption on all grid charges for solar open access projects commissioned until FY2018.

Figure 3: Annual Renewable Energy OA Installation Trend (FY2018-FY2022)



Source: JMK Research

Note: The data in the chart includes operational capacities of solar, wind, and wind-solar hybrid open access projects

The expiry of Karnataka's attractive incentive for open access solar installation severely dampened the growth of the entire renewable energy OA market. In FY2019, renewable energy OA installation in India fell by 75% year-on-year (YoY). Further, in 2019, some states, including Andhra Pradesh, Haryana, Maharashtra, Rajasthan and Uttar Pradesh, either withdrew their open access benefits or did not extend the effective implementation period. These actions, or inactions in terms of state policy and regulation, stagnated the growth of the renewable energy OA market in FY2020. The lowest annual installation in the last six fiscal years was in FY2020.

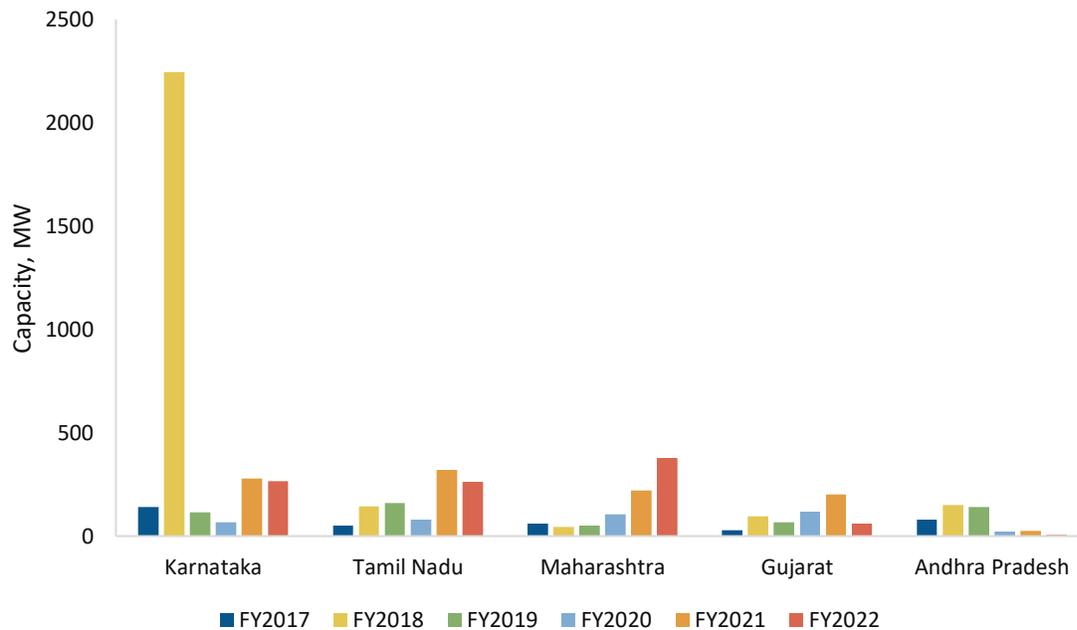
Capacity addition in FY2021 was substantially higher as compared to the previous fiscal. And this happened despite the adverse effects of the COVID-19 pandemic. Tailwinds such as the growing need for reduction in operational expense (OPEX), renewable purchase obligation (RPO), and decarbonisation targets of C&I consumers enabled the renewable energy OA segment to beat the slowdown in market activity.

Renewable energy OA installation in FY2021 of 1.24GW was ~1.8x higher than FY2020. In FY2022, the annual capacity addition of ~1.89GW was 1.5x more than the previous year. Considering the OA projects under construction, India may add a

further ~3.6GW in FY2023, which could potentially be the record high annual installation.²

Based on renewable energy OA capacity installed during FY2018 – FY2022, the top five states are Karnataka, Tamil Nadu, Maharashtra, Gujarat and Andhra Pradesh. These five states contributed 83% of India's renewable energy OA capacity addition during the same period.

Figure 4: Top Five States – Renewable Energy OA Capacity (Operational)



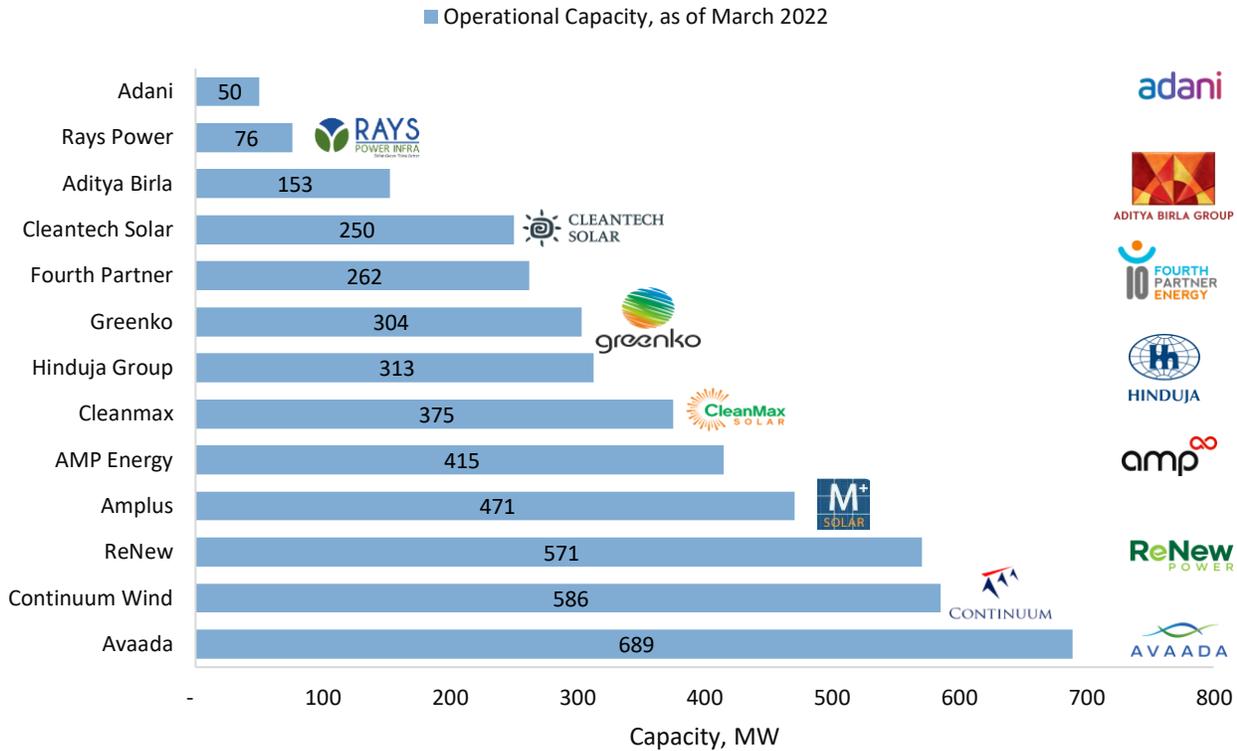
Source: JMK Research

Note: The data in the chart includes operational capacities of solar, wind, and wind-solar hybrid open access projects.

On the project development front, the five leading players in the Indian renewable energy OA market – Continuum Wind, ReNew, Avaada Energy, Amplus Solar and AMP Solar – have a combined open access capacity of more than 2.7 GW (see Figure 5).

² JMK Research

Figure 5: Leading Renewable Energy OA Developers – Operational Capacity



Source: JMK Research

3. New Entrants

Competition in the Indian renewable energy OA market segment is rising as the list of developers keeps increasing. In recent years, many companies ventured into the open access business. The key reasons for their emergence are –

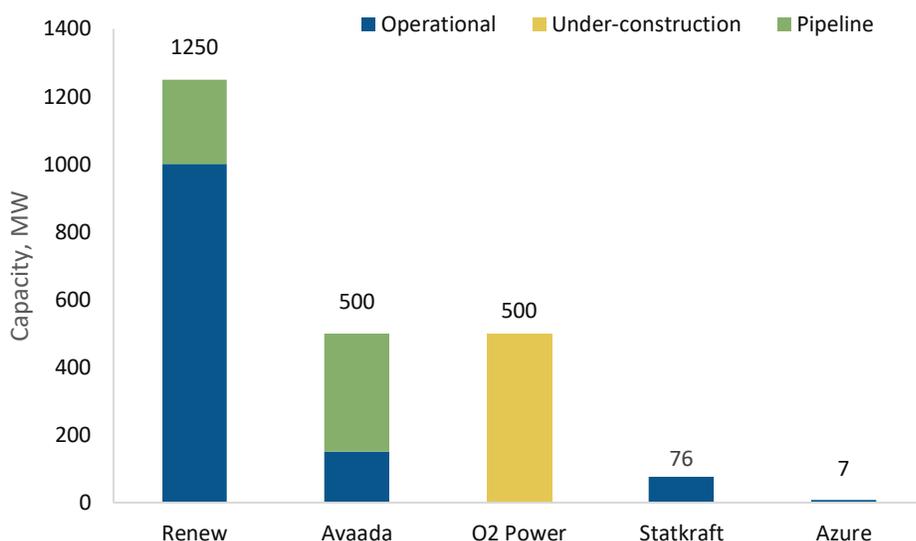
- Increasing C&I consumer awareness
 - Strengthening renewable procurement obligations (RPOs) of DISCOMs
 - Matured open access financing market
 - Diversification of renewables portfolio and thereby, of developers' risks
- } Demand-side drivers
} Supply-side drivers

Some new entrants include ReNew Power, Avaada Energy, Azure Power, O2 Power, Sembcorp, and Statkraft. These companies have a strong foothold in the grid-scale Indian renewable energy market. Apart from the reasons listed above, lower government tender issuance activity and delays in signing power supply agreements

(PSAs) between intermediary electricity procurers and DISCOMs are also pushing the grid-scale producers to explore the offsite private PPA market.

Among all the new players that have recently entered this market, ReNew Power has the maximum operational renewable energy OA capacity of ~1,000MW. In terms of under pipeline capacity, Avaada Energy leads with ~350MW. Further, O2 Power has about 500MW of capacity under construction.

Figure 6: Renewable Energy OA Portfolio of New Entrants

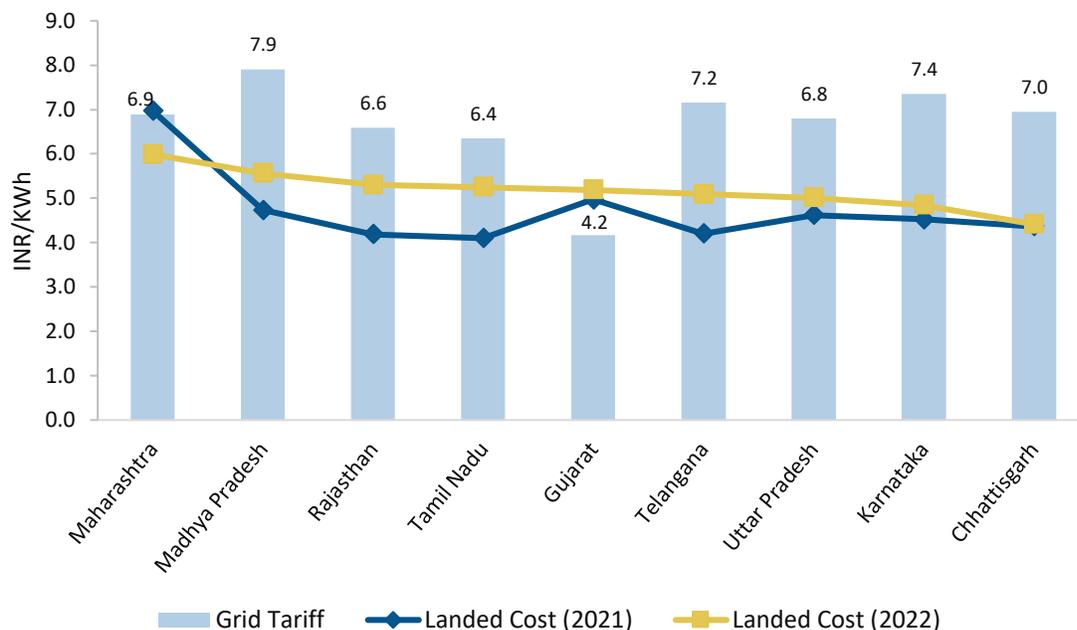


Source: Company websites, news articles, JMK Research

4. OA Landed Cost

OA tariff/landed cost per Kilowatt-hour (kWh) consists of two components – base tariff and OA charges. These OA charges comprise additional surcharge (AS), cross subsidy surcharge (CSS), Wheeling and Transmission charges and losses etc. Owing to the exemption of CSS and AS, the group-captive model is currently the most favoured OA business model. The third-party OA model, wherein all charges apply with almost no exemptions, is currently financially unviable in most states.

Figure 7: OA Landed Cost Across States for Captive/Group-Captive



Source: Tariff regulations of various State Electricity Regulatory Commission (SERCs), JMK Research

Note: (1) Base tariff for solar fixed at Rs3.8/kWh across states to highlight changes due to open access charges; actual tariffs vary; (2) Landed cost of solar calculated for industrial consumers connected at 33 kV voltage; (3) Grid tariff includes only energy charges (does not include fixed charges). Hence, the actual retail tariff will be substantially higher.

Landed cost per kWh for OA has increased in the past year in most leading OA states. This is because of rising project costs affecting the base tariff and the increase in OA charges last year. Interestingly, the landed cost decreased ~14% last year in Maharashtra. The fall is due to the Supreme Court of India's abolishment of Maharashtra's AS application on captive/group-captive consumers. We discuss the case in detail in the regulatory updates section of this report.

5. Policy and Regulatory Updates

The growth of the OA market in India is highly dependent on policies and the regulatory environment at both the national and state levels. Policies have been a driver for OA growth in some cases and a significant deterrent in others. A major issue with the OA policy development has been differing state-level policies. Varied interpretations of central policies also present an added challenge. At the state level, tariff structure, OA charges and associated exemptions, as determined by the state commission in tariff orders, play a vital role in the OA market development.

Henceforth, we examine in detail the national and state-level policy and regulatory updates since 2021 and their impact on India's OA market development. For better clarity, we have classified the updates into either a positive development or a regulatory hurdle.

Positive Regulatory Development

Green Energy OA Policy

The Ministry of Power initially introduced the Green OA Policy in the form of a draft in August 2021. After receiving public comments, it finalised the policy. Finally, the Ministry of Power published the policy as Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022 on 6 June 2022. The new policy received very positive feedback from the OA industry. We summarise the salient features of this policy in the table below.

Table 1: Summary of Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022

	Details						
OA Eligibility	<ul style="list-style-type: none"> Any consumer having contract demand/sanctioned load \geq 100 kilowatts (kW). No capacity limit for captive consumers. 						
Nodal Agency	<ul style="list-style-type: none"> A central nodal agency to be set up to maintain a centralised public registry/portal for all green OA consumers. All OA applications after getting registered in the centralised registry will get routed to the concerned nodal agency. Concerned Nodal Agency: <ul style="list-style-type: none"> Short-Term OA: Load Dispatch Centre (LDC) Medium-Term OA: State Transmission Utility (STU) Long-Term OA: Central Transmission Utility (CTU) 						
OA Charges	<ul style="list-style-type: none"> Only six kinds of OA charges have been specified: <table border="0" style="width: 100%;"> <tr> <td>a) Transmission Charges</td> <td>d) Standby Charges</td> </tr> <tr> <td>b) Wheeling Charges</td> <td>e) Additional Surcharge (AS)</td> </tr> <tr> <td>c) Cross Subsidy Surcharge (CSS)</td> <td>f) Banking Charge</td> </tr> </table> AS is not applicable on renewable energy OA if the consumer already pays fixed charges. CSS and AS do not apply to Waste-to-Energy plants. CSS on a C&I consumer will not increase by more than 50% during 12 year period from the “commercial operation date” of the OA plant. 	a) Transmission Charges	d) Standby Charges	b) Wheeling Charges	e) Additional Surcharge (AS)	c) Cross Subsidy Surcharge (CSS)	f) Banking Charge
a) Transmission Charges	d) Standby Charges						
b) Wheeling Charges	e) Additional Surcharge (AS)						
c) Cross Subsidy Surcharge (CSS)	f) Banking Charge						
OA Grant Procedure	<ul style="list-style-type: none"> All OA applications to be submitted on a centralised OA portal. Approval window of OA applications by concerned nodal agency: 15 days. OA applications priority: Long-Term > Medium-Term > Short-Term 						
Banking	<ul style="list-style-type: none"> Minimum banking settlement period: monthly Minimum banking allowed (as % of energy consumption): 30% 						
Green Energy Tariff	<ul style="list-style-type: none"> DISCOM obliged to supply green energy upon request by a consumer on payment of an additional charge – Green Energy Tariff. Any such requisition from the consumer shall be for a minimum period of one year. Renewable energy consumed by a consumer in excess of its RPO obligation is counted towards RPO compliance of DISCOM. 						
Green Energy Rating	<ul style="list-style-type: none"> Consumers will be rated based on the percentage of renewable energy consumed. 						
Green Hydrogen/Ammonia	<ul style="list-style-type: none"> Green hydrogen/ammonia purchase to be counted towards RPO fulfilment. CSS and AS are not applicable on renewable energy utilised for producing green hydrogen/ammonia. 						

Source: Ministry of Power, JMK Research

Green open access rules aim to provide a standardised framework for OA deployment across India. Some positive steps for renewable energy OA development outlined in the policy are:

The Green OA Policy specifies the appointment of a Forum of Regulators (FOR) to decide on a standard methodology for determining all OA Charges. The FOR will complete the exercise within four months from the policy's implementation date.

Banking of unused power is a critical provision for the green OA market. But, several states – Haryana, West Bengal, Telangana, etc. – have been restricting renewable energy banking. A few states like Tamil Nadu do not even allow banking. So, the Ministry of Power's clarification, through the Green OA Policy, about the provision of banking, at least monthly, is a major positive leap.

Exemption of AS for renewable energy OA consumers, if the consumers already pay fixed charges, is a highly encouraging step.

The policy appoints LDC/STU/CTU as nodal agencies for renewable energy OA. This is to reduce the influence of DISCOMs in the OA approval process. Thus, based on our interactions with industry stakeholders, we expect implementation of the OA application clearance window of 15 days, which the policy specifies, is highly likely.

On the other hand, some other policy provisions need further clarification:

The Green OA Policy has a clause that disallows the carry forward of banked energy from one month to another. This is a discouraging step considering some states already provide annual banking of renewable energy. The clause may prompt them to switch to a monthly banking system.

Regarding the new policy abolishing AS, if the C&I consumer pays fixed charges, it may be inaccurate to assume that fixed charges subsume the liability towards stranded assets. AS and fixed charges have different computation methodologies and generally serve different purposes in the tariff structure.

The policy reduced the eligibility for renewable energy OA to any consumer having a sanctioned load of 100kW. This might create an implementation tussle between the centre and the states, as most states currently set their OA eligibility limit at 1MW.

OA players have strongly demanded policy certainty and consistency across all the states for many years. The Green OA Policy, if implemented correctly and in a timely fashion, has the potential to spur the OA market. Indeed, the clarity for OA charges offered by the new policy could enhance OA projects' viability and the market's long-term feasibility.

The actual implementation of the Green OA Policy rests with the states. Thus, all stakeholders now keenly await responses from state commissions to understand the degree to which states align with the policy.

ISTS Waivers and General Network Access Regulations

ISTS allow OA developers to widen their scope and reach consumers across any state in the country. It enables developers to override the various challenges and inconsistencies in state policies that usually prove to be a major deterrent to OA growth. Hence, the central government is simultaneously developing the ISTS infrastructure and empowering the OA generators. The government has introduced ISTS waivers and simplified ISTS connectivity through General Network Access (GNA) regulations to augment the ISTS market. We summarise all current ISTS waivers below:

Table 2: ISTS Transmission Charges and Losses Waiver for Projects Commissioned Before 30 June 2025

Energy Source	Waiver (ISTS charges)	Waiver (ISTS losses)	Remarks
Solar	✓	✗	<ul style="list-style-type: none"> Waivers Timeline: 25 years from the date of commissioning (DOC)
Wind	✓	✗	
Pumped Storage Plant (PSP)	✓	✗	<ul style="list-style-type: none"> Waivers Timeline: 25 years from DOC Waivers Eligibility: 51% of charging energy from Wind/Solar.
Battery Energy Storage System (BESS)	✓	✗	<ul style="list-style-type: none"> Waivers Timeline: 12 years from DOC Waivers Eligibility: 51% of charging energy from Wind/Solar.
GTAM/GDAM	✓	✗	<ul style="list-style-type: none"> Waivers Eligibility: Only for trading energy from solar/wind/PSP/BESS.
Green Hydrogen	✓	✗	<ul style="list-style-type: none"> Waivers Timeline: 8 years from DOC Waivers Eligibility: Production using solar/wind/PSP/BESS energy sources
Any of the Above (Bidding before 15 January 2021)	✓	✓	<ul style="list-style-type: none"> Waivers Eligibility: Bidding of the project completed before 15 January 2021

Source: Ministry of Power, JMK Research

Currently, the waivers are applicable on projects commissioned by 30 June 2025. However, projects will face an annual addition of 25% ISTS charge post this date. Thus, for projects commissioned from July 2028, 100% of the ISTS charges will apply.³

Consequently, ISTS is generating a lot of interest from all stakeholders. However, associated ISTS infrastructure is a significant deterrent. The lack of dedicated last mile ISTS transmission lines has prevented C&I consumers from shifting to ISTS

³ Ministry of Power

from state DISCOM infrastructure. Consequently, on 16 December 2022, CERC published "Connectivity and GNA to the ISTS Regulations, 2021" as a draft.

These rules, if finalised, would bring a radical change in energy transmission and distribution in the country. GNA is essentially non-discriminatory access to the nation's ISTS infrastructure. GNA allows the generators and consumers to utilise the entire ISTS transmission belt for injection and drawing out of power. This radically differs from the point-to-point access that transmission and distribution networks currently follow. The minimum eligible capacity of the energy generator for connecting to ISTS through GNA is 50MW.

A big Win for Captive/Group-Captive: AS Quashed in Maharashtra

In recent years, group-captive has become the most viable model of procuring renewable energy OA power. The Electricity Act 2003 gives exemptions on CSS and AS for these projects, an important reason for the model's attractiveness.

However, in recent years, several states have been pushing to levy AS even on OA captive/group-captive. For example, Tamil Nadu, Madhya Pradesh and Maharashtra have been trying to discourage consumers from migrating away from their DISCOM network.

**In recent years,
group-captive has
become the most
viable model of
procuring renewable
energy OA power.**

One fascinating case regarding the application of AS occurred in Maharashtra. In September 2018, Maharashtra imposed AS on its captive/group-captive consumers. Since then, this issue has been under litigation as it violates the Electricity Act 2003. In December 2021, the Supreme Court of India settled this long-standing issue by ruling that the state cannot levy AS on captive/group-captive consumers.

The Supreme Court ruling was a big win for all renewable energy OA stakeholders. Consequently, this ruling will demotivate states in future to target the viability of the captive/group-captive OA model through unlawful application of AS or any other new charge.

Increased Adoption of Multi-Year Tariff Structure

Traditionally, most states follow the annual tariff period, wherein regulators issue retail tariff orders annually. Thus, values of OA charges for C&I consumers, such as wheeling and CSS, also vary annually. In addition to the uncertainty in the value of OA charges, this annual variation also exposes the developers to added risks, such as the imposition of new kinds of OA charges – for example, grid support charges in Haryana). A multi-year tariff structure is a retail tariff order released for several years. It addresses uncertainty and provides long-term clarity over OA charges. Hence, a stable multi-year tariff order is essential to help all stakeholders (developers, investors etc.) plan and execute OA projects.

Maharashtra was the first state to introduce multi-year retail tariff order in March 2020. The order provides values of retail tariffs and OA charges for five years from FY2020-21. Following suit, in November 2021, the Rajasthan Electricity Regulatory Commission (RERC) issued its multi-year tariff order. The order is applicable for four years from FY2020-21. Similarly, several other states, such as Haryana, Madhya Pradesh and Delhi, are also exploring this model.

Maharashtra was the first state to introduce multi-year retail tariff order in March 2020.

New Progressive State-Level Renewable Energy Policies Introduced: Karnataka Renewable Energy Policy 2022

In April 2022, Karnataka released its comprehensive renewable energy policy for the control period of five years, from 2022 to 2027. Through the new policy, Karnataka aims for an all-inclusive development of renewable energy in the state, rather than focusing on just a few technologies. For power procurement through OA, in addition to traditional methods (third-party/captive/group-captive), the policy also recognises energy trading and power exchanges as other viable means.

Furthermore, the policy gives equal importance to the intra-state transmission system (InSTS) and ISTS for power. It also details how consumers can use InSTS to access the ISTS network. Although energy trading through power exchanges and ISTS are already proven concepts, Karnataka is the first large OA state to recognise them officially. Going forward, it will be essential for OA developers to utilise these multiple revenue streams to increase the financial viability of a project. With the ever-increasing penetration of variable renewable energy (VRE) into the grid, the policy also outlines the importance of technologies like energy storage and wind-solar hybrid.

Upcoming state-level renewable energy policies will include all technologies (biomass, energy storage, green hydrogen etc.), not just wind and solar. Further development of evacuation infrastructure along with the associated OA waivers will likely lead to the installation of several dedicated ISTS-based projects. Karnataka's policy shows that states will also officialise energy trading from a renewable energy project through various exchanges.

Regulatory Hurdles

Increased Penalties in New Deviation Settlement Mechanism Regulations

Deviation settlement mechanism (DSM) is a commercial mechanism that the CERC introduced to schedule injection and drawing out of electricity effectively, thereby ensuring stability and security of the grid. After publishing the new DSM regulations as a draft in September 2021, it released the final version in March 2022. Deviation settlement for OA comes through an unscheduled interchange (UI) charge that DISCOMs levy on the concerned project developers.

Table 3: Summary of “CERC Deviation Settlement Mechanism and Related Matters Regulations, 2022” for Renewable Energy Generators

Attribute	New DSM Rules	Previous DSM Rules
Zero Penalty Deviation Window	Over Injection <ul style="list-style-type: none"> Up to 5% - No charge Under Injection <ul style="list-style-type: none"> Up to 10% - No charge 	Over Injection <ul style="list-style-type: none"> Up to 15% - No charge Under Injection <ul style="list-style-type: none"> Up to 15% - No charge
Zero Compensation Limit	Beyond Over Injection of 10%, no compensation provided	No such limit exists
Deviation Charge Settlement Period	Within seven days of issue of statement of deviation charges	Within 12 days of issue of statement of deviation charges

Source: Ministry of Power, JMK Research

As seen above, the new rules treat over-injection and under-injection of power differently. According to the new DSM rules, the window size for the no deviation penalty is 15% (+5% over to -10% under). This is a significant reduction from the previous window of 30% (+15% over to -15% under). In addition, the new DSM rules specify that there will be no compensation for the renewable energy developer beyond an over-injection of 10%, in other words, a 100% deviation penalty.

Unlike DISCOM PPAs, there is no defined contract rate between DISCOMs and renewable energy OA developers. Now, the new DSM regulations calculate the deviation charge per kWh by taking the weighted average of average clearing price (ACP) of the day ahead market segments of all power exchanges for the respective time block.

Several developers are concerned over these new DSM rules. Both wind- and solar-based power generation depend on external environmental factors and, thus, are unpredictable. Hence, allowing zero compensation to renewable energy developers for over-injection beyond 10% may lead to a significant revenue loss for them. Although the minimum deviation rate for zero compensation should ideally vary across states depending on RE penetration in that state, OA market stakeholders feel the current 10% limit to be very harsh.

This setback would be in addition to several headwinds (supply chain, BCD etc.) that developers currently face in India. Moreover, such a provision may likely compel developers to schedule higher than forecast to avoid that 100% penalty. Consequently, these incorrect schedules will affect forecasting quality, ultimately defeating DSM's whole purpose.

Withdrawal of Banking Provisions

Banking unused energy for utilisation later has been a major driver of OA market growth in India. Banking also helps

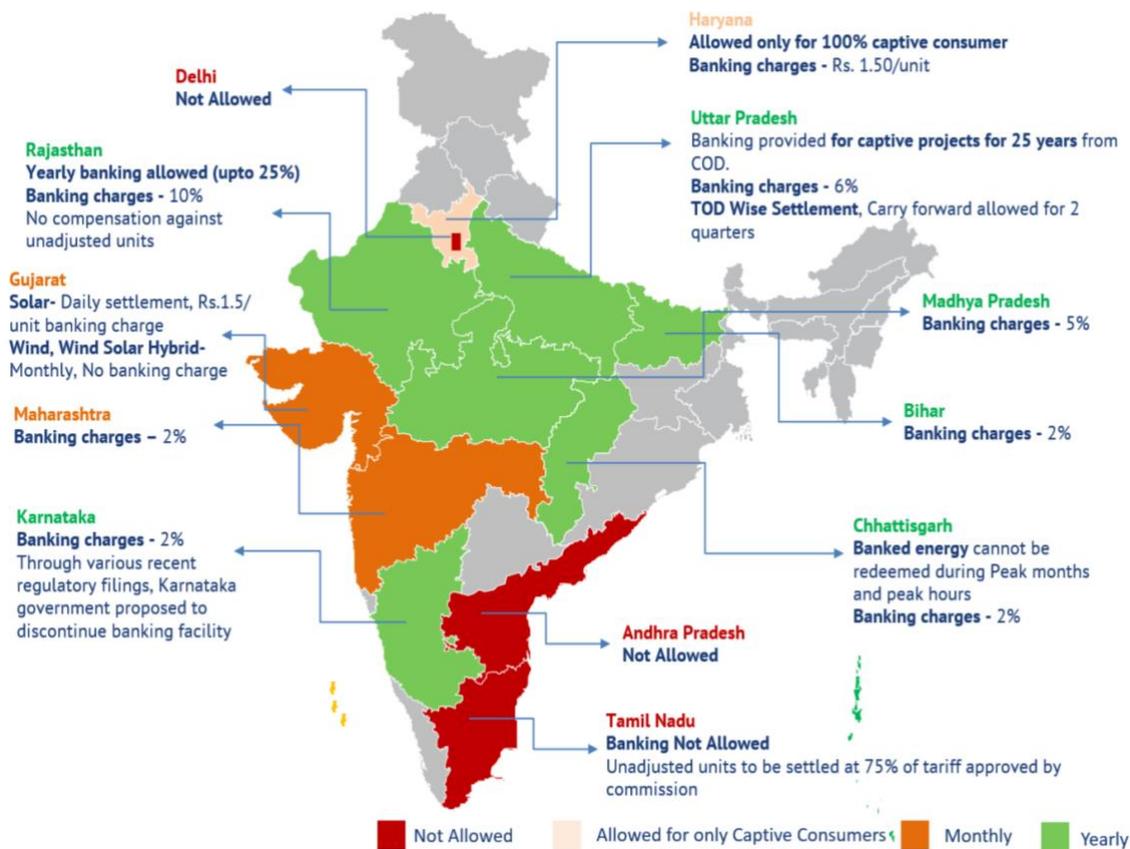
Banking unused energy for utilisation later has been a major driver of OA market growth in India.

DISCOMs maintain grid stability through peak load shifting. Yet, in recent years, many states have either limited banking or, in some cases, completely withdrawn the provision.

Across the leading renewable energy states, banking charges vary from 2% (in Karnataka, Maharashtra etc.) to as high as 10% (Rajasthan). Also, as a trend in the past couple of years, most renewable energy-rich states have moved from annual to monthly banking settlements. Renewable energy-rich states like Tamil Nadu and Andhra Pradesh have completely withdrawn their banking facility. This is a major headwind affecting the viability of OA projects, given that both these states have huge concentrations of C&I consumers in India.

The Karnataka Electricity Regulatory Commission (KERC) contemplated removing banking altogether in August 2020. However, in a September 2021 order, Karnataka finally declared it would continue with 2% banking and annual settlements. Instead, the Karnataka Renewable Energy Policy 2022-27, issued in April 2022, removed the banking provision for ISTS-connected projects.

Figure 8: Summary of Banking Provisions Across Key States



Source: JMK Research

Gujarat allows banking based on the renewable energy technology of the project. However, it discourages banking for vanilla solar projects with a high banking charge of Rs1.5/kWh and only allows daily settlements. On the other hand, no banking charge is applicable on wind and wind-solar hybrid plants.

Withdrawal of OA waivers

During FY2021-22, Gujarat and Rajasthan withdrew some OA waivers:

Gujarat Solar Policy 2021 explicitly removed any waiver for third-party OA, which was 50% on CSS and AS earlier. The state commission's order in June 2021 formalised this change.

Rajasthan Solar Energy Policy, issued in 2019, exempted electricity duty (ED). However, several solar OA consumers complained in 2021 that the state DISCOMs still applied ED. After multiple litigations, RERC finally ruled, in June 2022, to withdraw the ED waiver in the state for renewable energy OA. This was a massive setback for the developers and highlights risks that OA developers face, wherein the state did not implement the policy exemption during the control period.

Approval delays for group-captive projects in Rajasthan, Haryana and Gujarat

States targeting the viability of group-captive projects by levying AS were dealt a big blow through the Supreme Court ruling in December 2021. Still, some states are employing other means to discourage group-captive, currently the most financially viable renewable energy OA model. This includes delaying approvals of group-captive projects in states like Haryana and Rajasthan.

Table 4: Summary of Group-Captive Issues Across States

State	Issue	Current Status
Rajasthan, Haryana	<ul style="list-style-type: none"> Group-captive OA projects encounter difficulties getting approvals from state regulators. DISCOMs in both states are pushing for group-captive consumers to have a stake proportional to their energy consumption in the project. 	<ul style="list-style-type: none"> Developers who have executed projects are awaiting approvals. Many are thus forced to sell power to a DISCOM at a much lower tariff.
Gujarat	<ul style="list-style-type: none"> In February 2020, the draft solar policy of the state explicitly defined the captive mode of energy procurement by a consumer having 100% ownership of the plant. Group-captive was not recognised as a model of OA energy procurement. 	<ul style="list-style-type: none"> The final solar policy document (December 2020) still did not explicitly recognise group-captive. However, collective ownership of a captive plant is recognised with owners investing/holding 100% of the equity amount.

Source: JMK Research

This delay in the approval process of group-captive projects has forced some developers to ultimately sign DISCOM PPAs at much lower tariffs. Furthermore, Haryana imposed grid support charges (Rs1.5/kWh) on all OA consumers in May 2021. Meanwhile, Gujarat still does not officially recognise the group-captive model as a means of OA power procurement.

Green OA Charges Exemptions, as of March 2022

In the past, several states have provided exemptions to promote renewable energy OA. But in the past few years, several of those exemptions have been withdrawn. We provide the summary of OA charge waivers applicable across the states (if any) below:

Table 5: Summary of Exemptions on OA Charges

State	OA Charges Waivers
Chhattisgarh	<ul style="list-style-type: none"> 100% exemption on transmission, wheeling, SLDC charges and AS. 100% exemption on CSS for solar projects only
Delhi	<ul style="list-style-type: none"> All Open Access Consumers receiving electricity from Renewable Energy Sources are exempted from the Wheeling, Transmission, CSS and AS to the extent of quantum of RPO compliance
Gujarat	<ul style="list-style-type: none"> Electricity Duty (ED) exempted for 25 years
Haryana	<ul style="list-style-type: none"> Open Access consumers/generators must pay Rs1.50/unit for injection/drawing out of solar power in the grid as reliability charges. No waiver of wheeling and transmission charges, CSS and AS shall be given to solar/non-solar power projects set up by IPP/generators for third-party sale.
Karnataka	<ul style="list-style-type: none"> 70% exemption on AS for FY2022-23.
Maharashtra	<ul style="list-style-type: none"> ED exempted for captive projects for 10 years.
Odisha	<ul style="list-style-type: none"> 100% exemption on CSS and AS for OA consumers and 80% waiver on transmission and wheeling charges for procurement of green power.
Rajasthan	<ul style="list-style-type: none"> Wheeling charges are applicable on a per unit basis rather than contracted capacity for projects less than 25MW. Renewable energy with storage projects installed before 31 March 2023 are given a 75% exemption in intra-state transmission and wheeling charges.
Tamil Nadu	<ul style="list-style-type: none"> 50% exemption on transmission and wheeling charges. CSS exemption of 30% for solar and 40% for wind.
Uttar Pradesh	<ul style="list-style-type: none"> AS not applicable, exemption of 50% on wheeling charges/ transmission charges on intrastate sale of power and 100% exemption on ISTS on interstate sale of solar power. ED exempted for 10 years

Source: JMK Research

6. OA Market Trends

Among the many forms of renewable energy supply deals involving the OA network, captive/group-captive has been the go-to model in the last three fiscal years (FY2020-FY2022). The captive/group-captive model began overshadowing the third-party sale model in 2019.

Cut to the present, OA stakeholders, such as project developers, relevant state authorities, investors and lenders, have attained a high level of maturity in terms of experience with the captive business model.

Of late, the renewable energy OA market opened up other avenues, such as the green power market and wind solar hybrid, that are becoming increasingly favourable.

The renewable energy OA market opened up other avenues, such as the green power market and wind solar hybrid, that are becoming increasingly favourable.

Emerging Trends

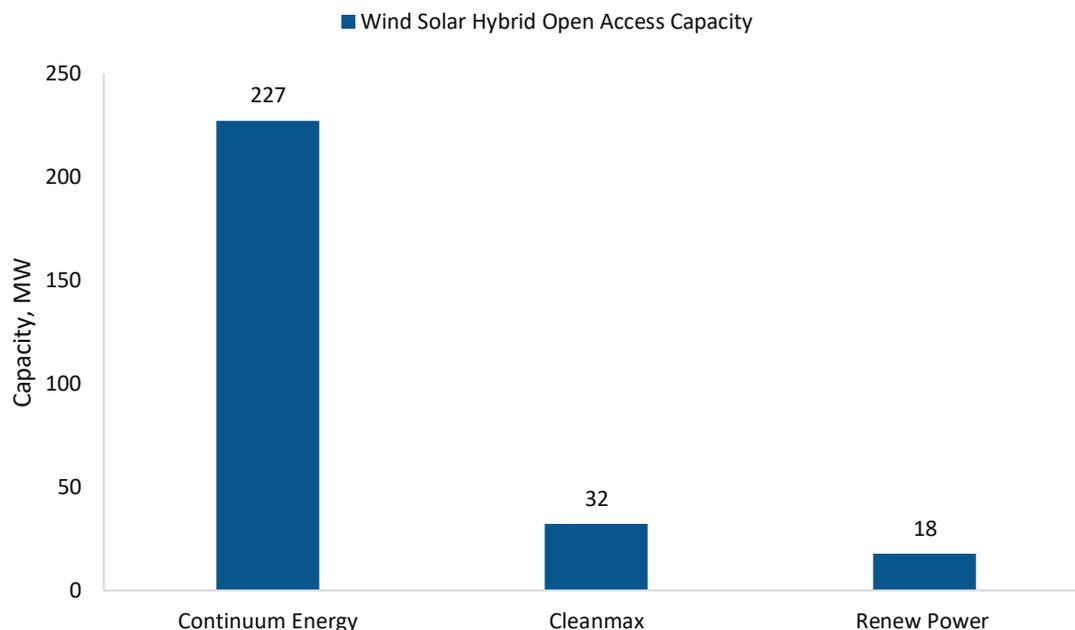
Developers Setting Up Wind-Solar Hybrid OA Projects

The wind-solar hybrid segment is gaining substantial traction in the renewable energy OA market.

Wind-solar hybrid systems help increase energy generation per MW vis-à-vis standalone solar or wind power systems. In addition, they also aid in improving the utilisation of T&D assets and maintaining grid stability.

Key developers in the renewable energy OA market, who have a considerable foothold in the wind-solar hybrid segment, are Continuum Energy, Cleanmax and ReNew Power. Continuum Energy owns and operates India's largest wind-solar co-located hybrid project in Tamil Nadu, with a capacity of 226.8MW.

Figure 9: Key Players setting up Wind-Solar Hybrid Open Access Projects in India



Source: JMK Research

States with wind-solar hybrid OA installations include Karnataka, Tamil Nadu and Gujarat. Besides being resource-rich in solar and wind, these states have favourable wind-solar hybrid policies supporting the market's growth.

Gujarat has the most favourable policy among the preferred states for wind-solar hybrid installation. In line with the National Wind-Solar Hybrid policy released in May 2018, Gujarat issued its own policy in June 2018, valid until March 2023. However, it was only after Gujarat issued the complete tariff framework for the policy in April 2021 that interest increased, and the development of wind-solar hybrid grew in the state. The tariff framework provides detailed values of all OA charges at different voltage levels. It also provides technical details about power evacuation and interconnection that must be adhered to while designing wind-solar hybrid projects in Gujarat.

Developers strongly favour Gujarat as the go-to-market for wind-solar hybrid on account of policy provisions, such as a waiver on electricity duty. Further, compared to other states, Gujarat's policy offers better clarity regarding energy banking, settlement aspects, etc. ReNew Power commissioned the state's first wind-solar hybrid project (~18MW) in February 2022.⁴ It set up the project under the captive power procurement model. All key C&I players are in the process of implementing wind-solar hybrid projects in Gujarat. Based on our interactions with industry

⁴ Economic Times. [ReNew Power commissions Gujarat's first wind-solar hybrid project](#). February 2022.

stakeholders, we expect a total of ~1GW of wind-solar hybrid projects, both C&I and utility, will likely come up in Gujarat in the next 3-4 years.

However, with less than a year left until the state's hybrid policy expires, Gujarat needs to address the uncertainty concerning the wind-solar hybrid market's long-term outlook.

Exchange-based Renewable Energy Trade Gaining Traction

OA project developers have also started exploring alternate modes of selling renewable power through the green day ahead market (GDAM) and the green term ahead market (GTAM) on power exchanges. Jointly, these two exchange-based renewables markets are known as the "green power market".

GDAM enables market participants, buyers and sellers, to transact a day in advance to deliver renewable power for up to 24 hours. As for GTAM, the transaction can be done three hours to 11 days in advance for renewable power delivery for up to one week.

The green power market is an additional avenue for renewable energy OA project developers to sell their power. To date, a select few renewable energy OA players have sold their power in this market. This had transpired only in cases where -

- A commissioned plant of the renewable energy developer had not received transmission connectivity for third-party sale
- OA approval grant from the state had been delayed or denied

The green power market is an additional avenue for renewable energy OA project developers to sell their power.

In addition, apart from a nominal fee per application, sellers among these renewable energy OA developers, whose projects have connections to either the Central Transmission Utility (CTU) or the Inter-State Transmission System (ISTS) network, need not pay any charges. Thus, such sellers in the green power market, who have faced restrictions in long-term renewable energy OA transactions, have found exchange-based trading beneficial and lucrative.

Furthermore, developers can sell surplus power in the green power market with increasing restrictions across various states on energy banking.

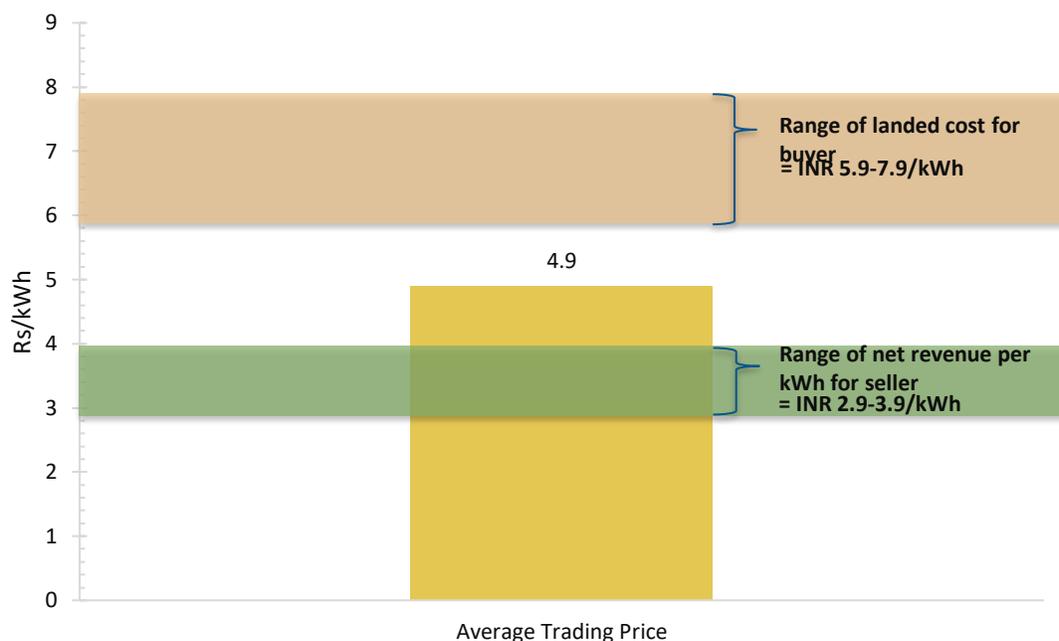
There is a huge need for integrating renewable energy into the electricity grid. Transitioning to a renewable energy-dependent economy will lead to lesser emissions of greenhouse gases (GHGs) and strengthen national energy security. With flexibility in transaction and certainty of power dispatch schedule, open access renewable energy trade via power exchange enhances the integration of clean power into the grid. This calls for a greater volume of transactions that require

higher supply-side participation. For this, stricter enforcement of RPO for obligated entities is necessary as it would augment renewable energy merchant capacity.

From its inception to April 2022, the green power market has allowed 7,660MUs of renewable energy transactions at an average price of Rs4.9/kWh.

Based on this price, we show the likely ranges for landed cost for the buyer and net revenue per kWh for the seller in Figure 9. For example: if the trading price is Rs4.9 per kWh, the landed cost for buyers (after adding relevant OA charges to the trading price) would be in the range of Rs5.9-7.9 per kWh. As for the sellers, the net revenue from the trade of green power (after deducting relevant OA charges from the trading price) would be Rs2.9-3.9 per kWh.

Figure 10: Trading Price v/s Net Price in Green Power Market



Source: JMK Research

Note: The above figure is only for representational purposes. The actual landed cost for the buyer and net revenue per kWh for the seller vary across states.

Some OA project developers, such as Amplus Solar and Adani Green Energy, have already begun using power trading platforms for trading renewable energy.

The green power market is still a niche category in the portfolios of OA developers. As discussed earlier, stricter enforcement of RPOs is necessary to increase sell-side participation to catalyse market growth.

Upcoming Trends

Additional alternatives to procuring renewable power through OA, such as renewable energy+storage, international renewable energy certificates (IRECs) and virtual power purchase agreements (VPPA), are yet to commercially be a part of the stream of avenues highlighted in the previous section. However, the C&I market is actively exploring these alternative solutions.

Integrating Energy Storage System with Renewable Energy

Excess electricity generated by renewable energy OA plants needs immediate utilisation or stored for use later. Wasting this electricity adversely impacts the viability of OA projects.

With regressive measures imposed against banking provisions by various states, storing excess electricity in energy storage systems is becoming an attractive option for OA developers.

Additionally, renewable energy+storage can be a strong value proposition for OA consumers who regularly consume power for about 0.5-1 hours per day through diesel-power generators.

Also, use-cases, such as time-of-use arbitrage and demand management, hold substantial potential for developing renewable energy+storage in the OA segment. However, apart from location and regulatory factors, the commercial viability of the renewable energy+storage system also hinges on the related capital expenditure (CAPEX). And this factor is yet to reach favourable levels in the Indian market.

Increased Adoption of "Green Tariff"

Yet another novel means for procuring green energy by C&I consumers is by paying a green tariff. Through this route, C&I consumers voluntarily pay a premium over the conventional retail brown power tariff. The sum of the premium and brown power tariff is the cost of supplying renewable energy power procured by DISCOMs. It includes the average pooled power purchase cost of renewable energy, among other charges.

Green tariff is likely to take off significantly in states with a relatively lesser share of renewable energy in their energy mix. Also, paying a green tariff is not generally perceived as low-hanging fruit by an organisation under its renewable energy transition strategy. Besides, in a price-sensitive market such as India, C&I consumers may be less likely to pay a premium for renewable energy.

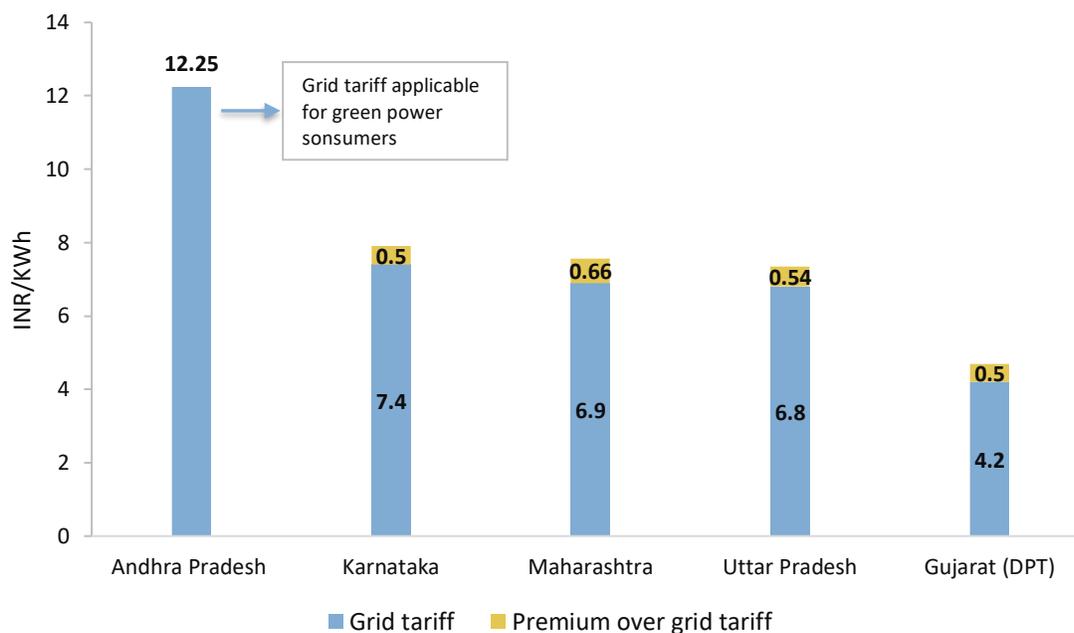
Green tariff is likely to take off significantly in states with a relatively lesser share of renewable energy in their energy mix.

However, in a survey conducted across Maharashtra, Karnataka and Gujarat, 82%

of C&I respondents showed a willingness to source power through the green tariff route.⁵

At present, four states – Andhra Pradesh, Karnataka, Maharashtra and Gujarat – have introduced green tariffs. It is interesting to note that Andhra Pradesh has created an entirely separate consumer category, known as Green Power Consumer, for its renewable energy scheme. Green Power Consumers must pay nil fixed and energy charges of Rs12.25/kWh.

Figure 11: Green Energy Tariff Across States



Source: Tariff regulations of various State Electricity Regulatory Commission (SERCs), JMK Research

Note: (1) Grid tariff shown is for industrial consumers connected at 33 kV voltage; (2) Grid tariff includes only energy charges (does not include fixed charges). Hence, the actual retail tariff will be higher.

Deendayal Port Trust, a Gujarat-based DISCOM, introduced a green tariff through its tariff order issued in September 2021. However, the Gujarat Energy Regulatory Commission (GERC) refused to allow the same for other DISCOMs in the state. GERC cited the current shortfall in meeting RPO targets by other state DISCOMs as the main reason for this refusal. GERC argued that it is only meaningful to introduce a green tariff when a DISCOM's renewable energy procurement is more than its RPO targets. Interestingly, the Green OA Policy, finalised by the Ministry of Power after this ruling by GERC in June 2022, allows state DISCOMs to fulfil their RPO targets from excess energy consumption of green energy consumers.

⁵ Mercom, [Green Power Tariff: An attractive Option for Consumers to Access Solar and Wind Power](#). June 2021.

DISCOMs create regulatory hurdles to prevent the migration of their high-paying C&I consumers to renewable energy. Thus, power procurement via the green tariff route creates a favourable “win-win” scenario for both DISCOMs and the C&I consumers. However, there is a concern regarding the current treatment of green tariff as a premium over retail grid tariff. The green tariff should be significantly lower from their current values as the average power procurement cost from renewables is lower. Despite all concerns, based on our interactions with project developers, we expect more states to introduce green tariffs soon for their C&I consumers.

VPPA

Under VPPA, the power producer sells its electricity on the power exchange at a market price. The consumer purchases the renewable energy attribute associated with the traded power for a pre-agreed price called the strike price. However, the difference between the strike price and the wholesale market rate forms the basis of the actual price settlement between the consumer and the power producer.

When the market rate is higher than the strike price, the power producer pays the difference to the consumer. Whereas when the market price is lower, the consumer pays the difference.

The VPPA route of renewable energy procurement is increasingly garnering the limelight in India. Albeit, the Indian VPPA market is yet to grow beyond the exploratory stage.

Many C&I developers, nonetheless, believe that the potential opportunity for open access stakeholders in the VPPA segment is immense.

A VPPA, if structured properly, can offer a financial hedge against future volatility of power prices. Further, entering into a VPPA does not impact the dynamics between the consumer and the relevant DISCOM. As VPPA is essentially just a financial contract, the physical power supply to the consumer is unhindered. Certainly, there are discernible benefits to signing up for VPPA.

However, while the VPPA market is an established renewable energy procurement avenue in the developed economies, such as the United States of America and the European Union, it is stuck as a concept in India, owing to primarily a regulatory roadblock.

For about a decade, the power regulating authority, the Central Electricity Regulatory Commission (CERC) and the regulatory body for securities and commodity market, the Securities and Exchange Board of India (SEBI), were in a

**Many C&I developers,
nonetheless, believe that
the potential opportunity
for open access
stakeholders in the VPPA
segment is immense.**

legal dispute with each other. The dispute relates to regulatory jurisdiction over the new market instruments – forward contracts and futures in electricity. However, on 6 October 2021, with the Supreme Court's intervention, the tussle between the two regulators ended.⁶

The apex court allowed the introduction of forward contracts and futures for power trading per the mutually agreed terms between the two parties. And as per these terms, VPPA is effectively out of jurisdictional bounds for both CERC and SEBI.

With the much-needed clarity on the regulatory front, based on our interactions with project developers, we expect the Indian VPPA market to make some on-ground progress soon.

IRECs

Relative to renewable energy certificates (RECs), IRECs have an independent mechanism to facilitate their issuance, sale, purchase and retirement. Further, there is traceability in the case of IRECs as against RECs.

However, since IRECs are not under the scope of Indian electricity regulations, C&I consumers' domestic RPO fulfilments do not reflect the IRECs they trade. Thus, IRECs are a credible support mechanism for organisations that are only voluntarily inclined to purchase renewable energy.

7. Non-regulatory Challenges in Renewable Energy OA market

Besides regulatory hurdles, supply-side constraints have been major headwinds for the Indian renewable energy OA market. The volatility of commodity prices and uncertainty on renewable energy equipment supply has exacerbated project delays because of late open access approval.

Inflated Module Cost

Globally, the prices of solar modules surged at an unprecedented rate after mid-2020. The critical factor behind the surge is the steep rise in polysilicon prices. Acute shortage of polysilicon led to an increase in its market price from US\$6.8/Kg in July 2020 to US\$38.9/Kg in March 2022.

The volatility of commodity prices and uncertainty on renewable energy equipment supply has exacerbated project delays because of late open access approval.

⁶ Business Standard. [Supreme Court settles 10-yr long CERC, SEBI dispute](#). October 2021.

The impact of rising polysilicon prices cascaded down the photovoltaic (PV) value chain to the solar module stage. Monocrystalline passivated-emitter-and-rear-contact (Mono PERC) – the current workhorse among PV technologies – saw a price surge of ~38% from Rs15/watt-peak (Wp) (US\$0.20/Wp) in August 2020 to Rs20.6/Wp (US\$0.275/Wp) in March 2022.⁷

The cost of OA solar projects in India has increased by at least 15% because of the global supply chain constriction. Moreover, the viability of such projects has been exacerbated further by India-specific challenges, which we discuss subsequently.

Imposition of BCD

In March 2021, the Indian government announced the imposition of basic customs duty (BCD) at 40% on imported solar modules and 25% on imported solar cells from 1 April 2022. This duty/tariff barrier has aggravated the existing demand-supply imbalance in the solar industry.

If open access solar projects consider BCD-imposed modules, the project cost will likely rise by 20-25%. Similarly, if they consider domestic modules with BCD-imposed cells, the project cost could increase by 5-10%.⁸

Amid the supply-side constraints, BCD imposition would raise the average open access solar tariff (bus bar⁹) to more than Rs3.8/kWh (US\$0.053/kWh).

Paucity in Supply of High-efficiency Domestic Modules

As of March 2022, India's total solar module production capacity was ~19GW per annum. However, most of this capacity is from multi-crystalline silicon (multi-Si) technology, which has become near-obsolete in the Indian context. Meanwhile, we expect the domestic demand for advanced high-efficiency modules to be 15-20GW in the medium term.

ALMM Restriction

On 13 January 2022, the Ministry of New and Renewable Energy issued amendments to the Approved List of Models and Manufacturers (ALMM) of Solar Modules (Requirements for Compulsory Registration) Order, 2019. This amendment extended the scope of ALMM to OA and net metering projects.

The ministry initially proposed ALMM inclusion to be applicable for solar projects with open access or net metering provision from 1 April 2022. Later, however, the government decided to defer the date of ALMM enforcement for open access and net metering projects to 1 October 2022.

There are about 3-4GW of capacity in-pipeline in the OA segment. After the effective date of ALMM enforcement, module procurement aspect for most of these projects

⁷ JMK Research

⁸ JMK Research

⁹ The point beyond the energy generating plant but prior to voltage transformation point in the plant switchyard.

would bear huge uncertainties, decelerating execution of under-development projects in the current year.

Of the 14GW of ALMM-listed capacity, a large chunk (~75%) represents outdated modules. The remaining domestic module capacity offer high-wattage (greater than 400Wp) modules.

The lack of these high-wattage modules implies lower energy generation, thus putting upward pressure on the future open access solar price. Owing to this, lenders and equity investors will likely be more hesitant to fund such projects in the near term.

From February-March 2022, leading domestic solar manufacturers increased the prices of their modules by US\$0.30-0.40/Wp, anticipating more supply-side constraints.

Module price volatility will persist in the Indian solar landscape for the next 1-2 years. We expect a substantial portion of the high-wattage domestic module capacity will cater to the export market. This would be an added constraint to the supply of such modules for the Indian market.

8. Way Forward

Technological Evolution to Continue

Technological shifts inside the clean power sector will also impact the renewable energy OA sector. PV technology is continuously evolving, considering multi-Si that was the standard a few years back is currently almost obsolete. We expect the next significant shift in PV technology to be towards mono PERC bifacial. High-wattage output solar modules with large wafer sizes (M10, M12) will become the norm as the developers look to maximise the efficiency/generation of their OA plant. Combining single- or multi-axis trackers can further enhance generation.

Developers opting for imported bifacial modules along with a single-axis tracker can achieve about 20% to 22% generation gain, which, in part, can compensate for the higher project cost.¹⁰ Developers will also look at alternate ways to increase efficiency, for example, introducing advanced operation and maintenance (O&M) practices such as robotic cleaning.

¹⁰ JMK Research

Legal Tussle Expected Between the Centre and the States

Electricity is a concurrent subject in India, wherein states have sovereignty to design and implement their policies. Section 42 of the Electricity Act, 2003 gives state commissions jurisdiction to determine their OA charges and OA eligibility capacity limits.¹¹ Of late, the general stance of states has been to hinder the migration of their high-paying C&I consumers to renewable energy OA. The Centre, on the other hand, has come up with several policies, such as Green OA Policy, to promote renewable energy OA.

The general stance of states has been to hinder the migration of their high-paying C&I consumers to renewable energy OA.

Green OA Policy, issued in June 2022, has several contentious provisions that will lead to significant tussles between states and the Centre upon implementation. Such provisions include OA eligibility limit (reduced to 100kW), mandatory banking, and removal of DISCOMs as nodal agencies for OA. Based on our interactions with industry stakeholders, we expect the removal of AS for renewable energy OA consumers to be a major point of contention. We also expect similar legal disputes for future central policies affecting the OA market.

New Policy Developments Expected

Going forward, based on regulatory trends of the past few years, we anticipate the following policy developments based on ongoing market trends:

- **Consumer profile will drive OA waivers** – In the past couple of years, the central government has formulated policies to grant OA waivers based on the energy consumers use.

In January 2022, the Ministry of Power issued guidelines on charging infrastructure for Electric Vehicles (EV). The guidelines specified priority grant of OA and waiver of any other surcharge except CSS. Also, it set the limits for CSS and energy tariff on electricity consumption in EV charging stations. Similarly, National Green Hydrogen Policy (February 2022) specified ISTS waiver, mandatory banking, and priority grant of OA for a green hydrogen/ammonia producer. We expect the regulators to extend similar waivers to other industries such as steel. Green steel is already a popular catchphrase in many western countries for steel made using renewable energy.

- **National Electricity Amendment Act** – The Ministry of Power issued the draft Electricity (Amendment) Bill 2020 on 17 April 2020. The bill contained certain provisions impacting the OA market. The amendments proposed a new national renewable energy policy, stricter compliance of RPO by states and systematic reduction of CSS charges over the years. However, the amendments are not yet

¹¹ Ministry of Law and Justice

final. The delay is because of stringent opposition to some of the amendment's provisions by farmers, state-owned DISCOMs and power utility staff associations.¹² We expect that this bill will finally become an act in FY2023.

- **DISCOM Privatisation** – DISCOM losses in India are significant and have increased from Rs345 billion (~US\$4.42 billion) in FY2019-20 to Rs590 billion (~US\$7.56 billion) in FY2021-22.¹³ The government considers the privatisation of DISCOMs as a solution to reduce the financial woes and improve the efficiency of the whole distribution network.

The government considers the privatisation of DISCOMs as a solution to reduce the financial woes and improve the efficiency of the whole distribution network.

Thus, since 2020, the Centre has accelerated plans to privatise multiple DISCOMs, especially in central government-administered Union Territories. Even after facing multiple hurdles, during the financial year 2021-22, the Centre privatised DISCOMs in Chandigarh, Daman & Diu and Dadra and Nagar Haveli. In addition, there are plans to expedite the privatisation process for DISCOMs of major states such as Uttar Pradesh, Gujarat, Haryana, Karnataka and Madhya Pradesh. The improvement in the financial health of DISCOM through privatisation in these states will indirectly lead to lower tariffs and surcharges for C&I consumers. This would allow the OA market to grow unrestrained.

Multiple Revenue Streams for OA Developers

Intra-state OA (through third-party/captive/group-captive) has been the traditional renewable OA power procurement method until 2020. The introduction of green power markets (GTAM in 2020 and GDAM in 2021) allowed developers to generate additional revenue through their unutilised electricity.

We expect the growth of the green power market and the development of novel markets, such as VPPA and IRECS, to offer developers multiple revenue streams in the future. With renewable energy OA waivers already down to a minimum in most states (with further reduction expected in coming years), an OA project's participation in multiple markets will be essential.

¹² Hindustan Times. [Government drops four clauses from draft electricity bill](#). December 2021.

¹³ Economic Times. [Power discoms losses widened to Rs 59,000 crore in 2021-22: Report](#). June 2022.

9. Conclusion

Despite all the challenges and hurdles the OA market has faced over the years, it is still growing organically. All major renewable energy OA players have a healthy pipeline of projects with strong financial backing from investors. Several overseas firms are also vying to enter the Indian renewable energy landscape through investment (equity/debt) or acquisition.

Most states have withdrawn the waivers on OA charges, and others may follow suit. Yet, all stakeholders have a sense of optimism about the market. C&I consumers' awareness of alternate power procurement modes has increased tremendously in the past five years. Substantial cost savings in electricity and a growing focus on net-zero targets drive the understanding of new procurement modes. Environmental, social and governance (ESG) ratings of C&I consumers are gradually becoming a vital parameter to attract investors and clients.

Thus, this momentum of the C&I sector to source green power, mainly through OA, will only increase. Surveys conducted across several states further underscore this drive of C&I consumers towards green energy. The surveys show that most C&I consumers are even willing to pay DISCOMs a premium over the existing tariff (green energy tariff) for renewable energy supply. Corporates are also exploring VPPA as a viable avenue for sourcing clean energy.

The momentum of the C&I sector to source green power, mainly through OA, will only increase.

The Supreme Court's quashing of AS by Maharashtra and the Green OA Policy were two significant positive policy developments during the past year. The two major takeaways from the Green OA Policy were long-term clarity about banking and OA charges. However, state commissions must approve the policy for its successful implementation across the country. As differing regulations regarding OA exists across states, we expect some dispute between the Centre and the states.

Despite some key positive changes, the sector has recently faced many regulatory and non-regulatory hurdles. Regulatory hurdles include delays in approvals for group-captive projects and unfavourable banking provisions.

The renewable energy industry has been reeling under supply chain constraints for the last few months. This has ultimately contributed to the rising cost of solar modules, leading to higher landed costs of OA projects. Our interactions with industry stakeholders show that several OA projects are currently on-hold and expect to be so until there is clarity on equipment prices. Domestic PV manufacturing infrastructure is under development to counter such situations in future.

The imposition of BCD of 40% on imported modules and the forthcoming implementation of ALMM for OA developers from October 2022 are India-specific risks that further exacerbate the worrisome situation.

Going forward, the central government, state governments and regulators can take multiple steps to drive further growth in the OA sector. This includes:

- States need to implement a multi-year tariff structure, with a minimum control period of five years, to provide long-term regulatory clarity and certainty to developers/investors.

- Banking restrictions hamper the financial viability of OA projects. Hence, until India achieves the renewable energy targets, states must not impose further restrictive measures on banking. Alternatively, regulators can promote banking by allowing banked energy with DISCOMs to contribute to their RPOs.

- Proper implementation of the Green OA Policy, as it provides mandatory banking and other provisions, becomes essential.

- Until significant development of domestic manufacturing capacity of high-wattage modules, the Centre should keep renewable energy OA projects out of the ambit of ALMM.

- With the newfound regulatory clarity on VPPA after the Supreme Court order, regulators can incentivise developers to build VPPA-based renewable energy OA projects. VPPA contracts are a win-win-win solution for consumers, developers and DISCOMs alike.

Moreover, India's ambitious non-fossil fuel target of 500GW by 2030 will require a concerted development of all sectors. Going forward, central tendering alone will not be enough. Along with central tendering, the renewable energy OA market will also play a vital role in reaching that target.

About JMK Research & Analytics

JMK Research & Analytics provides research and advisory services to Indian and International clients across Renewables, Electric mobility, and the Battery storage market. www.jmkresearch.com

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

About the Authors

Jyoti Gulia

Jyoti Gulia is the Founder of JMK Research and has about 16 years of rich experience in the Indian renewable sector. Her core expertise includes policy and regulatory advocacy, assessing market trends, and advising companies on their business strategy. Jyoti.gulia@jmkresearch.com

Akhil Thayillam

Akhil is a Senior Research Associate at JMK Research. A renewable sector enthusiast, he has experience in tracking new sector trends as well as policy and regulatory developments.

Prabhakar Sharma

Prabhakar is a Senior Research Associate at JMK Research with expertise in tracking the renewable energy and the battery storage sector. Previously, he worked with Amplus Solar.

Vibhuti Garg

Energy Economist Vibhuti Garg has advised private and public sector clients on commercial and market entry strategies, investment diligence on power projects and the impact of power sector performance on state finances. She also works on international energy governance, energy transition, energy access, reallocation of fossil fuel subsidy expenditure to clean energy, energy pricing and tariff reforms. vgarg@ieefa.org

This report is for information and educational purposes only. The Institute for Energy Economics and Financial Analysis ("IEEFA") does not provide tax, legal, investment, financial product or accounting advice. This report is not intended to provide, and should not be relied on for, tax, legal, investment, financial product or accounting advice. Nothing in this report is intended as investment or financial product advice, as an offer or solicitation of an offer to buy or sell, or as a recommendation, opinion, endorsement, or sponsorship of any financial product, class of financial products, security, company, or fund. IEEFA is not responsible for any investment or other decision made by you. You are responsible for your own investment research and investment decisions. This report is not meant as a general guide to investing, nor as a source of any specific or general recommendation or opinion in relation to any financial products. Unless attributed to others, any opinions expressed are our current opinions only. Certain information presented may have been provided by third-parties. IEEFA believes that such third-party information is reliable, and has checked public records to verify it where possible, but does not guarantee its accuracy, timeliness or completeness; and it is subject to change without notice.