

Demystifying India's rooftop solar policies

A state-level analysis

Issue Brief | November 2019



Image: iStock

About rooftop metering arrangement

In accordance with the *Electricity Act, 2003*, every state in India has come up with a net metering policy or a rooftop solar policy which dictates the modalities of installing a grid-connected rooftop solar (RTS) or a small solar power plant in the given state. These policies determine how consumers are compensated for the electricity produced by their solar system. Currently, the metering arrangement can be either net or gross or both. So far,

19 states offer both net metering and gross metering (subject to conditions) while 17 states permit only net metering. This document aims to serve as an easy-to-use guide for consumers, developers, and investors in the RTS sector. It shares macro insights on state policies and provides comparisons between states on key parameters for installing RTS systems.

The difference between net metering and gross metering

In the **net metering mechanism**, the electricity generated by the RTS system is consumed by the user and any excess electricity is injected into the grid. In case the consumer requires more power than what is produced by the RTS system, they can import the balance from the grid. At the end of the settlement period, the consumer is only charged for the ‘net’ energy utilised – the difference between the energy produced through the RTS system and the energy consumed over

the billing period. A bi-directional meter is used to measure the net electricity consumption of the system.

In case of **gross metering**, the total electricity generated by the solar system is injected into the grid, and the consumer imports electricity from the grid for consumption. At the end of the settlement period, the consumer is compensated for the electricity exported to the grid at the Feed-in-Tariff (FiT) rate determined by the State Electricity Regulatory Commission.

Figure 1: Net metering arrangement

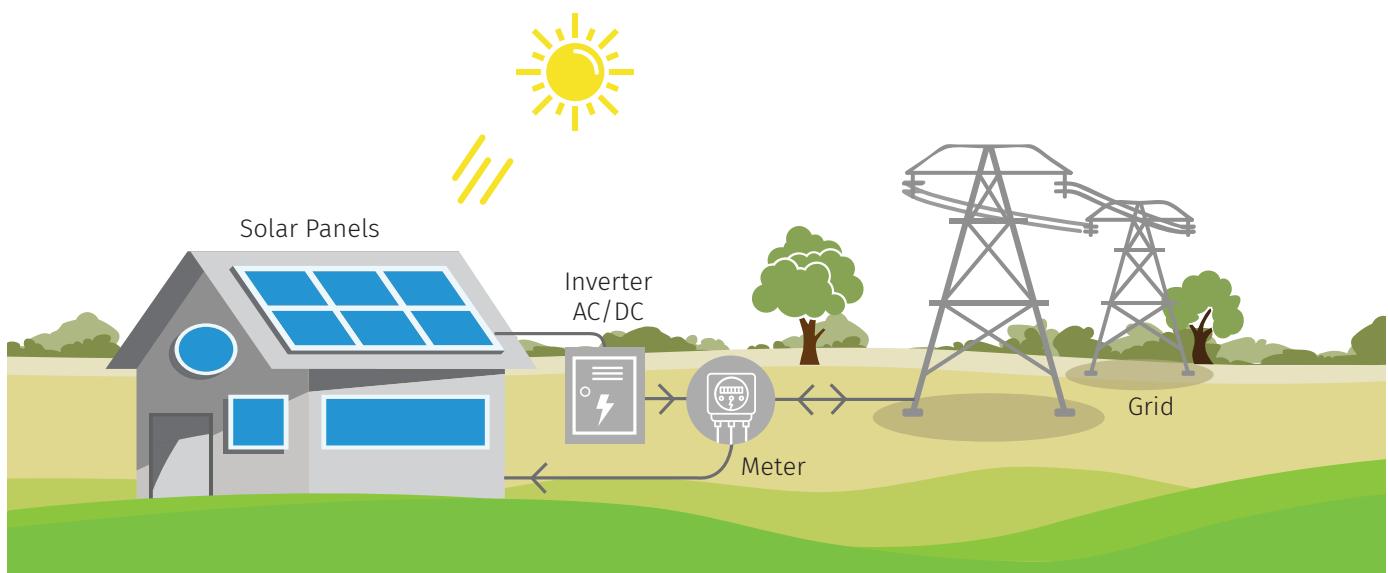
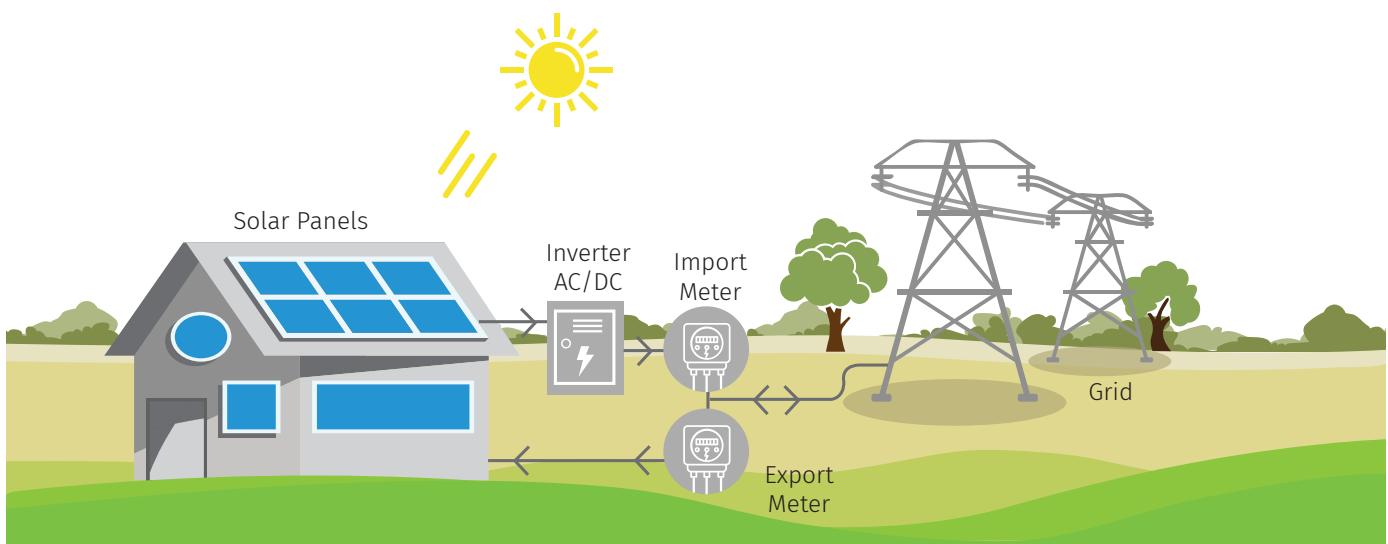


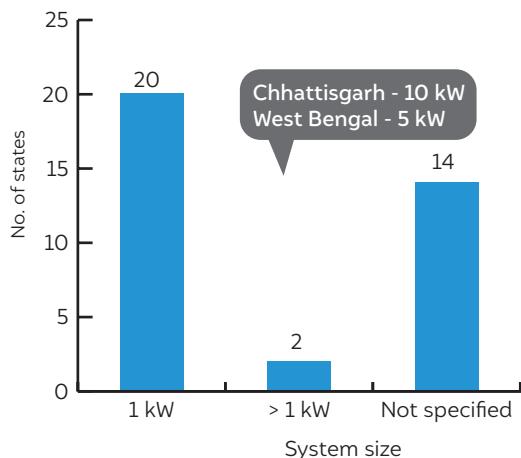
Figure 2: Gross metering arrangement



A state-wise perspective of net metering policies

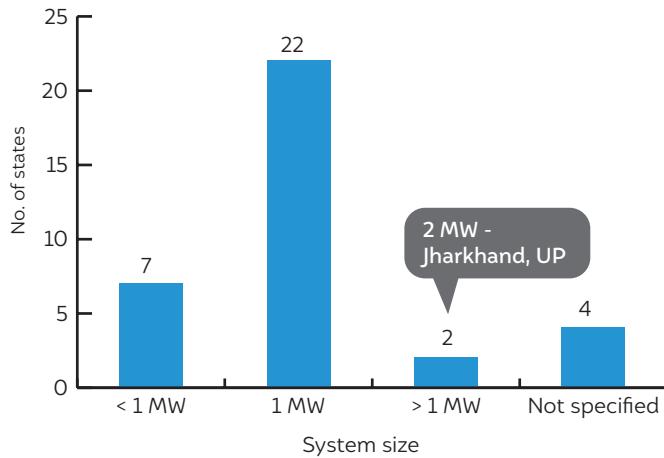
The allowed limit of the system size lies between 1 kW and 1 MW for most states. The minimum and maximum size is limited to 1 kW and 1 MW by 20 and 22 states respectively. Some notable outliers like West Bengal and Chhattisgarh have a minimum requirement of 5 kW and 10 kW, respectively, whereas Jharkhand is the only state which allows connectivity upto 2 MW.

Figure 3(a): Limitations on system size - minimum system size



Source: CEEW-CEF analysis

Figure 3(b): Limitations on system size - maximum system size



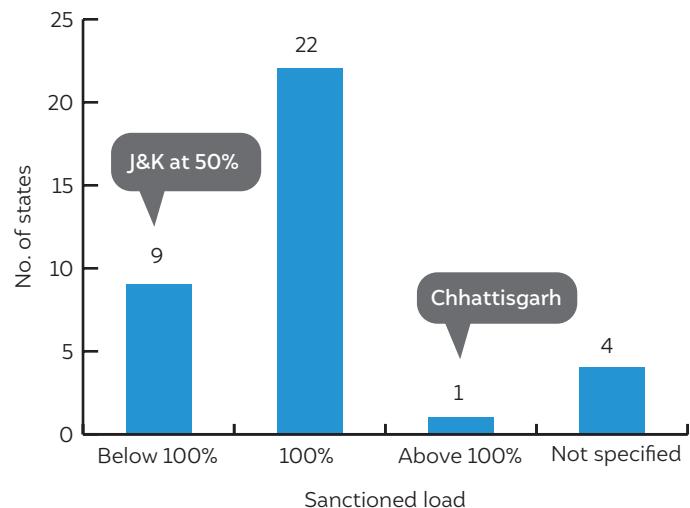
Source: CEEW-CEF analysis

Sanctioned load

As far as limitations on the sanctioned load are concerned, most states limit system capacity to 100 per cent of the sanctioned load, while a few restrict it

to below 100 per cent. A notable exception in this case is Jammu and Kashmir, where the size of the system is restricted to 50 per cent of the sanctioned load. Chhattisgarh, in contrast, permits systems with capacity above 100 per cent of the sanctioned load.

Figure 4: Sanctioned load

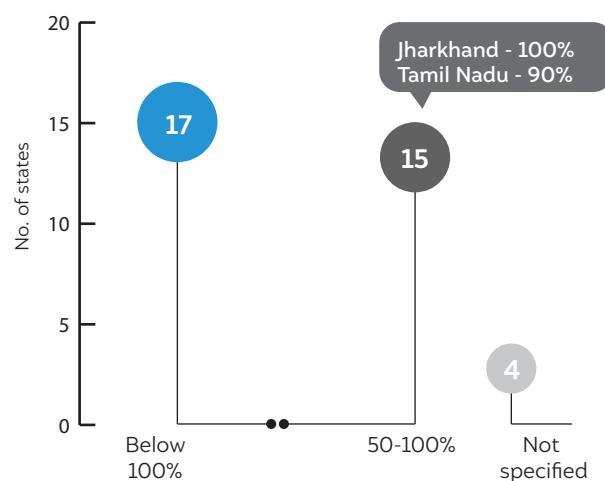


Source: CEEW-CEF analysis

Limitations on transformer capacity

For the integration of the generated solar power into the grid, almost half of the states allow connectivity up to 50 per cent of the transformer capacity for grid integration on a first come first serve basis. The notable exceptions are the states of Jharkhand and Tamil Nadu, which allow an addition of 100 per cent and 90 per cent, respectively, of the transformer capacity.

Figure 5: Limitations on transformer capacity



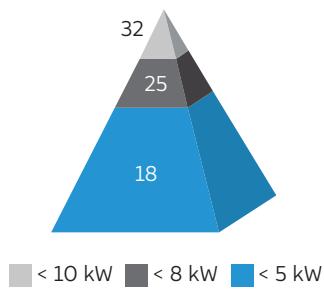
Source: CEEW-CEF analysis

Voltage connectivity

For consumers with single-phase low tension (LT) connections, most states allow connectivity up to 5 kW, while for three phase LT consumers, most states allow up to 100 kW.

The data is not specified for three states.

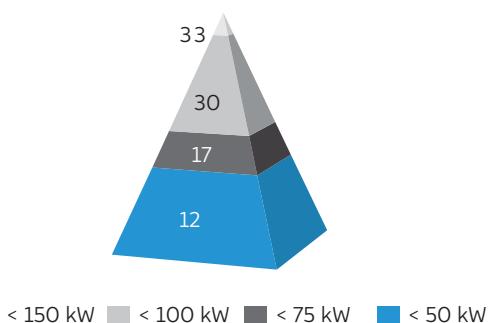
Figure 6(a): Voltage connectivity: single-phase LT



Source: CEEW-CEF analysis

Figures represent
number of states

Figure 6(b): Voltage connectivity: three-phase LT



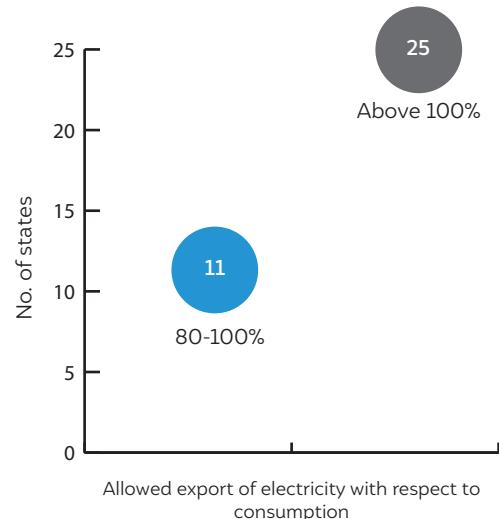
Source: CEEW-CEF analysis

Figures represent
number of states

Export of electricity with respect to consumption

For grid integration of the generated electricity, the net metering policies also cap the export of electricity with respect to consumption. As per this limitation, 11 states mandate that the capacity exported should not exceed the capacity consumed (100%). In these states, there will be no compensation for the surplus power. A notable outlier is Chhattisgarh, which limits export with respect to generation. Consumers can only export 49 per cent of the total electricity generated from the system.

Figure 7: Export of electricity with respect to consumption



Source: CEEW-CEF analysis

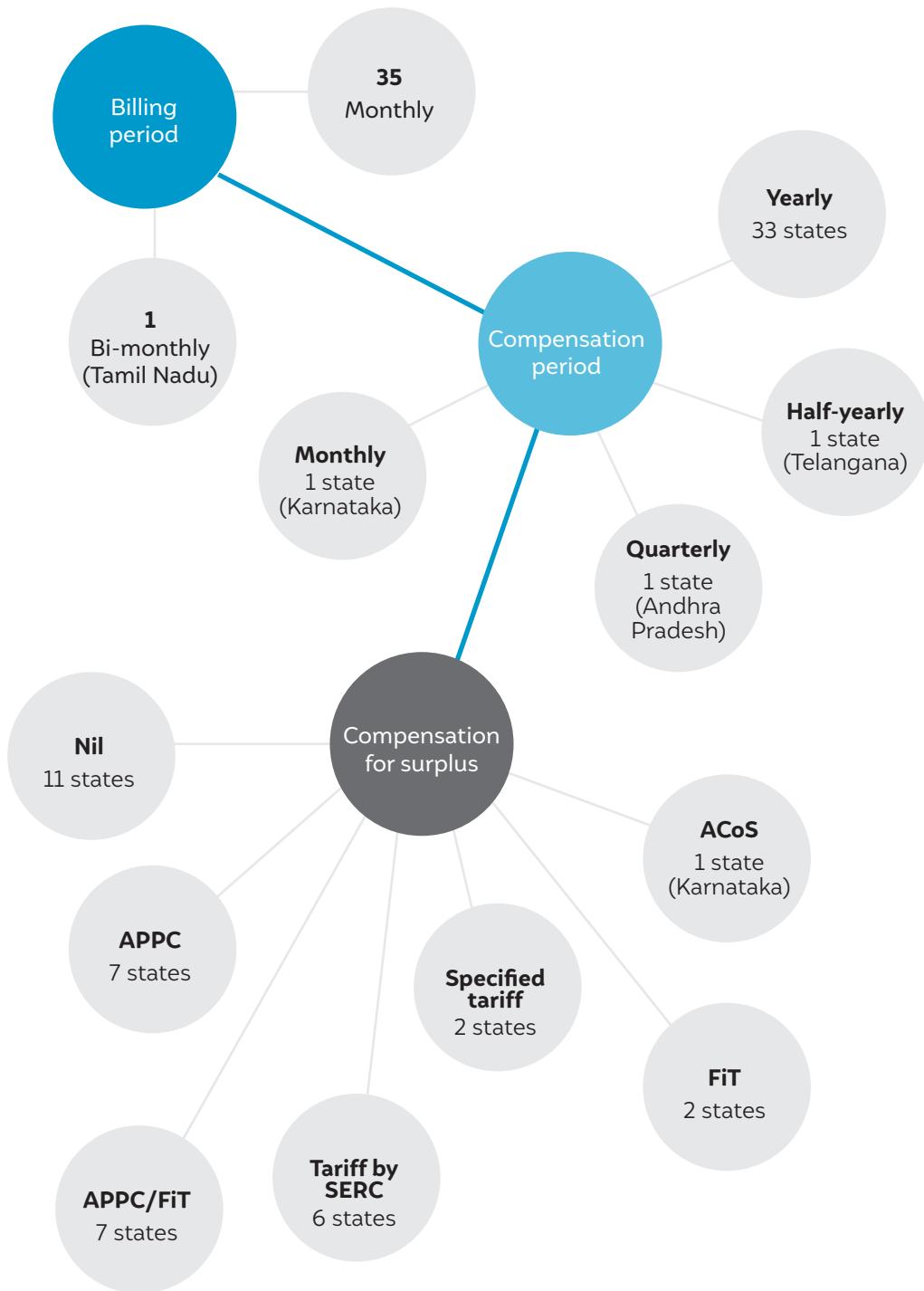


Image: iStock

Compensation mechanism

Lastly, states have different types of billing arrangements and compensate consumers at different rates for the surplus generation. An analysis of the same is presented below.

Figure 8: Compensation mechanism



Source: CEEW-CEF analysis

Net metering policies of India

October 2019

States	Year of release	Gross/Net	Specifications on capacity						Specifications for grid integration (electricity or power)			
			Range allowed	Allowed system size at voltage levels			Max. capacity w.r.t sanctioned load	Limitations on transformer capacity	Export of electricity allowed when compared to consumption	Billing period for settlement	Compensation period for surplus	Compensation for surplus
				LT single phase	LT three phase	HT level						
Andhra Pradesh	2015, amended in 2019	Both	1 kW–1 MW	< 3 kW	< 56 kW	56 kW–1 MW	100%	80% for LT 100% for HT	Above 100%	Monthly	Quarterly	APPC
Arunachal Pradesh	2016	Net	1 kW–1 MW	< 5 kW	< 50 kW	50 kW–1 MW	NA	15%	Above 100%	Monthly	Yearly	APPC rate
Assam	2015, amended in 2017	Both	1kW–1 MW	< 4 kW	< 20 kW	20 kW–1 MW	80%	20%	90%	Monthly	Yearly	Nil
Bihar	2018	Both	1 kW-up to the sanctioned load	< 7 kW	< 100 kW	100 kW–1 MW	100%	80%	Above 100%	Monthly	Yearly	Tariff determined by BERC
Chhattisgarh	2013, amended in 2017	Both	10 kW–1 MW	NA	10 kW–100 kW	100 kW–1 MW	Above 100%	NA	Above 100%	Monthly	Yearly	Tariff by CSERC*
Delhi	2014	Net	1 kW – NA; for group/virtual metering 5 kW – 5 MW	NA	NA	NA	100%	20%	Above 100%	Monthly	Yearly	Tariff by SERCs
Goa	2019	Both	NA–500 kWp for group/virtual net metering 5 kWp–NA	< 10 kW	10 kW–100 kW	Above 100 kW	100%	75%	Above 100%	Monthly	Yearly	APPC or FiT

States	Year of release	Gross/Net	Specifications on capacity						Specifications for grid integration (electricity or power)			
			Range allowed	Allowed system size at voltage levels			Max. capacity w.r.t sanctioned load	Limitations on transformer capacity	Export of electricity allowed when compared to consumption	Billing period for settlement	Compensation period for surplus	Compensation for surplus
				LT single phase	LT three phase	HT level						
Gujarat	2016, amended in 2017	Both	1 kW–1 MW	< 6 kW	6 kW–100 kW	Above 100 kW	Residential-Above 100%; Non-residential 50 % (for initial two years)	65%	Above 100%	Monthly	Yearly	APPC**
Haryana	2014, amended in 2015	Both	NA–1 MW	< 5 kW	5 kW–50 kW	Above 50 kW	100%	30 % for LT and 15% for HT	90%	Monthly	Yearly	Nil
Himachal Pradesh	2014, amended in 2018	Net	1 kW–1 MW	< 7 kW	7 kW–20 kW	20 kW–1 MW	Under two-part tariff –80%; under single part tariff < 5 kW – 100%, Between 5 kW–10 kW – 5 kW or 70% > 10 kW – 7 kW or 70%	30%	Above 100%	Monthly	Yearly	30% of the weighted APPC rate***
Jammu and Kashmir	2015	Net	1 kW–1 MW	< 5 kW	5 kW–100 kW	Above 100 kW	50%	20%	90%	Monthly	Yearly	Nil
Jharkhand	2015, amended in 2019	Both	1 kW–2 MW	< 5 kW	5 kW–50 kW	Above 50 kW	100%	100%	Above 100%	Monthly	Yearly	Tariff determined by JSERC
Karnataka	2016	Both	1 kW–1 MW	< 5 kW	5 kW–50 kW	Above 50 kW	100%	80%	Above 100%	Monthly	Monthly	Higher of tariff agreed to in PPA or retail supply tariff
Kerala	2014	Net	1 kW–1 MW	< 5 kW	5 kW–100 kW	Above 100 kW	NA	80%	Above 100%	Monthly	Yearly	As per tariff order
Madhya Pradesh	2015, amended in 2017	Net	NA–1 MW	< 3 kW	3 kW–112 kW	Above 112 kW	100%	30%, as per amendment in 2017	Above 100%	Monthly	Yearly	APPC rate

States	Year of release	Gross/Net	Specifications on capacity						Specifications for grid integration (electricity or power)			
			Range allowed	Allowed system size at voltage levels			Max. capacity w.r.t sanctioned load	Limitations on transformer capacity	Export of electricity allowed when compared to consumption	Billing period for settlement	Compensation period for surplus	Compensation for surplus
				LT single phase	LT three phase	HT level						
Maharashtra	2015, amended in 2017	Net	NA-1 MW	< 8 kW	8 kW-150 kW	Above 150 kW	100%	40%	Above 100%	Monthly	Yearly	APPC rate
Manipur	2016	Both	1 kW -1 MW	< 8 kW	8 kW-50 kW	Above 50 kW	100%	40%	Above 100%	Monthly	Yearly	FiT by JERC
Meghalaya	2015	Net	1 kW-1 MW	< 5 kW	5 kW-50 kW	Above 50 kW	NA	15%	90%	Monthly	Yearly	Nil
Mizoram	2016	Both	1 kW-1 MW	< 8 kW	8 kW-75 kW	Above 75 kW	100%	40%	Above 100%	Monthly	Yearly	FiT by JERC
Nagaland	2016	Net	NA-1 MW	NA	NA	NA	100%	15%	90%	Monthly	Yearly	Nil
Orissa	Amended in 2018	Net	Up to sanctioned load	< 5 kW	5 kW-70 kW	Above 70 kW	100%	75%	90%	Monthly	Yearly	Nil
Punjab	2015	Net	1 kW-1 MW	< 7 kW	7 kW-100 kW	Above 100 kW	80%	30%	90%	Monthly	Yearly	Nil
Rajasthan	2015, amended in 2019	Net	1 kW-1 MW	< 5 kW	5 kW-50 kW	Above 50 kW	80%	30%	Above 100%	Monthly	Yearly	Domestic category – above 100 units @INR 3.14/kWh, Other categories - Nil
Sikkim	2014	Net	1 kW-1 MW	< 5 kW	5 kW-25 kW	Above 25 kW	80%	NA	Above 100%	Monthly	Yearly	Tariff order of SSERC
Tamil Nadu	2019	Net	NA	< 4 kW	4 kW-112 kW	Above 112 kW	100%	90%	90%	Bi-monthly	Yearly	Nil

States	Year of release	Gross/Net	Specifications on capacity						Specifications for grid integration (electricity or power)			
			Range allowed	Allowed system size at voltage levels			Max. capacity w.r.t sanctioned load	Limitations on transformer capacity	Export of electricity allowed when compared to consumption	Billing period for settlement	Compensation period for surplus	Compensation for surplus
				LT single phase	LT three phase	HT level						
Telangana	2016	Both	1 kW–1 MW	< 5 kW	5 kW–75 kW	Above 75 kW	Residential: 100% Others: 80%	50%	Above 100%	Monthly	Half-yearly	APPC rate
Tripura	2016	Net	1 kW–1 MW	< 5 kW	5 kW–20 kW	Above 20 kW	100%	15%	90%	Monthly	Yearly	Nil
Uttar Pradesh***	2019	Both	1 kW–2 MW	< 5 kW	5 kW–50 kW	Above 50 kW	100%	25%	Above 100%	Monthly	Yearly	INR 2/kWh or as per rates decided by UPERC
Uttarakhand	NA	Net	NA – 1 MW	< 4 kW	4 kW–75 kW	Above 75 kW	80%	NA	95%	Monthly	Yearly	Nil
West Bengal	2013	Net	5 kW-not specified	NA	NA	NA	NA	NA	90%	Monthly	Yearly	Nil
UTs – Andaman & Nicobar, Chandigarh, Dadar and Nagar Haveli, Daman & Diu, Lakshadweep, Puducherry	2019	Both	NA–500 kWp; for group/virtual net metering 5 kWp–NA	< 10 kW	10 kW–100 kW	Above 100 kW	100%	75%	Above 100%	Monthly	Yearly	APPC or FiT determined for that year

* Compensation is capped at 49% of the generation

** For residential, industrial, commercial not under REC, APPC rate is applicable. For consumers under REC, 85% of APPC rate is applicable.

*** The applicable rate will be 30 % of the weighted APPC rate at which the discom has purchased power from the ground mounted solar PV plant up to 5 MW capacity

**** Net metering is not allowed for future projects

Glossary

- **Sanctioned load/contracted load** – Sanctioned load is the maximum demand which is to be supplied by the discom to the consumer as indicated in the agreement between them. It is denoted in kW, kVA, or HP.
- **Distribution transformer (DT) capacity** – A distribution transformer is a step-down transformer which is used for electric power distribution. DT capacity is the maximum load that can be put on a transformer within voltage limits by the electricity-generating consumers.
- **Surplus generation** – It is the difference in electric power exported from the RTS plant and imported from the grid. It is denoted in kW, kVA, or HP.
- **Cap on export with respect to consumption** – It is the limitation put on the export of electricity to the transformer with respect to the consumer's total consumption.
- **Billing period** – The time period for which regular electricity bills are prepared for the consumers by the discom.
- **Settlement period** – The time period within which consumers should be compensated for the surplus energy injected into the grid if it has not yet been settled in the billing period.
- **Range allowed** – This is the approved minimum and maximum capacity of the rooftop solar system which can be installed by an eligible consumer.
- **Average power purchase cost (APPC) rate** – The weighted average pooled price at which the discom purchased electricity from its energy suppliers, except those based on renewable sources, including its self-electricity generation cost in the previous year.
- **Feed-in tariff (FiT)** – The payment made in proportion to the power generated to consumers who generated electricity from renewable sources and provided it to the grid.
- **Group-net metering** – An arrangement whereby the surplus energy which is generated from a renewable source and fed into the grid through net metering is adjusted within the same discom's area of supply in more than one electricity service connection(s) of the same consumer.
- **Virtual-net metering** – An arrangement in which the entire energy which is generated from a renewable source is exported to the grid through a net meter or gross meter, and the exported energy is adjusted within the same discom's area of supply in more than one electricity service connection(s) of the participating consumer.

LT - Low tension line

HT - High tension line

About the National Rooftop Solar Policy

In August 2019, the Ministry of New and Renewable Energy (MNRE) issued operational guidelines for the implementation of Phase – II of the *Grid Connected Rooftop Solar and Small Power Plant Programme*. To achieve the target of 40 GW of grid interactive rooftop solar by 2022, MNRE has set a target of installing 4,000 MW of RTS capacity in the residential sector, and another 18,000 MW in the non-residential sector (commercial, industrial, government, and institutional consumers). In tandem with the *National Solar Mission*, policy targets have also been set for FY 2022. As per the scheme, discoms and their local offices are to be the nodal points to facilitate the rapid deployment of RTS. They are mandated to create an RTS cell at each division office, headed by an executive engineer and sub-divisional officer. They are also required to empanel solar developers and release tenders to deploy and identify competitive market rates for RTS systems.

Developers are also required to either individually or collectively set up service centres in each district to provide services to RTS owners free of cost for the first five years of the new RTS system.

Incentives for discoms

To accelerate the deployment of RTS, MNRE will provide performance-linked incentives to discoms to compensate them for costs such as the additional manpower required to run the RTS cells, capacity building, creating new infrastructure, etc. The incentive will be calculated as follows:

For additional installed RTS capacity of 10–15 per cent above the base capacity, 5 per cent of the RTS benchmark cost will be provided as incentive to discoms.

For installed capacity above 15 per cent of the base capacity, discoms will receive 5 per cent of the RTS benchmark cost for the first 10–15 per cent, and 10 per cent for the remaining capacity.

Incentives for residential consumers

MNRE provides capital incentives to residential consumers, including individual households and housing societies, to promote adoption of RTS. Central financial assistance (CFA) is calculated based on the benchmark cost of RTS systems as notified by the MNRE, or the rate discovered through transparent bidding by the discom.

The MNRE will allocate the capacity eligible for CFA for each discom annually on the basis of demand, solar renewable purchase obligations (RPO), any additional subsidies or benefits being given by the state or union territory (UT) in addition to the CFA, and the performance of the state, UT, and discom in the past.

Individual households: MNRE has restructured the CFA to increase it to up to 40 per cent for RTS systems up to 3 kW capacity. For RTS systems of capacity 3–10 kW, 40 per cent CFA will be provided for the first 3 kW, and 20 per cent for the remaining 7 kW at the benchmark cost. Capital subsidy is only limited to systems up to 10 kW capacity.

Group housing societies (GHS) and residential welfare associations (RWAs): CFA will be limited to 20 per cent for the installation of RTS plants that supply power to common facilities. The capacity eligible for CFA will be limited to 10 kW per house and to a total capacity of 500 kW, including existing installations on individual houses in that society or association.

Government-owned discoms will be eligible to avail advance CFA up to 30 per cent. For private discoms, CFA will be disbursed on a reimbursement basis. However, if required, private discoms can also avail advance CFA upon submission of an equivalent bank guarantee.

In addition, MNRE has allocated INR 198 crore (USD 27.6 million) for service charges and INR 66 crore (USD 9.2 million) for capacity building and awareness activities.

CEEW Centre for Energy Finance

The CEEW Centre for Energy Finance (CEEW-CEF) is an initiative of the Council on Energy, Environment and Water (CEEW), one of South Asia's leading think tanks.

CEEW-CEF acts as a non-partisan market observer and driver that monitors, develops, tests, and deploys financial solutions to advance the energy transition. It aims to help deepen markets, increase transparency, and attract capital in clean energy sectors in emerging economies. It achieves this by comprehensively tracking, interpreting, and responding to developments in the energy markets while also bridging gaps between governments, industry, and financiers.

The need for enabling an efficient and timely energy transition is growing in emerging economies. In response, CEEW-CEF focuses on developing fit-for-purpose market-responsive financial products. A robust energy transition requires deep markets, which need continuous monitoring, support, and course correction. By designing financial solutions and providing near-real-time analysis of current and emerging clean energy markets, CEEW-CEF builds confidence and coherence among key actors, reduces information asymmetry, and bridges the financial gap.

Financing the energy transition in emerging economies

The clean energy transition is gaining momentum across the world with cumulative renewable energy installation crossing 1000 GW in 2018. Several emerging markets see renewable energy markets of significant scale. However, these markets are young and prone to challenges that could inhibit or reverse the recent advances. Emerging economies lack well-functioning markets. That makes investment in clean technologies risky and prevents capital from flowing from where it is in surplus to regions where it is most needed. CEEW-CEF addresses the urgent need for increasing the flow and affordability of private capital into clean energy markets in emerging economies.

CEEW-CEF's focus: analysis and solutions

CEEW-CEF has a twin focus on markets and solutions. CEEW-CEF's market analysis covers energy transition-related sectors on both the supply side (solar, wind, energy storage) and demand-side (electric vehicles, distributed renewable energy applications). It creates open-source data sets, salient and timely analysis, and market trend studies.

CEEW-CEF's solution-focused work will enable the flow of new and more affordable capital into clean energy sectors. These solutions will be designed to address specific market risks that block capital flows. These will include designing, implementation support, and evaluation of policy instruments, insurance products, and incubation funds.

CEEW-CEF was launched in July 2019 in the presence of H.E. Mr Dharmendra Pradhan and H.E. Dr Fatih Birol at Energy Horizons.

The authors



Saloni Jain
Analyst
(CEEW-CEF)



Tanushree Garg
Research Fellow
(IIM Ahmedabad)



Rishabh Jain
Manager
(CEEW-CEF)



Neeraj Kuldeep
Programme Lead
(CEEW)

This brief has been peer-reviewed by: Sishir Garemella, Founder & CEO, Sunvest Capital; and Soumya Maiti, Senior Manager, Policy - Regulatory and Energy Sales, Amplus Solar.

COUNCIL ON ENERGY, ENVIRONMENT AND WATER (CEEW)

Sanskrit Bhawan, A-10, Aruna Asaf Ali Marg
Qutab Institutional Area
New Delhi 110 067, India
T: +91 11 4073 3300

cef@ceew.in | @CEEW_CEF

For latest updates and comparison of net metering policies across states, please visit the CEEW-CEF
<http://cef.ceew.in/>



Copyright © 2019

Council on Energy, Environment and Water (CEEW)