

The Impact of the 10kW Net Metering Limit on India's Rooftop Solar Market

Potential Solutions for Consumers, Developers and Discoms

Introduction

The Indian rooftop solar market grew from a mere 623 megawatts (MW) in 2015 to about 5.9 gigawatts (GW) by June 2020.¹ However, there is a shortfall of about 34GW which needs to be fulfilled in the next two years to achieve the Government of India's rooftop solar target of 40GW by 2022. Recently, distribution companies (discoms), fearful of losing their high paying Commercial and Industrial (C&I) consumers, have been issuing orders and notifications to restrain net metering provisions.

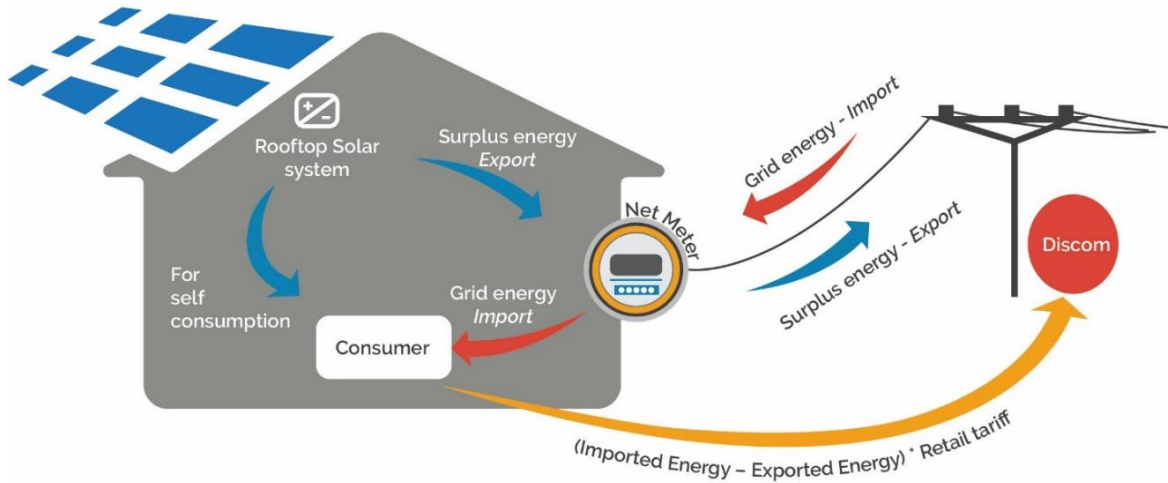
It took several years for the central government to ensure that all states offer net metering regulations to promote rooftop solar installations. Then, just when the market was taking off, discoms started to impose restrictions. Adding to the industry's woes, on 31 December 2020 the Ministry of Power issued a new notification that mandates, under the "Consumer as Prosumer" section, net metering for loads up to 10 kilowatts (kW) and gross metering for loads above 10kW.² While this central government notification is not legally valid unless the state governments implement it, many states are reluctant to allow net metering for corporate consumers and are likely to shift them to gross metering. This uncertainty deters many C&I players from deploying rooftop solar.

Under net metering, the electricity generated by the rooftop solar system is consumed by the user and any excess electricity is injected into the grid. When demand exceeds the generation from the rooftop solar system the consumer can import electricity from the grid. At the end of the settlement period, the consumer is only charged for the 'net' electricity utilised – the difference between the electricity produced through the rooftop solar system and the electricity consumed over the billing period.

¹ Bridge To India. [India Solar Rooftop Map](#). June 2020.

² Ministry of Power. [Electricity \(Rights of Consumers\) Rules, 2020](#). December 2020.

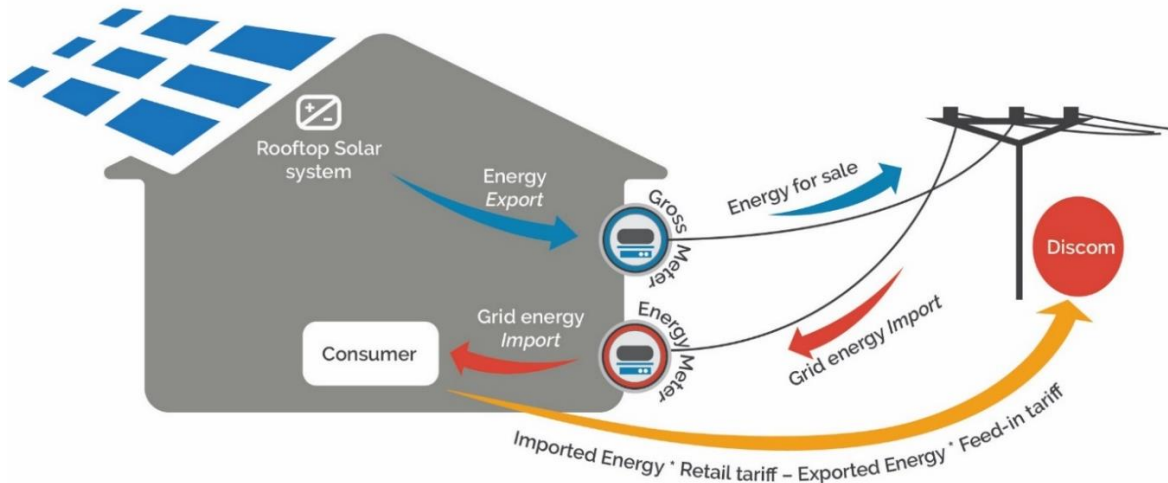
Figure 1: Net Metering Mechanism



Source: JMK Research.

Under a gross metering arrangement (GMA), all the power generated by the rooftop solar system is injected into the grid and the consumer is compensated for the exported power at a fixed feed-in tariff. The consumer pays the retail supply tariff for energy imported from the grid for consumption.

Figure 2: Gross Metering Mechanism



Source: JMK Research.

Even though the gross metering arrangement has existed for many years, it has found very few takers due to issues related to distribution companies (discoms), such as inconsistency in payments, the administrative processes, and unattractive feed-in tariffs. But with net metering limited to rooftop solar systems up to 10kW, consumer categories – barring small- to medium-sized households – will be left with an economically unattractive gross metering arrangement. This could prove a roadblock for the rooftop solar market, which has just started to pick up pace.

Current Status of Net Metering vs Gross Metering Regulations Across States

**Table 1: Gross and Net Metering Regulations Summary Across Key States
(as of Jan 31, 2021)**

State	Rooftop Solar Plant Capacity Limit	Maximum Rooftop Solar System Capacity (w.r.t. sanctioned load)	Consumer Categories With Access To Net Metering Arrangement	Compensation for Surplus Injection Under Net Metering	Gross Metering Provision Availability	Gross Metering Tariff
Delhi	Above 1kW For group and virtual net metering – 5kW to 5000kW	100%	Group Net Metering Framework shall be applicable to all consumers Virtual Net Metering Framework applicable to consumers under domestic category	At APPC (average power purchase cost) rate Rs4.51/kWh	Not applicable	Not applicable
Gujarat	Above 1kW up to 1000kW	No cap	Industrial, Commercial and Other Consumers	1. For residential @ Rs2.25/kWh 2. For Industrial and MSME (Micro, Small & Medium Enterprises) @ Rs1.75/kWh	Applicable	Rs2.25/kWh
Haryana	Above 1kW up to 2MW	<= 100%	All consumers	<ul style="list-style-type: none"> Solar Generation capped at 90% of the electricity consumption by the end of the settlement period Unadjusted units laps at the end of settlement period 	Applicable	Rs3.96/kWh
Karnataka	Above 1kW upto 2MW	100%	Only for LT (Low Tension) residential consumers	Rs3.99/kWh only for LT residential consumers	Applicable	Rs3.07/kWh
Maharashtra	1kW - 70% of DT (Distribution Transformer)	100%	All consumers	Generic tariff approved by MERC (Maharashtra Electricity Regulatory Commission) for that year (current tariff is Rs2.83/kWh)	Applicable for all LT and HT (High Tension) consumers	At APPC rate of Rs3.85/kWh

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Punjab	Above 1kW up to 1MW	<=80%	All consumers	<ul style="list-style-type: none"> •Solar Generation capped at 90% of the electricity consumption by end of settlement period •Unadjusted units laps at end of settlement period 	Not applicable	Not applicable
Rajasthan	Above 1kW up to 1MW	<=80%	All consumers	<p>Domestic category – above 100 units @Rs3.14/kWh</p> <p>Excess generation by other category consumers shall lapse</p>	Not applicable	Not applicable
Tamil Nadu	Above 1kW	100%	Consumers under LT category except Hut and Agricultural category of tariff	75% of APPC/feed-in tariff (Rs2.79/kWh) whichever is lower	Not applicable	Not applicable
Telangana	Above 1kW up to 1MW	Residential: 100% Others: 80%	For residential, Government consumers, Industrial, Commercial	At APPC of Rs.4.15/kWh	Applicable	At APPC of Rs4.15/kWh
Uttar Pradesh	Above 1kW up to 2MW	100%	Agricultural or metered Residential/Domestic category under LMV-5 and LMV-1	Rs2/kWh for domestic category	Applicable	Rs2-2.5/kWh
West Bengal	Up to 5kW	Up to 100% of sanctioned load	Domestic, Agricultural, C&I, Government	Rs3.55/kWh	Yes, mandated for above 5kW system capacity	Rs3.55-4/kWh
Kerala	1kW to 1MW	Up to 100% of sanctioned load	All consumers	As per APPC determined by Commission (Rs2.95/kWh)	Not applicable	Not applicable
Madhya Pradesh	Up to 1MW	Upto 100% of sanctioned load	All consumers	As per APPC determined by Commission (Rs2.83/kWh)	Not applicable	Not applicable

Source: JMK Research.

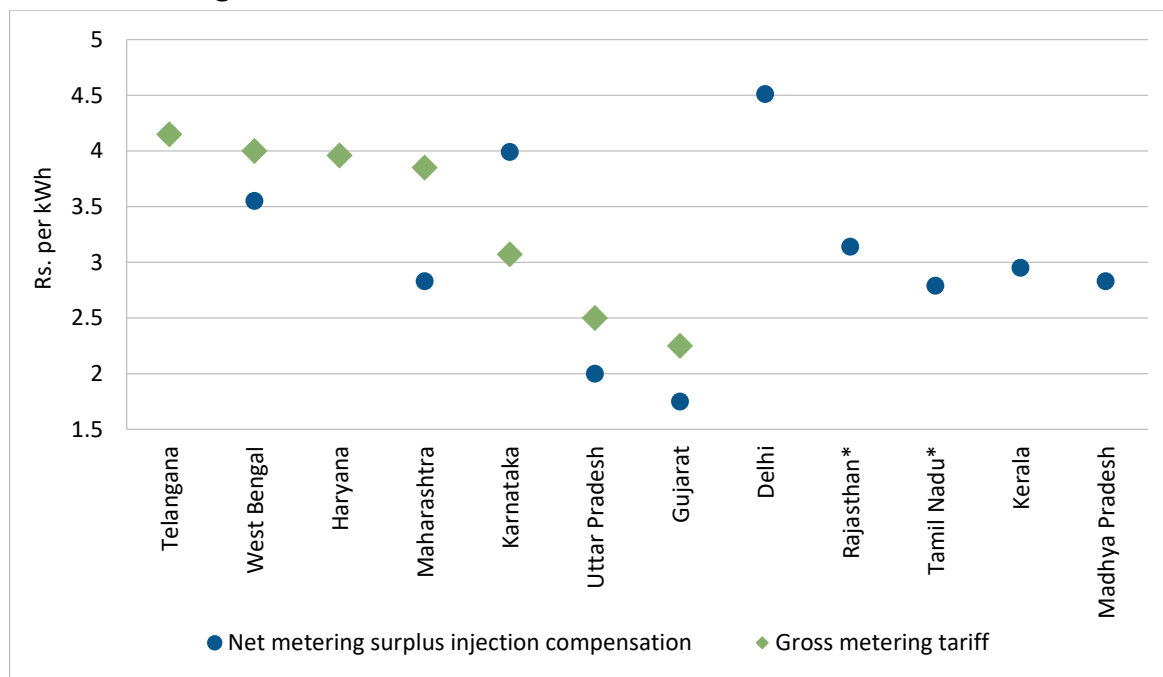
Note: Tariffs mentioned for net and gross metering are tentative tariffs paid by various discoms based on prevailing regulations/orders.

On analysing various net metering and gross metering tariffs payable across leading states, the current compensation rates applicable to net metered or gross metered consumers for export of surplus or entire solar power respectively varies between Rs2-4/kWh. For most states, the sole factor in determining the monetary benefits for the rooftop solar owners across many State Electricity Regulatory Commissions (SERCs) is average power purchase cost (APPC). This is the weighted average pooled price at which the distribution licensee purchases electricity including cost of self-generation. The APPC does not take into consideration the overall cost per kWh borne by the consumer for rooftop solar generation.

For five major states, this number is less than Rs3/kWh. If some of the key industrial states were to shift to gross metering, then the payback period of a solar system would increase from the current 3 to 4 years to 5 to 6 years on average.

Furthermore, current rooftop power purchase agreements (PPAs) signed by Tier 1 developers have tariffs in the range of Rs3.5-4/kWh. Developers and corporates would consider any tariff lower than the current PPA tariff unviable. And not only would corporates be reluctant to set up a rooftop solar system for just Rs2-2.5/kWh benefit, under gross metering they cannot use the units generated from their own system for self-consumption. Therefore, the compensation rates offered by various SERCs pushes back the viability of rooftop solar projects.

Figure 3: State-wise Compensation Offered Under Net metering and Gross Metering



Source: JMK Research.

* Excess generation payable only to domestic category in Rajasthan and LT category in Tamil Nadu. For other categories excess generation will be lapsed.

Note: Tentative tariffs paid by various discoms based on prevailing regulations/orders

A net metering arrangement is not available to C&I consumers in three big industrial states, namely, Karnataka, Tamil Nadu and Uttar Pradesh. While in Haryana, Punjab and Rajasthan, no compensation is paid for surplus generation. In fact, at the end of the settlement period, the net excess units exported to discoms in these states are considered 'lapsed'.

Table 2: Summary of Net Metering Suitability for C&I Consumers

State	Net Metering for C&I Segment (Yes/No)	Surplus Injection Compensation for C&I
Delhi	Yes (group net metering)	Rs.4.51/kWh
Gujarat	Yes	Rs.1.75/kWh
Kerala	Yes	Rs.2.95/kWh
Telangana	Yes	Rs.4.28/kWh
Maharashtra	Yes	Rs.2.83/kWh
Madhya Pradesh	Yes	Rs.2.83/kWh
West Bengal	Yes	Rs.3.55/kWh
Haryana	Yes	Excess generation not payable
Rajasthan	Yes	Excess generation not payable
Punjab	Yes	Nil
Karnataka	No	Not applicable
Tamil Nadu	No	Not applicable
Uttar Pradesh	No	Not applicable

Source: JMK Research.

Note: Green-shaded rows highlight states with surplus injection compensation. Conversely, pink-shaded rows indicate states without provision for surplus injection compensation.

Success Factors in 3 International Markets

To fulfil the 40GW rooftop solar target, India must discover new avenues to evolve its rooftop solar market, and with market enablers devised to overcome the local challenges. Understanding the factors that led to the successes of other international rooftop solar markets and moulding them to tackle India-specific barriers could help uplift the rooftop solar market to the self-replication phase, so that it can thrive predominantly under market demand and supply forces.

California

Ranked as the No.1 solar market in the U.S., California has made remarkable progress in both the rooftop solar and utility-scale segments. The state has been an aggressive proponent of rooftop solar with the launch of the landmark Million Solar Roofs Initiative in 2006 which envisioned the goal of setting up distributed solar systems on residences, businesses and farms. Though California achieved its goal in 2015, it has continued to witness robust development in the rooftop solar segment. As a consecutive wave for renewable energy transition in the state, a new policy termed "Residential Solar Mandate" was effectively introduced at the beginning of 2020. This law requires every new housing establishment up to 3 storeys to install rooftop solar of capacity meeting 100% of annual electricity demand.

In addition to this, the solar Investment Tax Credit (ITC), implemented in 2006, has also boosted the growth of the rooftop solar industry. The solar ITC is a 26% tax credit claimed against the tax liability of residential, commercial and utility investors in solar energy properties. The residential and commercial solar ITC catalysed the U.S. solar industry to grow by a year-on-year average of 50% over the last decade.³ Stringent policy measures and attractive investment incentives greatly intensified the development of the rooftop solar industry in California.

Australia

In 2019, Australia had the highest PV installed capacity per capita at 644 Watts per person.⁴ There are more than 2.3 million rooftop solar systems in the country. This enormous number of rooftop solar installations can be attributed largely to the solarisation of the residential segment. Various federal and state-level policies and regulatory incentives have vastly influenced Australia's rooftop solar market success. At the federal level, the Small-scale Renewable Energy Scheme, introduced in 2011, consists of a mechanism called Small-scale Technology Certificates (STCs). STC is a subsidy that allows Australian households and small businesses a reduction of around 30% on the upfront cost of PV systems. Moreover, there are some states that offer rebates on solar panels, in addition to the federal STC rebate. In addition to these incentives, rooftop solar-installed households in every state are compensated at a feed-in tariff for surplus solar power exported to the grid.

Vietnam

In 2020, Vietnam's rooftop solar development skyrocketed due to a government policy update. In just one year, Vietnam's rooftop solar installed capacity grew about 25-fold from 378MW to a massive 9.3GW by the end of 2020.⁵ In April 2020, with the announcement of solar FiTs 2.0, the Vietnam government set new FiT rates for solar projects of various categories commissioned on or before 31 December 2020. For rooftop solar projects, the FiT was fixed at US\$0.0838/kWh for a period of 20 years. The earlier FiT scheme for rooftop solar projects, which was approved in

³ Solar Energy Industries Association. [Solar Investment Tax Credit \(ITC\)](#).

⁴ International Energy Agency (IEA). [IEA PVPS Trends 2020 In Photovoltaic Applications](#). 2020.

⁵ BloombergNEF (BNEF). [Vietnam Was Likely the Third-Largest Solar Market in 2020](#). January 2021.

January 2020, kept the tariff at US\$0.0935/kWh for all installations completed till 2021. The superseding solar FiTs 2.0 effected in April 2020 tightened the deadline for availing the rooftop solar incentive, causing the enormous spurt in demand for new capacity addition.

Ways To Boost India's Solar Rooftop Market

In order to accomplish the national rooftop solar target of 40GW, it is important to find a middle ground between all the stakeholders in the industry including discoms, project developers and end consumers. Some possible solutions to resolve the ongoing issues in the sector are summarised below. Some have already been adopted or have been proposed in some states.

Impose Banking Charges on Consumers

One potential solution could be permitting a Net Metering Arrangement for rooftop solar systems of more than 10kW until the state's specific rooftop solar target is achieved, provided that banking charges (proportional to the wheeling losses) can be imposed on consumers. For example, in Maharashtra, as per an order issued by Maharashtra Electricity Regulatory Commission (MERC) in April 2020, banking charges at 7.5% for HT consumers and 12% for LT consumers have been levied.

Calculate FiTs Based on Rooftop Solar System Size and Cost of Supply to Discom

Different FiTs should be allocated for different ranges of rooftop solar plant capacity, offering viable compensation to the system owners. This would also ensure investment in quality equipment to ensure longevity of rooftop solar projects. Simultaneously, FiTs can be attributable to the average cost of rooftop solar power supply to discoms and not calculated on the basis of APPC.

Time-of-Day (TOD) Tariff Benefits for Consumers Under Gross Metering Mechanism

Transfer of monetary benefits to the gross metered rooftop solar user based on TOD in exchange for solar power exported to the grid could prove to be beneficial for both the utility and the rooftop solar user. With variable tariffs linked to off-peak and peak hours (i.e. higher tariff for peak hours viz-a-viz the tariff for off-peak hours), discoms can purchase renewable power at rates attractive enough for rooftop solar owners to sell.

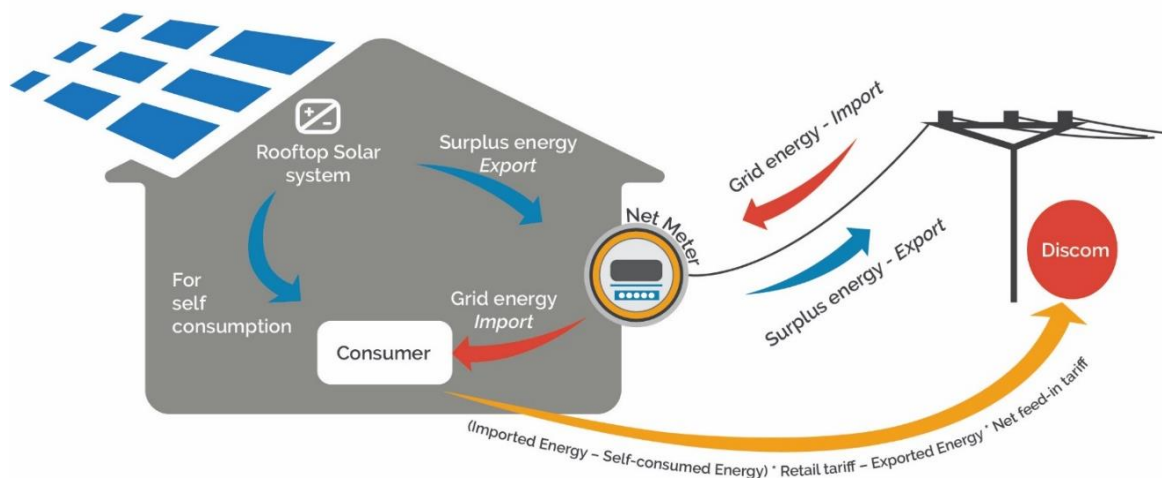
Allow Peer-to-Peer (P2P) Energy Trading

This P2P trading model allows online trading of energy between prosumers and consumers at a mutually agreed price. This online platform would widen RE transmission opportunities and improve grid balancing and load congestion management.

Explore 'Net Feed-in' Mechanism

A net feed-in mechanism is similar to net metering except for the tariff calculation. In the Tamil Nadu Solar Energy Policy 2019 net-metering was replaced with a net feed-in mechanism.⁶ Under this arrangement, for every unit of rooftop solar power used for self-consumption, the consumer is credited at a price equivalent to the retail supply tariff charged by the discom. Meanwhile, the surplus energy exported to the grid is compensated at a net feed-in tariff determined by the relevant SERC.

Figure 4: Net Feed-in Mechanism



Source: JMK Research.

To illustrate the comparative benefits between gross metering, net metering and net feed-in arrangements, we considered the following sample case.

Assumptions

Consumer energy demand (imported energy from grid)	= 100 units
Rooftop solar energy generation	= 30 units
Self-consumed units from rooftop solar system	= 20 units
Exported units from rooftop solar system	= 10 units
Retail tariff	= Rs. 7/ kWh
Feed-in tariff	= Rs. 3/ kWh

⁶ Auroville Consulting. *Rooftop solar in Tamil Nadu: From doom to bloom?* 2019.

Table 3: Bill Calculation Under Net Metering, Gross Metering and Net Feed-in Mechanism

Scenario	Consumer Payment Calculation	Payment To Discom	Savings To End Consumer
No Rooftop Solar System	Consumer energy demand*retail tariff =100*7	Rs. 700	Nil
Gross Metering	(Consumer energy demand*retail tariff)-(rooftop solar generation* FiT) = (100 *7) – (30 * 3)	Rs. 610	Rs. 90
Net Metering	(Consumer energy demand-rooftop solar generation) * retail tariff = (100-30) *7	Rs. 490	Rs. 210
Net Feed-in	(Consumer energy demand-self consumption from solar) * retail tariff -exported solar units to grid*FIT = ((100-20) *7) –(10*3)	Rs. 530	Rs. 170

Source: JMK Research.

As seen from this sample calculation, the net feed-in option could offer an alternate solution that would not have any major negative impact on discoms' revenue and would still be beneficial for the end consumer compared to net metering and gross metering.

Conclusion

As one of the most economical and eco-friendly energy generation technologies, rooftop solar is a highly valuable resource to advance India's path to sustainability. To promote the industry, it is important to ensure the key enablers are in place and functioning to support the overall ecosystem. But sustained momentum of the rooftop solar industry can only be assured if the foremost enablers i.e. the relevant policies and regulations are designed to provide guidance measures and balance the concerns of all stakeholders.

The latest amendment to the rooftop solar metering mechanism diminishes the "grade" of incentive or the attractiveness of the market. This puts a sizeable set of net-metered consumers in a highly unfavourable position. The mandate under the "consumer as prosumer" section of the Electricity (Rights of Consumers) Rules 2020, which follows a series of state-level restrictions on net metering provision, signals an alarmingly dim prospect of the rooftop solar industry.

Notably, if India were to achieve the national rooftop solar target of 40GW, it would only contribute to about 3-4% of the entire energy generation in the country. This

figure represents a miniscule revenue share for the discoms and at just about 6-7GW presently, the rooftop solar market poses no threat to the discoms.

The interests of all stakeholders including consumers, developers and discoms should be given equal weight, while also stimulating private investment in new low cost, zero emissions distributed capacity. Potential solutions aimed at resolving the challenges of the net metering restriction such as the imposition of banking charges, a net feed-in tariff, and peer-to-peer energy trading should be explored, with a balanced approach meeting different stakeholders' interests in providing the serviceability of the rooftop solar system. Also, on the topic of treading the middle ground, it is imperative to evaluate the true cost incurred by discoms for storing electricity and for providing subsidised power to residential and agricultural consumers.

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