ICRA

Indian Renewable Energy Sector

New rooftop solar scheme to create a 20-25 GW opportunity for Indian solar OEMs and system integrators

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Highlights

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Rooftop capacity witnessed a healthy growth over the past five years, though falling short of the 40-GW target.

The Pradhan Mantri Suryodaya Yojana is expected to provide a fillip to the rooftop solar segment; timely implementation remains key.

- The Government of India (GoI) launched the 'Pradhan Mantri Suryodaya Yojana' with a target of installing rooftop solar projects on 1 crore houses, enabling these households to generate up to 300 units per month and achieve savings in electricity cost. The Central financial institution, REC Limited, has been appointed as a nodal agency for implementing this scheme across the country.
- Given that the rooftop solar projects under this scheme would be funded through subsidy support from the GoI, these projects are required to use modules sourced from domestic original equipment manufacturers (OEMs). This in turn is expected to create a 20–25-GW demand opportunity for domestic solar module OEMs and system integrators over the next two to three years.
- The rooftop solar capacity in India witnessed a healthy growth over the past five years increasing to 11.1 GW as of December 2023 from 1.8 GW as of March 2019. The growth was driven mainly by commercial and industrial (C&I) customers. However, the capacity fell short of the 40-GW target set by the GoI. This is owing to the regulatory challenges, slow pace of addition in the residential segment and reluctance shown by the state distribution utilities in promoting these projects.
- The pace of installations in the rooftop solar segment has been constrained by various implementation challenges in the past including delays in providing approvals by the state distribution utilities, lack of adequate financing avenues and lack of awareness among consumers. The new scheme is expected to address these implementation challenges. Moreover, consistency in net metering regulations across the key states remains important.
- While the detailed guidelines for the scheme are to be notified, the states and Union Territories (UTs) are expected to be divided among eight central public sector undertakings (CPSUs), who will take up the rooftop projects under the Renewable Energy Service Company (RESCO) model. The capex for these will be met through capital subsidy from the GoI and balance through debt funding tied up by the CPSUs. The investment by the CPSUs is to be recovered through sale of surplus power generated by these rooftop projects to the discoms. Timely implementation remains key.

Growth in rooftop solar capacity driven by C&I customers; however, capacity remains short of the 40-GW target

Exhibit 1: Trends in cumulative rooftop solar capacity at all-India level

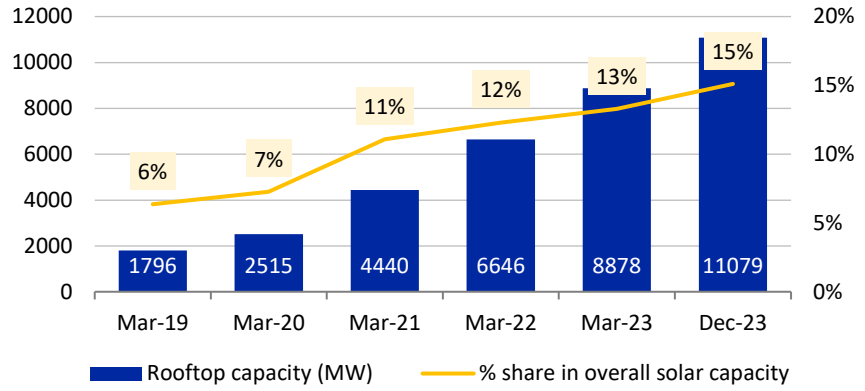
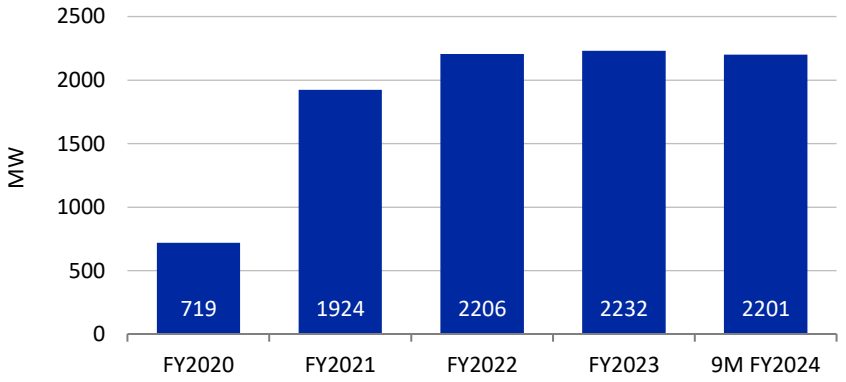


Exhibit 2: Trends in annual addition of rooftop solar capacity at all-India level

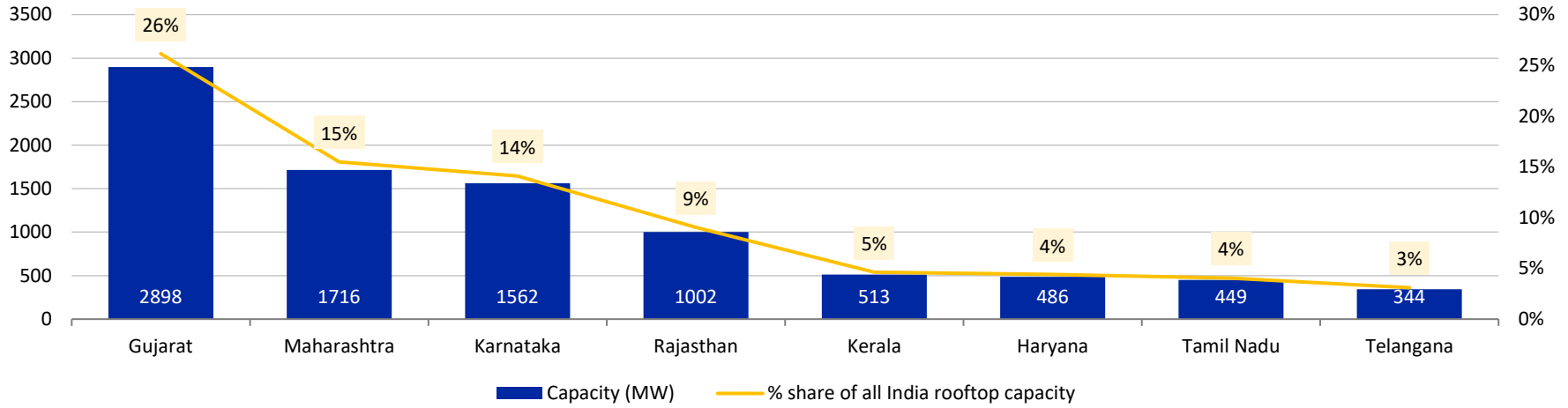


Source: ICRA Research, Ministry of New & Renewable Energy (MNRE)

- The rooftop solar capacity witnessed a healthy growth over the past five years increasing to 11.1 GW as of December 2023 from 1.8 GW as of March 2019, at a CAGR of 47%. This in turn increased the share of rooftop solar projects in the overall solar capacity to 15% as of December 2023 from 6% in March 2019. The capacity in the residential rooftop segment is ~2.7 GW, with the balance mainly contributed by C&I customers.
- The growth in rooftop capacity was driven mainly by C&I customers, given the significant discount available between the cost of generation from rooftop solar projects and grid tariffs, and the fact that these customers were serviced by large renewable energy platforms focused on the C&I market. However, the installed rooftop capacity fell significantly short of the 40-GW target that the Union Government had set by the year 2022. The slow pace of addition in the residential segment and reluctance shown by the state discoms in promoting the rooftop projects remain concerns.

Gujarat leads the way in rooftop solar installations

Exhibit 3: State-wise installed rooftop solar capacity as of December 2023

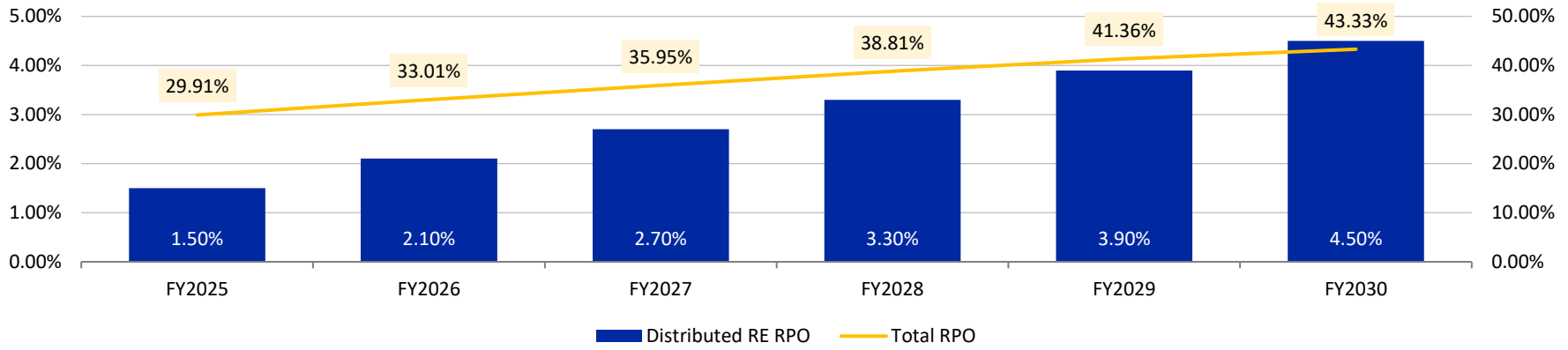


- The state of Gujarat leads the rooftop solar installations in the country with installed capacity of 2.9 GW accounting for 26% of the all-India rooftop solar capacity. This is supported by a favourable policy and regulatory environment in the state. Gujarat is followed by other solar-rich states such as Maharashtra, Karnataka and Rajasthan. However, the capacity installed in these states remains well below their potential for rooftop installations.

Source: ICRA Research, MNRE

Notification of distribution RE component under RPO regulations to drive demand for rooftop solar projects

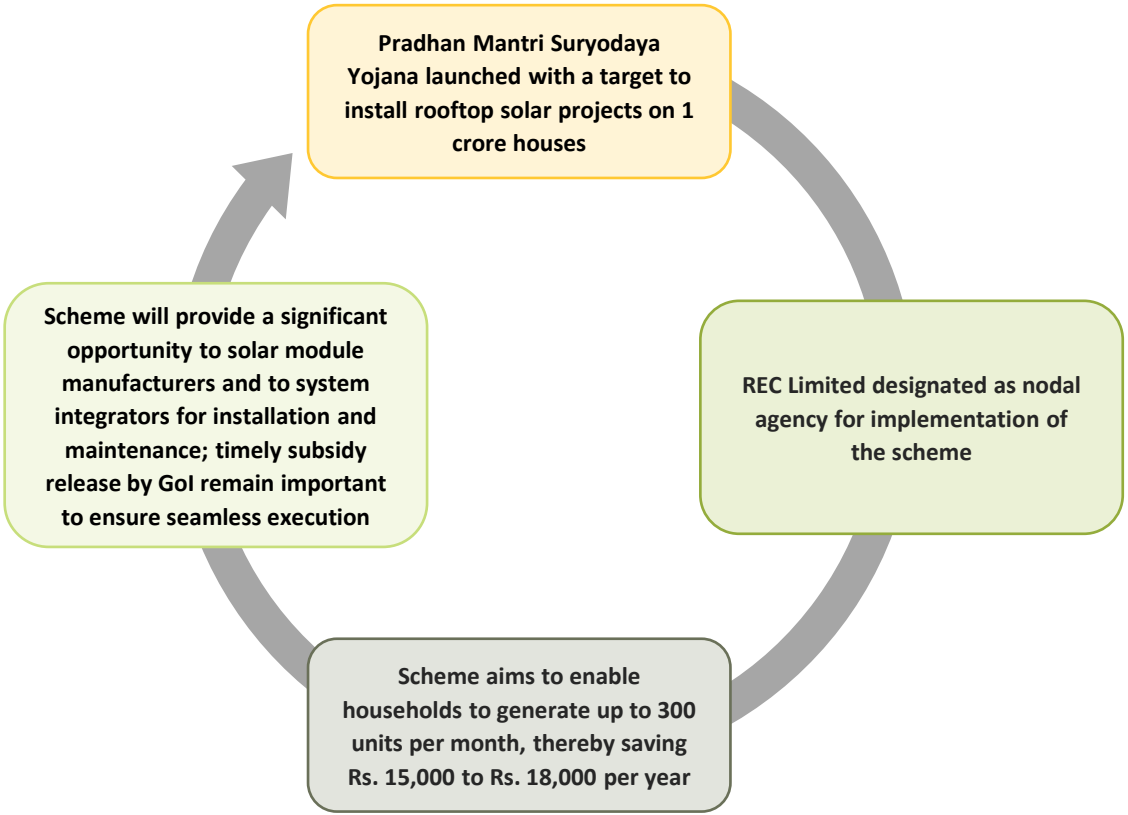
Exhibit 4: Distribution renewable purchase obligation notified by Ministry of Power



- The Ministry of Power vide its notification dated October 20, 2023, notified the Renewable Purchase Obligation (RPO) trajectory for the period from FY2025 to FY2030, under the Energy Conservation Act 2001. While the overall RPO trajectory remains in line with the RPO targets notified by the Ministry in July 2022, the composition of the RPO has been revised with addition of distributed RE component. This is required to be met from RE projects of less than 10 MW in size, including solar power projects under gross/net/behind the meter installations. The presence of distributed RE RPO target is expected to drive the demand for rooftop solar installations, going forward. ICRA estimates the capacity required to meet the 4.5% target by FY2030 at ~75 GW including rooftop installations and distributed on-ground installations.

Source: ICRA Research, Ministry of Power

Pradhan Mantri Suryodaya Yojana launched with target of installing rooftop solar projects on 1 crore houses



- State and UTs are expected to be divided among eight CPSUs, who would take up the rooftop installations under RESCO model
- The capex for these rooftop projects will be met through capital subsidy from GoI and balance through debt funding tied-up by the CPSUs
- Detailed guidelines for the scheme are to be notified shortly

Source: Government of India, Union Budget for FY2025

Capital subsidy expected to increase under new rooftop solar scheme

Exhibit 5: Central financial assistance (CFA) for residential rooftop solar projects under existing National Solar Rooftop programme

Capacity	Subsidy for general category states / Union Territories (UTs)	Subsidy for special category states / UTs
Up to 3 kW	Rs. 18,000 per kW	Rs. 20,000 per kW
Above 3 kW and up to 10 kW	Rs. 18,000 per kW for first 3 kW and Rs. 9,000 per kW for balance capacity up to 10 kW	Rs. 20,000 per kW for first 3 kW and Rs. 10,000 per kW for balance capacity up to 10 kW
Resident welfare associations (RWAs) / Group Housing Societies (GHS)	Rs. 9,000 per kW For common facilities up to 500 kW with cap of 10 kW per house including any individual rooftop plant	Rs. 10,000 per kW For common facilities up to 500 kW with cap of 10 kW per house including any individual rooftop plant

Source: ICRA Research, www.solarrooftop.gov.in

- Based on the prevailing capital costs for solar power projects, the capital subsidy provided by Government of India under the existing rooftop solar programme accounts for ~40% of the capital cost for 1-3 kW capacity projects. The balance cost is incurred by the consumer, which is in turn recovered through savings from reduction in electricity bill.
- Under the newly announced Pradhan Mantri Suryodaya Yojana, the capital subsidy is expected to be increased to ~60% of the capital cost for consumers having monthly consumption of less than 300 units (1-3 kW projects), with the balance 40% cost incurred by the empaneled CPSUs. The investment by the CPSUs is to be recovered through sale of surplus power generated by these rooftop unis to the discoms.

Implementation challenges constraining solar rooftop installations in residential segment

Challenges in securing approvals from discoms

- While the national rooftop solar programme with subsidy support along with various state level schemes have been running for quite some time now, the progress in rooftop solar installations in the residential segment remained slow. This can be attributed to the challenges in securing approvals from the state discoms, inconsistent policies across the states and non-availability of meters (with net metering facility) in a timely manner. One way to overcome this challenge is to set up discom level targets for rooftop capacities along with incentives for meeting the targets and penalties for missing the targets.

Financing options

- Apart from bureaucratic delays associated with the discoms, the limited access to debt financing avenues for residential consumers in setting up rooftop solar projects has constrained the progress in this segment.
- The appointment of central sector financer, REC, as a nodal agency under the Pradhan Mantri Suryodaya Yojana along with empaneling CPSUs for taking up the installations, if implemented in a timey manner, is expected to mitigate the challenge associated with financing rooftop solar installations. However, the guidelines on recovery of such investment by the CPSUs remain to be seen.

Lack of awareness

- The limited awareness on available benefits for installing rooftop solar projects along with lack of transparency over the availability of quality service providers for taking up installation and maintenance of the rooftop solar projects are other hurdles facing this segment. The Government is expected to take up a national level awareness campaign under the Pradhan Mantri Suryodaya Yojana, which would play a role in mitigating this challenge.

Metering arrangements available under the state regulations

Gross Metering

- Under this mechanism, the renewable energy generated from the system of an eligible consumer and the energy consumed by the eligible consumer from the grid are accounted separately through appropriate metering arrangements.
- With respect to billing, the energy consumed is accounted for at the approved grid tariff and the renewable energy supplied to the grid is accounted at a pre-determined tariff approved by the Commission. Herein, the renewable energy project is set up to supply energy generated to the grid

Net Billing

- Under this mechanism, the rooftop project is set up for self consumption. The surplus renewable energy injected into the grid from the generating system of a consumer is accounted by the discom at a pre-determined rate approved by the Commission.
- The discom raises the bills on the consumer for his consumption from the grid at the approved grid tariff, after giving credit for energy injected into the grid at pre-determined tariff approved by the Commission.

Net Metering

- Under this mechanism, the surplus renewable energy exported to the grid from the generation system of a consumer is deducted from the energy imported from the grid by the consumer to arrive at the net imported by using a single bi-directional energy meter. The discom shall raise a bill on net energy imported by the consumer at the applicable grid tariff.
- In case of the exported energy being higher than the imported energy, the surplus energy shall be carried forward to the next billing period. At the end of the settlement period (typically April to March), any surplus energy remaining shall either lapse or will be credited at a certain predetermined rate, depending upon the state regulations.

Net metering regulations for rooftop solar projects vary across states

State	Cap on capacity for net metering	Cap on capacity for other metering arrangements	Additional charges	Tariff for procurement of surplus power (Rs/unit)
Maharashtra	5 MW or sanctioned load (whichever is lower)	Contracted demand / sanctioned load	Grid support charges shall not be levied on rooftop projects till the rooftop installations in the state reach 5 GW	3.0 (FY2023)
Gujarat	Allowed up to 1 MW; no cap at sanctioned load for residential consumers	1 MW	No additional charges applicable	2.25 (Surya Urja Rooftop Yojana)
Karnataka	1 MW or sanctioned load (whichever is lower)	1 MW or sanctioned load (whichever is lower)	No additional charges applicable	2.97 (FY2024) for 1 kW to 10 kW projects
Tamil Nadu	Sanctioned load or 999 kW (whichever is lower)	151 kW to 999 kW	Network charges are levied for the energy generated under net metering arrangement	Surplus injection under net metering shall lapse at the end of financial year. For gross metering, applicable tariff is Rs. 3.61/unit for 1 kW to 10 kW projects
Uttar Pradesh	2 MW or sanctioned load (whichever is lower)	2 MW or sanctioned load (whichever is lower)	No additional charges applicable	Rs. 2.0/unit at the end of settlement period for net metering arrangement
Haryana	500 kW or sanctioned load (whichever is lower)	500 kW or sanctioned load (whichever is lower)	No additional charges; but the electricity generated is capped at 90% of the consumer's consumption	Surplus injection under net metering shall lapse at the end of financial year. Rs. 3.11/unit for projects under gross metering

Source: ICRA Research, Regulations notified by state electricity regulatory commissions

Attractive payback period for the residential customers led by the capital subsidy support and relatively high retail grid tariffs

Exhibit 6: Illustrative sensitivity of payback period (in years) for a customer to capital cost of rooftop solar system and capital subsidy under net billing arrangement

Payback period in no of years		Capital cost in Rs. per kW					
		37,500	40,000	42,500	45,000	47,500	50,000
Capital subsidy (as a % of capital cost)	40%	4.6	4.9	5.2	5.6	5.9	6.3
	45%	4.2	4.5	4.8	5.1	5.4	5.7
	50%	3.8	4.1	4.4	4.6	4.9	5.2
	55%	3.4	3.7	3.9	4.2	4.4	4.7
	60%	3.0	3.3	3.5	3.7	3.9	4.2

- Exhibit 6 presents the expected payback period for a customer setting up a rooftop solar system under a net billing arrangement. The residential retail tariff for this analysis is considered at Rs. 6.0 per unit, in line with the tariff approved across the key large states for consumers with monthly consumption of over 200 units. Also, the rooftop owner is assumed to consume only 50% of the generation considering that the consumption pattern would not fully match the solar generation during the day and the balance is assumed to be sold to discoms at Rs. 2.5 per unit under the net billing arrangement. Under these assumptions, the payback period varies from 3-6 years. If the rooftop system were to be installed under net metering arrangement, the pay back period is expected to be lower.

Assumptions:

Project capacity: 2 kW
PLF: 15.0%
Module degradation: 0.7%
O&M cost: Rs. 400 per kW per year

Proportion of electricity consumed captively by the residential user: 50%
Proportion of electricity supplied to the discom: 50%

Residential retail tariff considered for computing savings in electricity bill: Rs. 6.0 per unit

Tariff assumed for sale of surplus power to discom: Rs. 2.5 per unit

Source: ICRA Research

Pradhan Mantri Suryodaya Yojana expected to create 20–25-GW opportunity for solar OEMs and integrators; timely implementation remains key

20-25 GW

Demand opportunity for domestic solar module manufacturers over next two to three years

>1 lakh crore

Large capital investment to benefit solar system integrators across the country

Rs. 15,000

Rooftop units to generate 250-300 units per month for residential consumers leading to savings of ~Rs. 15,000 per year

500 GW

Scheme would contribute to reducing carbon emissions and achieving the 500-GW capacity target by 2030

- Households in the urban areas have a typical sanctioned load of 3-5 kW, while the same in rural areas would be slightly lower. Considering the available rooftop space in these households and their load profile, most consumers are expected to install rooftop solar capacity of 2-3 kW. Given that the projects receiving subsidy support are required to use modules from domestic manufacturers, this is expected to lead a demand opportunity of 20-25 GW for domestic solar model manufacturers and system integrators. Also, this would lead to significant savings to residential consumers and reduce carbon emissions. Timely implementation of the scheme by the empaneled agencies along with timely release of capital subsidy by the GoI remains important.

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Thank You!