

# Rooftop Solar Lagging: Why India Will Miss Its 2022 Solar Target

## *Utility-Scale Solar Has Done the Heavy Lifting So Far*

### Executive Summary

India is projected to miss its target for 2022 of having 100 gigawatts (GW) of installed solar capacity by ~27%.

This report anticipates that by December 2022 there will be a shortfall of 25GW from the 40GW rooftop solar target, and 1.8GW from the 60GW utility-scale solar target, indicating the need for a concerted effort towards expanding rooftop solar.

On the current trajectory, India's solar target of 300GW by 2030 will be off the mark by about 86GW.

The anticipated 27GW shortfall from the 2022 solar target can be attributed to multiple challenges including regulatory roadblocks; net metering limits; the twin burdens of basic customs duty (BCD) on imported cells and modules and issues with the Approved List of Models and Manufacturers (ALMM); unsigned power supply agreements (PSAs) and banking restrictions; financing issues plus delays in or rejection of open access (OA) approval grants; and the unpredictability of future OA charges.

The report proposes short- and long-term measures to get India back on track to meet solar targets.

#### Short-term

- Uniform policies to apply nationally for at least the next five years.
- Consistent regulations for net metering and banking facilities, also to apply nationally.
- Restrictions on banking revoked at least until rooftop and OA state targets have been achieved.

#### Long-term

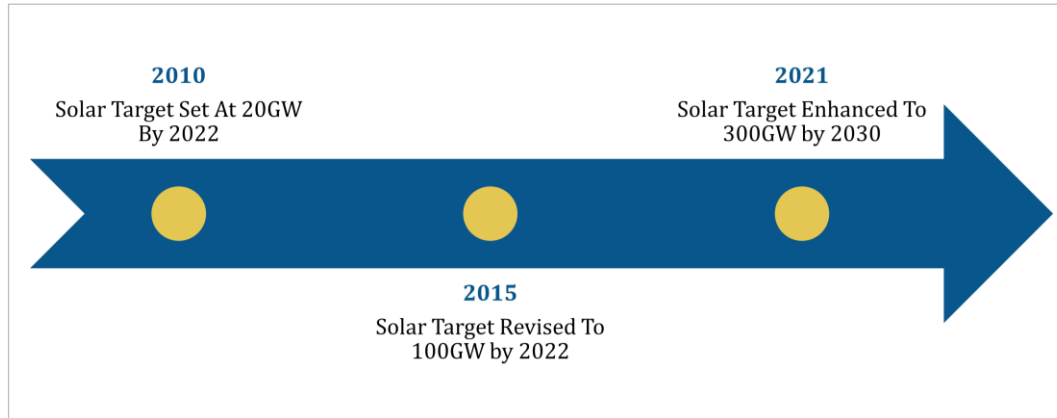
- Stricter enforcement of the renewable purchase obligation (RPO).

- Improved financial health, and potentially privatisation, of distribution companies (discoms).
- Reduced cross-subsidy surcharge (CSS) for commercial and industrial (C&I) consumers.
- A capital subsidy for Battery Energy Storage Systems (BESS).

## 1. Introduction

Over the past decade, the solar sector in India grew at a compound annual growth rate (CAGR) of ~59% from 0.5GW in 2011 to 55GW in 2021.<sup>1</sup> To enhance national energy security and to promote environmentally sustainable energy choices to fuel economic growth, the Government of India (GoI) launched the Jawaharlal Nehru National Solar Mission (JNNSM), also known as the National Solar Mission (NSM) scheme in January 2010. This marked the beginning of focussed promotion and development of solar power in India. Under the scheme, the total installed capacity target was set as 20GW by 2022.<sup>2</sup> In 2015, the target was revised to 100GW, with no change in the timeline.<sup>3</sup> Then in August 2021, the government increased the solar target to 300GW to be achieved by 2030.<sup>4</sup>

**Figure 1: Timeline of India's Solar Target Announcements**



Source: JMK Research.

In the past few years, advances in solar technology and economies of scale primarily helped to lower solar tariffs. Demand in India's price-sensitive solar market experienced robust growth, stimulated by the deflationary trend of solar. Tariffs fell from Rs9.28/kWh in 2011 to Rs2.14/kWh in 2021, while annual capacity addition grew from 0.2GW in 2011 to 11GW in 2021 during the same period.

<sup>1</sup> JMK Research.

<sup>2</sup> NRDC. [India Records Its Climate Actions by Copenhagen Accord Deadline](#). February 2010.

<sup>3</sup> Business Line. [Solar power capacity target raised five-fold to 100 GW](#). June 2015.

<sup>4</sup> Economic Times. [Solar energy to contribute 300 GW to India's RE target: Amitesh Sinha, Jt Secy, MNRE](#). August 2021.

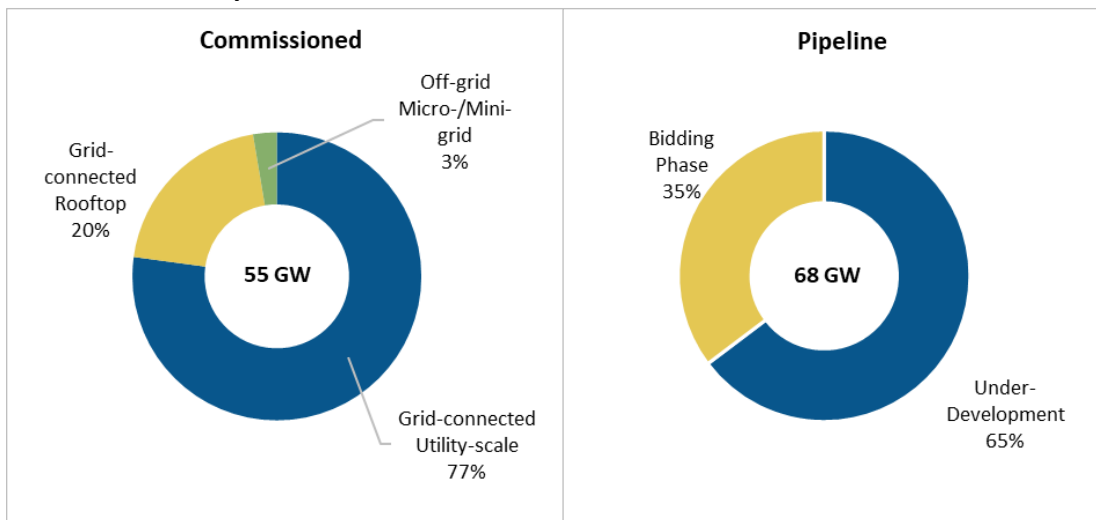
With just eight months of 2022 remaining, only ~50% of the 100GW solar target has been met. Headwinds ranging from pandemic-induced supply chain disruption to deeply rooted policy restrictions impede market growth. As the 100GW target capacity includes different scales of installation, this analysis is on the basis of installation scale, the progress, prospects and challenges as well as potential means to achieve the government targets.

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## 2. Achievements (as of December 2021)

In the global solar installation marathon, India is, currently, in fifth position after China, U.S., Japan and Germany.<sup>5</sup> As of December 2021, the cumulative solar installed capacity of India is 55GW.<sup>6</sup> The share of solar power is about 50% of the renewable energy (RE) capacity (excluding large hydro power) and 14% of the overall power generation capacity of India.<sup>7</sup> Of the 55GW, grid-connected utility-scale projects contribute 77% and the balance comes from grid-connected rooftop and off-grid projects.

**Figure 2: Share of Solar Capacity – Commissioned and Pipeline (as of December 2021)**



Source: Ministry of New and Renewable Energy (MNRE), JMK Research.

Note: Grid-connected rooftop solar capacity (11GW) taken for the above figure is an estimate by JMK Research & Analytics; The rooftop solar capacity, as per MNRE, is ~6GW.

<sup>5</sup> IRENA.

<sup>6</sup> JMK Research.

<sup>7</sup> JMK Research.

Additionally, other than the commissioned solar capacity, as of December 2021, ~68GW of solar capacity was in various stages of development. Of this, ~44GW of solar capacity was under development where auctions were completed and another 24GW was in bidding phase, i.e., where tenders were issued but auctions were not yet concluded.

Whether utility-scale or rooftop, India's solar market has undergone development at varied pace. This report presents the track records, bottlenecks and more importantly potential measures for enhancing the solar deployment to reach the 2030 targets.

### *Utility-scale*

Of the 55GW commissioned solar capacity, nearly 42GW comes from the utility-scale segment. Within this, OA accounts for just 14% while the remaining 86% is represented by the distribution company (discom) power purchase agreement (PPA) projects.

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Interest from international investors and the availability of standardised and secure long-term (25-year) PPAs are among notable factors that led the development of utility-scale solar.

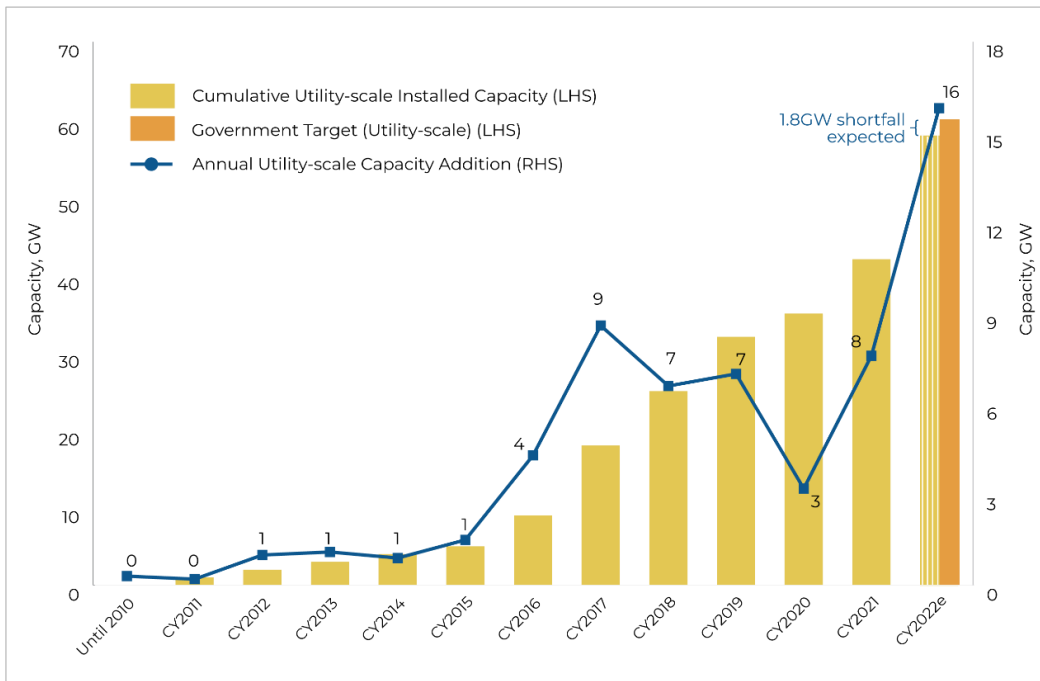
Key growth contributors to the discom PPA market include the provision of solar parks enabling faster arrangement of land and evacuation, the transition from feed-in-tariffs (FiTs) to reverse bid auctions and increased payment security for project developers in relation to central agency-tendered projects.

Contributing to the growth of open access were the increasing need for low-cost alternate power procurement options, the sustainability goals of commercial and industrial (C&I) consumers and RE100 targets. Also, initially, state governments promoted OA via such incentives as concessional wheeling and banking facilities, and waivers on certain OA charges, among them cross-subsidy surcharge (CSS), additional surcharge (AS) etc.

In 2017, the utility-scale market added 9GW of solar capacity, the highest annual addition so far. In 2018 and 2019, about 7GW annual capacity was added, then in 2020, the figure plummeted to 3GW due to the COVID-19 pandemic as shortage of solar equipment and labour delayed projects. However, in 2021 there was a substantial recovery, with ~8GW capacity added.

In 2022, JMK Research estimates 15.8GW of utility-scale solar capacity will be added. And with this capacity addition, the utility-scale segment is anticipated to achieve 58.2GW of cumulative capacity by 2022. Thus, there would arise a minor shortfall of 1.8GW from the 60GW utility-scale solar target.

**Figure 3: Utility-scale Solar Capacity Addition Trend**



Source: JMK Research.

Of the capacity addition expected in 2022, about 37% is likely to come from major players Adani and National Thermal Power Corporation (NTPC). And about 60% of the potential utility-scale capacity addition in 2022 is likely to be installed in Rajasthan and Gujarat, mainly through Solar Energy Corporation of India (SECI) and NTPC tenders.

The duty-free period (August 2021 to March 2022) on imported modules and the window available for OA projects until the effective date of implementation of the approved list of models and manufacturers (ALMM), i.e., October 1, 2022 are critical windows for module procurement. The estimated solar capacity addition in 2022 will be largely driven by projects installed using the modules that have been purchased in these timeframes. The recent announcement regarding the deferral of effective ALMM date for OA projects from April 1, 2022 is a major relief for stakeholders. The assured ALMM-free window until Q3 2022 would substantially spur the deployment of OA as well as rooftop solar projects in India. Rooftop and OA projects alike will gain substantial benefits from the deferral.

### Rooftop Solar

In December 2015, the GoI launched the first phase of the grid-connected rooftop solar program, aiming to provide incentives for residential, institutional and social use. The second phase, approved in February 2019, had a target of 40GW of cumulative rooftop solar capacity by 2022, with incentives in the form of central financial assistance (CFA). As of November 2021, of the phase 2 target of 4GW set for the residential sector, only 1.1GW had been installed.

In its early years, India's rooftop solar market struggled to grow, held back by lack of consumer awareness, inconsistent policy frameworks in centre and state governments and absence of non-recourse financing.

More recently, there has been a sharp rise in rooftop solar installations thanks to falling technology costs, increasing grid tariffs, rising consumer awareness and the growing need for achieving cost savings (especially within the C&I segment). These factors are expected to persist, providing much-needed traction for this segment.

In the past year, there has been a significant surge in residential installations, driven by state government programs. One stand-out success was the Surya Urja Rooftop Yojana of Gujarat. The incentive enabled Gujarat to achieve the highest cumulative rooftop installed capacity (~1.6GW<sup>8</sup>) among all the states. Under the scheme, a 40% subsidy from the state is provided on installation of systems less than 3kW and 20% subsidy for 3kW-10kW rooftop solar systems.

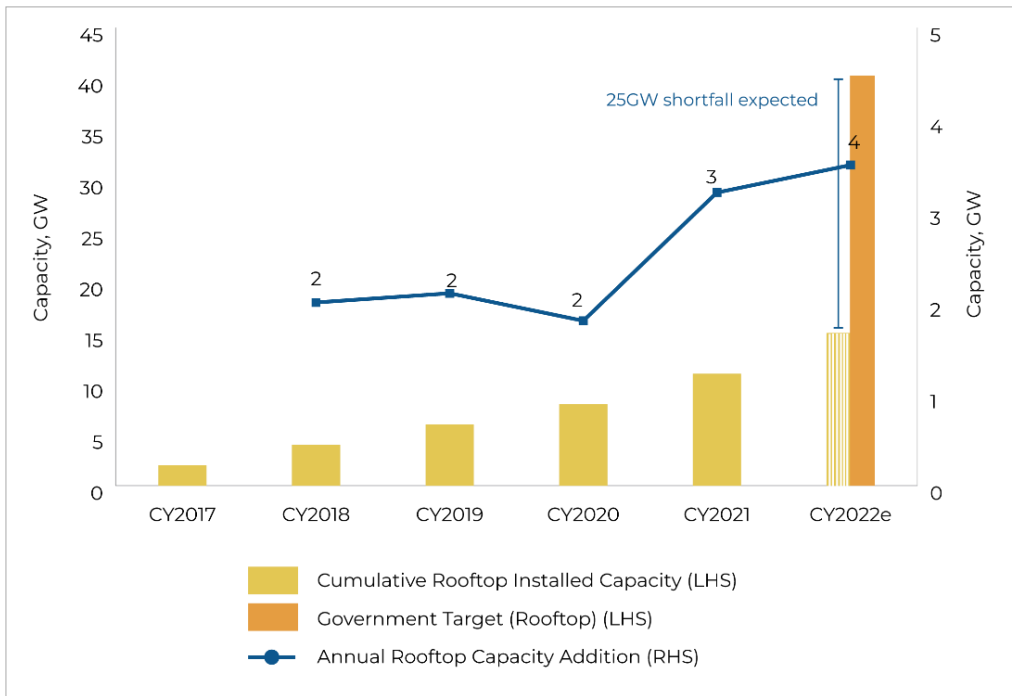
**Gujarat's Surya scheme  
has enabled the state  
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all the states.**

In terms of cumulative installation, JMK Research estimates rooftop solar capacity in India reached 11GW to December 2021. The rooftop solar installation grew at a CAGR of 54% between 2017 and 2021. As is evident from the figure below, the rooftop solar target is highly unlikely to be met, with just over a quarter of the 40GW target capacity being achieved by 2021. The predicted annual capacity addition for 2022 is 3.5GW, bringing the anticipated cumulative rooftop solar capacity to 15GW by December 2022 (so the rooftop solar target shortfall is 25GW). With shortfall tallies combined, India is likely to miss the 100GW target by about 27GW, mainly due to the underwhelming growth of rooftop solar.

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<sup>8</sup> MNRE.

Figure 4: Rooftop Solar Capacity Addition Trend



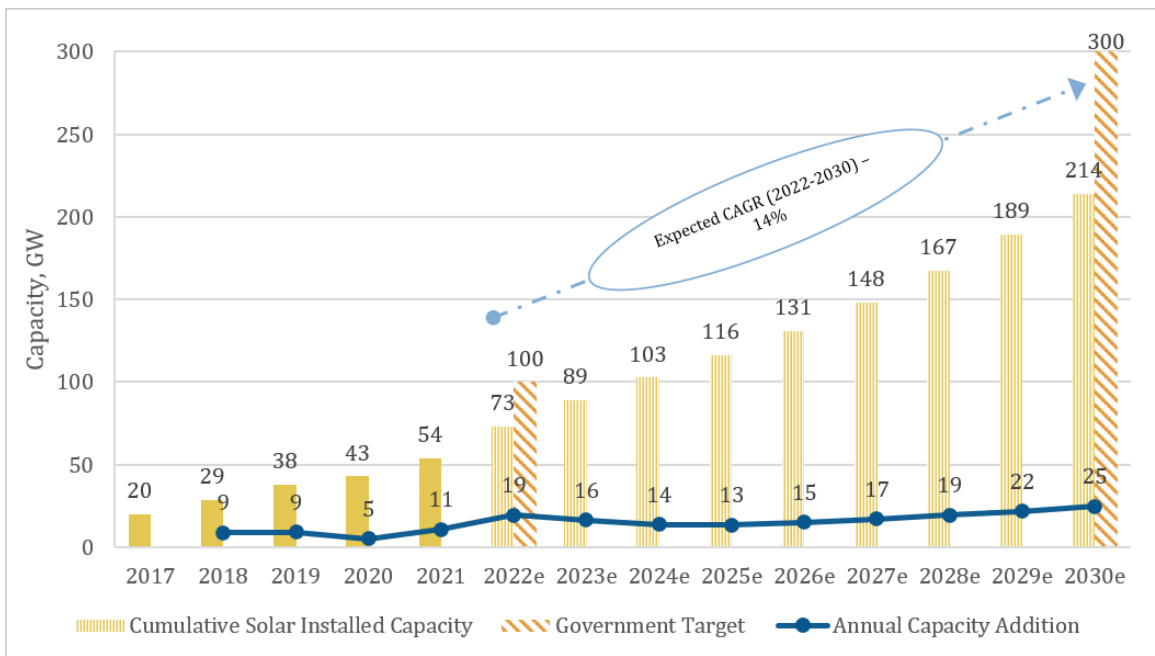
Source: JMK Research.

### Government Target by 2030

To boost the renewable energy installation drive in the long term, the GoI in 2020 set a target of 450GW of RE-based installed capacity to be achieved by 2030. Within this, the target for solar was 300GW. Given the challenge of integrating variable RE into the grid, most of the RE capacity installed in the latter half of this decade is likely to be based on wind solar hybrid (WSH), RE-plus-storage and round-the-clock RE projects rather than plain vanilla solar/wind projects.

The rooftop solar market is expected to develop at a higher growth rate in the future than that hitherto achieved. On the other hand, lack of land and grid availability would become more challenging for the utility-scale market, disincentivising annual capacity addition in the same market. This would act as the primary headwind against overall solar sector growth.

Figure 5: India Solar Installation Projection Through to 2030



Source: JMK Research.

JMK Research finds the government solar target of 300GW by 2030 will be off the mark by about 86GW. Annual capacity additions to 2030, as shown in the figure, are calculated on the basis of solar projects that are at the bidding phase (tenders issued but auctions not yet concluded) and historical capacity addition trends. The anticipated 27GW shortfall from the 2022 solar target can be attributed to a string of challenges.

## 4. Challenges

Over more than a decade, India's solar industry has encountered numerous ups and downs, the most frequent issues for developers being policy or regulatory roadblocks. Solar policy inconsistency has been a longstanding challenge. The effects of the COVID-19 pandemic (particularly on the supply chain) briefly stalled the growth of solar in India and further amplified the inadequacies (as well as opportunities) in the Indian PV manufacturing sector.

However, the most critical to the growth of solar sector has been discoms' non-alignment with the interests of solar project developers. Legacy financial challenges in electricity distribution overall have caused discoms to be highly sensitive to tariffs quoted for PPA projects.

Policy reversals and regulatory pushbacks have been a major deterrent for rooftop solar and OA. Restrictions and/or ambiguity on provisions such as banking of electricity and net metering have undermined the opportunities.



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## **Net Metering Limits**

Varying and ineffective regulations on net metering have been a significant hurdle. Until 2020, most states limited rooftop solar capacity to 1MW for net metering, so restricting large-scale rooftop installations. In 2021, the union government introduced the Electricity (Rights of Consumers) Rules, 2020, a guideline lowering rooftop capacity to 500kW. This prompted various state electricity regulatory commissions (SERCs) to enforce similar net metering restrictions.

The most attractive aspect of rooftop solar for consumers is cutting the cost of electricity. Halving the net metering limit significantly lowers the potential savings, especially large and medium industrial consumers.

## **Basic Customs Duty**

In March 2021, the MNRE announced the imposition of basic customs duty (BCD) on imported solar cells and modules effective from April 1, 2022. The duty applies to all imports, regardless of the country of origin. Goods and services from Special Economic Zones (SEZ), when supplied in the domestic tariff area (DTA), are considered imports.

Intended to improve competitiveness of domestic modules, BCD however was a cause of concern for solar PV manufacturers operating in such zones, which accommodate more than half of India's solar cell manufacturing units and about 40% of solar panel manufacturing units.

Further, the BCD imposition<sup>9</sup> is predicted to have a severe impact on ~15GW of solar projects. Awarded prior to the BCD announcement, these projects were intended to attain a commercial operation date (COD) pre-April 2022 but due to the pandemic the dates were extended. However, the grandfathering provision was not allowed for these awarded projects. Without extending the provision to the 15GW of projects, the end-consumer faces an additional cost of at least Rs0.3-0.5/kWh, even under the change-in-law compensation.

## **Unsigned Power Supply Agreements**

Power supply agreements (PSAs) for nearly 5GW of RE capacity tendered by SECI are yet to be signed by discoms.<sup>10</sup> Anticipating a fall in tariffs, discoms have been reluctant to tie-up with these capacities, and this has been a serious headwind for the developers.

## **ALMM-Related Issue**

The Approved List of Models and Manufacturers, primarily intended as a major reinforcement to the existing non-tariff barriers against foreign module makers, can exacerbate the viability risks of potential new projects. The list includes government projects, government-assisted projects, those under government schemes and

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<sup>9</sup> National Solar Energy Federation of India (NSEFI). [15GW Solar Projects risk impact from BCD on April 2022](#), February 2022.

<sup>10</sup> JMK Research.

programs (e.g., Component A of PM-KUSUM scheme) as well as open access and rooftop net metering projects. The effective date of implementation of ALMM for government projects is April 1, 2022, whereas, for non-government projects including OA and rooftop net metering projects, the date of ALMM enforcement has been postponed by six months to October 1, 2022. In the recent past, developers have completely shifted module demand to the high-efficiency 400W+ category. Given the paucity in overall production capacity for such high-wattage modules in India, ALMM would become a major deterrent in the near-term. Regardless of module preference, the total ALMM-enlisted capacity is just 11.5GW<sup>11</sup> as against 15-20GW of annual module demand. Especially as India has remained a laggard in OA and rooftop solar installations, extending ALMM's effective date for implementation by at least one year is highly warranted.

### **Banking Restrictions**

In key states, for example, Gujarat and Maharashtra, the banking period of renewable power has changed from annual to monthly. In most states, banking provisions are further likely to be restricted to time-of-day or day-long. States such as Andhra Pradesh and Tamil Nadu have withdrawn banking facilities altogether. Also, for major states, banking charges are in the range of 2% to 12.5% of the banked energy.

Imposing undesirable constraints on banking provision removes incentives for C&I consumers, at least while storing excess generated power in energy storage systems (ESS) remains an unviable option.

### **Financing Issues**

Access to finance for rooftop solar is easier for creditworthy C&I clients with BBB+ credit rating. For clients excluded from this category, credit schemes offered by banks for rooftop solar have been typically unattractive. This is especially true for Micro, Small & Medium Enterprises (MSME), a segment that remains, largely, a vast trove of untapped rooftop solar potential.

For MSMEs, in general, the turnaround time for loan grant for rooftop system is excessive (up to three to six months). Additionally, with high interest rates (>14%) and scarcity of non-collateralised finance schemes in the market, MSMEs have been typically reluctant to instal solar.

### **Denial or Delay of Open Access Approval Grant**

Several states have delayed grant of approval to OA projects; in some cases, state policy provisions were modified to delay the grant, discouraging developers. To restrict large C&I consumers from procuring power through private PPAs, many states have imposed restrictions on the sanctioned or contracted load for OA\consumers.

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<sup>11</sup> MNRE, [Updation of List I \(Manufacturers and Models of Solar PV Modules\) of ALMM Order, 2019](#), March 2022.

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## **Unpredictability of Future Open Access Charges**

Uncertainty of certain OA charges (e.g., the cross-subsidy surcharge) adversely affect the bankability of OA projects. The multiple charges imposed for sourcing electricity through the OA route mean that the model could not be firmly established as an economically viable option for India's consumers.

Further stalling C&I growth, in recent years, were the imposition of additional surcharge (AS) and electricity duty for group captive OA model and, in solar-rich states, the withdrawal of waivers/exemption on specific OA charges.

## **5. Potential Measures**

Consistent and potent policy measures and regulations, to catalyse the growth of solar, are of utmost importance for India. Solar needs both a strong government push to accelerate short-term addition of capacity and a dedicated 2030 roadmap for long-term development.

It is critical that solar projects whose commercial operation date (COD) is within one year are "shielded" from prevailing supply chain uncertainties, which are amplified by the imminent implementation of ALMM and the now-applicable BCD. These factors must be no longer allowed to impede solar capacity addition.

### **Short-term Recommendations**

#### *Revival of Rooftop and Open Access Solar Market*

To unlock the full potential of the solar market, a uniform policy framework must be formulated, to apply to all states in the union for at least the next five years.

The need of the hour is to formulate consistent policy and regulatory framework pertaining to net metering and banking facilities, also to apply across India. This would be a boon for the C&I segment which has been adrift in policy ambiguity for many years.

Restrictions on banking need to be revoked at least until rooftop and OA state targets have been achieved. Instead of returning power to the end consumer/developer, discoms could simply pay for the banked energy after each month at their lowest cost of procurement.

Further, the respective state regulators should allow such procurement of the banked energy to be counted towards discoms' Renewable Purchase Obligation (RPO) compliance.

Unrestricted access to net metering is vital to help the growth of rooftop solar, especially the MSME segment. As these companies are eager to find ways to increase operational efficiency and minimise costs, it is important that the GoI support rooftop solar installation with such attractive options as discounted interest rates, priority net metering approval etc.

### *Augment Inflow of Low-cost Finance*

To spur private/commercial investment growth in solar in India, it is necessary to explore novel means to attract more streams of concessional finance to help cushion various projects risks.

Mainstreaming of green bonds in India is pivotal in the current scenario. Regulatory mechanisms need to be reformed to significantly boost issuance of these bonds.

Another vital step for Indian solar, to assuage industry concerns about increasing project costs, would be expediting disbursement of unused concessional credit lines, e.g., State Bank of India (SBI)-World Bank concessional debt financing and Asian Development Bank (ADB)-Punjab National Bank (PNB) credit line.

### *Extension of ALMM Enforcement Date*

A suitable time window should be allowed for enlisting substantial capacities of 400+Wp modules, broadening project developers' options for selection of solar modules. Further, the effective date of ALMM needs to be gradually extended in segments such as rooftop and OA that must scale-up massively, requiring access to wider (PV manufacturer and module) options.

### *Reduction/Deferment of BCD on Solar Cell*

BCD of 25% on solar cell needs to be reduced considerably or deferred to curb a probable price hike in domestic solar modules in the near-term. The ratio of cell to module manufacturing capacity for a given year must be a deciding factor in fixing the BCD rate for solar cells for that year.

## **Long-term Recommendations**

### *Stricter RPO Enforcement*

Pan-India implementation of renewable purchase obligation (RPO) for utilities and large consumers and strict penalties for non-fulfilment of RPOs.

### *Introducing Plans to Improve Financial Health of Discoms*

Discom losses in India are significant and have increased multi-fold in the past few years. Various government measures to address this have not generated substantial results to-date. Privatisation of loss-making discoms is now under discussion; if implemented successfully, this can open new pathways to reform the power sector.

### *Reducing Cross-Subsidy Surcharge (CSS)*

C&I consumers are currently levied an additional CSS, leading to higher-than-average electricity tariffs, while the tariffs paid by residential and agricultural users are subsidised. The Draft Electricity (Amendment) Bill, 2020, mandates that the state electricity regulatory commissions abide by the National Tariff Policy to reduce the CSS on a year-on-year basis. This would further strengthen the open access framework for C&I consumers.

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*Introducing Capital Subsidy for Battery Energy Storage System (BESS)*

With the potential to help reduce the solar market's dependence on discoms, BESS can be a game-changing solution. Introducing financial incentives such as capital subsidies or tax concessions for lithium-based BESS can be pivotal to address the grid integration and balancing issues, while also increasing the share of renewables in the overall energy mix.

## **6. Conclusion**

In 2022, about 19GW of solar power is expected to be added in India (~16GW from utility-scale and 3.5GW from rooftop solar). Even with this capacity addition, ~27% of India's 100GW solar target would be unmet. Nevertheless, the country's capacity-addition exercise in the utility-scale domain has been commendable. The utility-scale segment is on track to achieve nearly 97% of its 60GW target. On the other hand, rooftop solar has severely underperformed over the years, with just over a quarter of the 40GW target being achieved. By December 2022, this segment is expected to fall short of its target by 25GW. It is imperative to have greater focus on, and more concerted efforts towards expanding rooftop solar.

In rooftop solar, state-level efforts such as Gujarat's Surya Scheme need to be emulated and implemented by other states in the short-term to help in boosting rooftop capacity.

It is also likely that the GoI, in the short-term, will push aggressively for expediting solar capacity addition to achieve the 100GW target by 2022, by re-allocating some of the unmet rooftop target to utility-scale generation.

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60GW target.**

Critical, short-term challenges that may significantly impede India's solar growth momentum to the end of the year come in the form of BCD and ALMM. It is necessary to reduce the BCD on solar cells and defer the effective date of implementation of ALMM to avoid major supply chain disruption in the near future.

Further, central and state government policies and regulations must be aligned to support the solar sector overall, and especially the ailing rooftop and Open Access segments.

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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](http://www.jmkresearch.com)

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