

ACCELERATING ROOF-TOP SOLAR PHOTOVOLTAICS DEPLOYMENT IN THE EASTERN STATES OF INDIA



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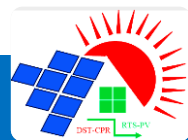
ABOUT

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In December 2021, the Ministry of Science and Technology, Department of Science and Technology (Policy Research Programme) made an open call for the submission of Expressions of Interest in STI Policy Research towards the Establishment of the Center for Policy Research (CPR) by the academic and research Institutes in India. After multiple rounds of consultations and review, the DST-CPR at NISER received the final sanction order from the Government of India, Ministry of Science & Technology, Department of Science & Technology, bearing the letter No DST/PRC/CPR/NISERBhubaneswar-2023 (G)(PCPM) dated 29/03/2023. The primary focus of the DST-CPR at NISER is to study the Energy Transition, and the secondary focus is to study Tribal Education and Innovations for Tribal Education in Eastern India covering Odisha, Bihar, Chhattisgarh, Jharkhand, and West Bengal.

SUGGESTED CITATION

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EXECUTIVE SUMMARY

This policy brief examines the deployment of Rooftop Solar Systems (RTS) in eastern India. Various policy recommendations are proposed to enhance the solar market and expedite RTS installation. These include suggestions for modifying policies to encourage solar power use in government offices. We propose to set a mandate for government offices to fulfill 30-50% of their total electricity consumption through RTS PV in a time-bound manner. We advocate for larger solar installations over multiple smaller units for grid-connected systems to minimise the noise in the grids. We also suggest that every Panchayatiraj Institution and Urban Local Body should spend at least 10% of their annual grant on SPV. State governments should develop solar villages on a pilot project basis, in line with Gujarat's Modhera village, with public and private sector participation.

In order to avail the users' feedback, the National/State Portal for Solar Rooftop should add features for customer reviews for DISCOMs, solar PV modules, and installers, as well as the promotion of virtual net metering. We emphasize the involvement of more prominent industries in installing RTS units to avail carbon credits. We suggest providing EMI options for consumers and ensuring the participation of local vendors in solar schemes. Additionally, we propose region-wise review meetings, educational programs on renewable energy in schools, awareness initiatives for research scholars, and skill development programs for operation and maintenance. We also recommend including women in renewable energy schemes, insurance for solar panels against natural disasters, and the responsibility of solar PV installers for maintenance till the payback period to ensure the success of RTS systems.

“The greatest threat to our planet is the belief that someone else will save it.”

-Robert Swan (Founder of 2041, activist)

ACCELERATING ROOF-TOP SOLAR PHOTOVOLTAICS DEPLOYMENT IN THE EASTERN STATES OF INDIA

1. BACKGROUND

A significant shift is observed in electricity production sources from fossil fuels to renewable energy to mitigate the effects of global warming and climate change. India is actively addressing these concerns and has implemented various measures to offset carbon emissions. According to a 2013 report by CEEW, states in the eastern region, such as Odisha, Bihar, and Chhattisgarh, are significant contributors to carbon emissions in India [1]. India, a country with abundant solar radiation, experiences over 300 sunny days annually, with an average Global Horizontal Irradiance (GHI) or solar radiation of 4- 7 kWh/sq. m/day [2]. As per the GHI of the states and land availability, the MNRE estimated the solar photovoltaic (SPV) potential for Indian states. The SPV potential of the eastern states (Bihar, Chhattisgarh, Jharkhand, Odisha, and West Bengal) is reproduced by MNRE data [3] and presented in Fig.1 (a) via QGIS software. The development and deployment of solar technologies as an impactful renewable energy technology have been observed since the launch of Jawaharlal Nehru National Solar Mission (JNNSM) in 2010. The current SPV installed capacity in eastern states up to 31-12-2022 (MNRE annual report [4]) is shown in Fig. 1 (b).

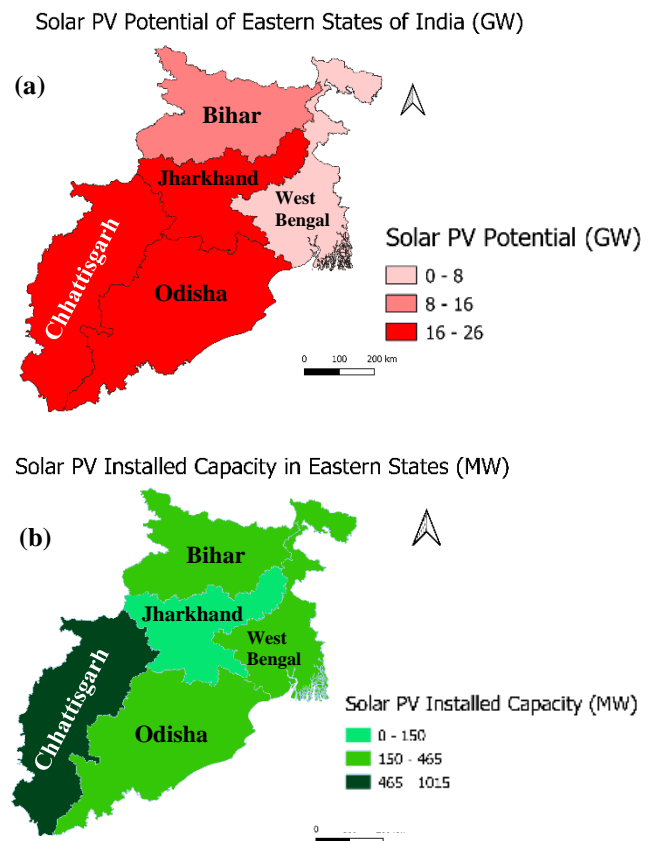


Fig. 1 Solar PV (a) Potential of Eastern states (b) Installed capacity of Eastern states [3,4]

Though the installed capacity of eastern states is <3% of their total potential, overall solar PV installed capacity growth over the previous years is observed in Fig. 2 (a). Among the selected states, SPV installed capacity of Chhattisgarh proliferated from 2016 to 2023.

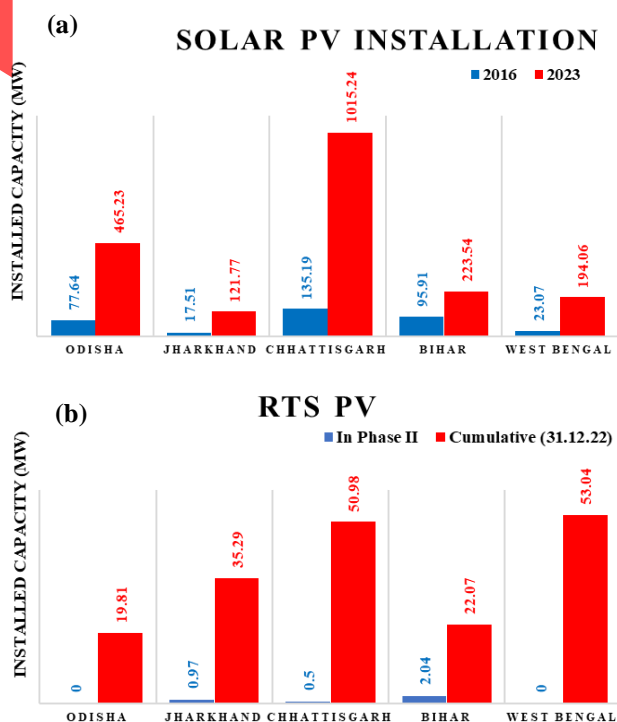


Fig. 2 (a) Solar PV installed capacity growth from 2016-23 [4, 5], (b) Comparative RTS capacity of states in phase II and cumulative.

In order to promote uninterrupted solar PV installation in urban and rural areas, including offices, households, residential buildings, and institutional buildings, MNRE launched a Rooftop Solar (RTS) scheme.

Phase I of the RTS scheme was launched on 30th December 2015, and with further modifications to the scheme, Phase II was launched in 2019 with a massive target of 4 GW in residential. Considering the COVID-19 condition, the RTS scheme phase-II period is extended until March 2026 with a similar target. However, till March 2023, the installed SPV capacity through RTS in residential areas was only 1.9 GW [4]. According to the MNRE annual report 2022-23, the eastern states' RTS share may be worth worrying about such big targets. Odisha and West Bengal have no share of the installed RTS capacity in Phase II, as shown

in Fig. 2 (b). Concurrently, Bihar, Chhattisgarh, and Jharkhand contributed 2.05 MW, 0.50 MW, and 0.97 MW as RTS installed capacity in residential areas [4]. In addition, the cumulative installed capacity of the states is also given in Fig. 2 (b). To strengthen the RTS further in the eastern states, deployment of RTS should be accelerated in the region.

2. REGULATORY FRAMEWORK

The regulatory framework for the RTS scheme under phase II, in particular for residential buildings, is governed by two mechanisms as shown in Fig. 3. There are two mechanisms for application: (i) a direct central government portal named '**National Portal for Rooftop Solar**'; (ii) **State DISCOM portals**. In the first mechanism, DISCOM is involved in a technical feasibility check and the installation of net metering/virtual net metering systems. However, consumers can choose the solar PV vendor, module specifications, and DISCOM. The Central Financial Assistance (CFA) is directly provided to the consumer. On the other hand, in the state DISCOM portal, consumers need to apply through the state government DISCOM portal, and the company itself is responsible for everything, from technical feasibility assessment to solar PV development and net metering systems [6]. In the second mechanism, the CFA is provided directly to the solar PV installer, and the consumer has to pay the developer the remaining amount.

To further accelerate the RTS installation, few state government nodal agencies like OREDA propose the RTS installation in the RESCO (RENEWABLE ENERGY SERVICE COMPANY) model [6, 7]. In this RESCO model, the developer decides the design of the SPV plant, and the developer is responsible for building the plant, arranging

the funds, and operating it for the consumer and his benefit, like a business.

In the RESCO model, the consumer is responsible for providing the space and, in return, availing of solar PV electricity facilities at a reasonable cost. However, the developer benefited in two ways: by the consumer and by selling the remaining part to the DISCOMs. In this model, feasibility checks and net metering installations have been taken care of by the states' DISCOMs. Many government banks provide loans for solar PV installation via the RESCO Model.

3. FINANCIAL INCENTIVES

To facilitate the easy installation of solar PV in residential buildings under phase II of the RTS scheme, there is a provision of **Central Finance Assistance (CFA)** by MNRE, the government of India. The government has provided the fixed CFA to the consumer or the developer, depending upon the mechanism chosen for SPV installation under the RTS scheme.

To better understand the CFA amount according to the installed capacity, it has been simplified and shown in Table 1;

Table 1. RTS SPV capacity and CFA

RTS	Central Financial Assistance (CFA)
Up to 3 kWp	Rs 14588/kWp
>3 kWp to 10 kWp	Rs 14588/kWp for 3 kWp + additional generation 7294/kWp
>10 kWp up to 500 kWp	94822/- fixed

For the initial 3 kWp, the CFA amount is 14588/kWp, and additional units after that are considered for 7294/kWp INR. However, the CFA amount is fixed for larger plants at 94822/- INR [8]. The MNRE provided financial aid for the plants with a capacity of ~500 kWp. On the other hand, in the case of the RESCO model, there is a provision of direct financial aid by MNRE of Rs

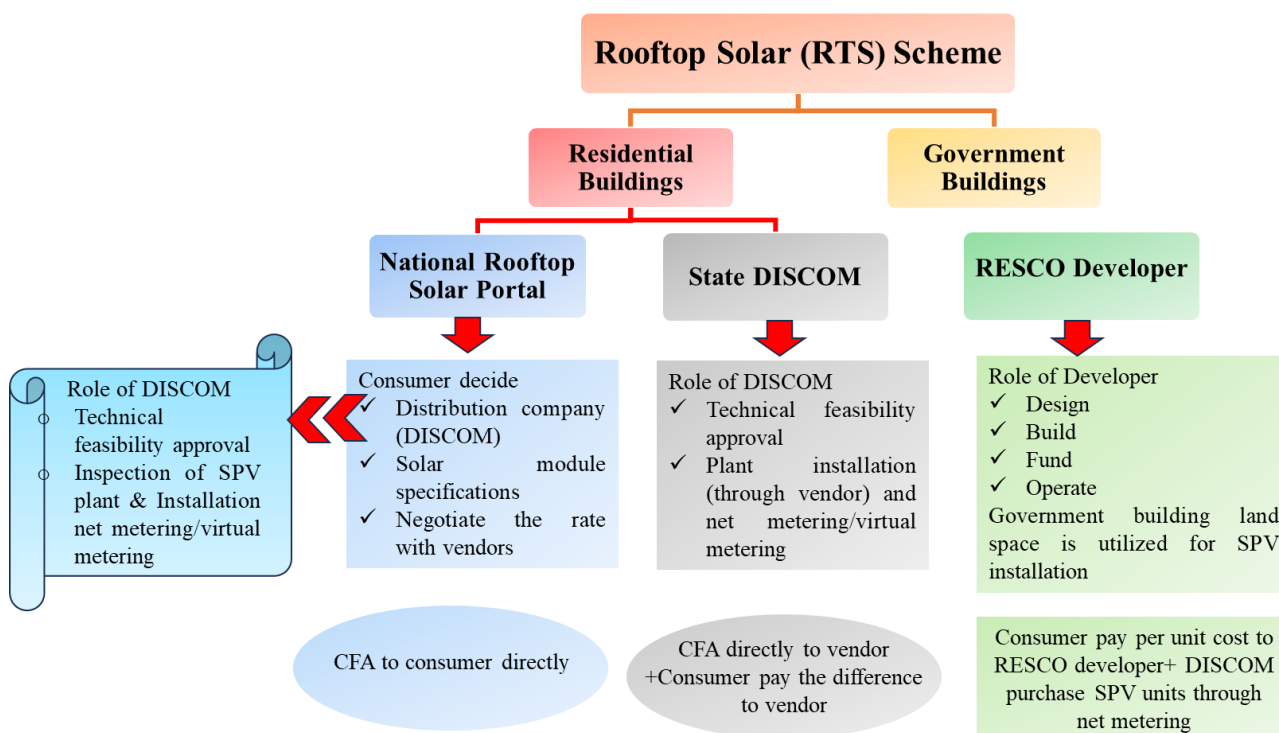


Fig. 3 RTS regulatory frame work

14588/kWp, and the rest is developer's investment where RESCO developers are allowed to ask for loans (70% of their total investment) from banks at an interest rate of 9%. In the RESCO model, capital investment by the consumer is 0%, but the consumer is supposed to pay the electricity bills to the developer at 4 Rs/ unit consumed. This scheme aims to minimize consumers' electricity bills by minimizing low transmission (LT) losses and increasing renewable energy capacity in the states [9]. Initially, the RESCO model was available for off-grid systems only. However, after revision in 2022, the model is applicable for on-grid systems as well with a Virtual Net Metering (VNM) provision. In the VNM model, remote installation of solar PV plants is possible with feed-in to local DISCOMs. As per the agreement with the consumers, the local DISCOMs provide electricity to specific consumers. Many states, including Odisha, agree with the VNM and MNRE, pursuing other states and Union Territories (UTs) to allow for the same [10].

4. AWARENESS AND SKILL DEVELOPMENT

In different platforms, discussions on global warming and climate change threats are rising. The government provides several scholarships/fellowships and imparts skills to educate people about the importance of RE technologies and their benefits. Individuals like Dr Chetan Singh Solanki (via his 'Energy Swaraj' Foundation) are taking several initiatives to educate people about the importance of reducing energy consumption and adopting renewable energy [11]. MNRE provides scholarships for master's and bachelor courses in RE and fellowships for doctoral and post-doctoral programs in RE. In addition, MNRE also skills Surya Mitras for solar PV installation. Surya Mitra Scheme was launched to create

50,000 trained solar photovoltaic technicians by March 2020 [5]. However, there is a lot to be done in this direction by the central and state governments. There is a need to strengthen the skill development and awareness programmes on RTS. Local ITI colleges and professional schools/colleges should provide Solar PV manufacturing, installation, repair, and maintenance training programs.

5. MONITORING AND EVALUATION

Usually, solar PV plants are said to be maintenance-free; only timely cleaning is required as their lifespan is more than 25 years. However, the balance of the system (BOS), including the batteries (in case of a stand-alone off-grid system) and inverter (for on-grid), require regular maintenance and checks. In the RTS scheme for smaller residential systems, the customer or owner of the plant is supposed to maintain the system. However, in the case of net metering with DISCOMs, few state agencies have norms for time-to-time operation checks for the larger PV systems. Concurrently, in the RESCO model, the RESCO developer is responsible for maintaining the solar plant up to the agreement period (10-15 years) [12].

It is worth noting that, to date, there are no such guidelines for the operation and maintenance of solar PV systems after installation by any agency. The skilled workers for the operation and technical check are also unavailable, which indicates the loophole in the maintenance framework of the RTS plants.

6. POLICY RECOMMENDATIONS

Despite the several initiatives the ministry took for RTS installation, eastern India needs to catch up in RTS deployment. To develop a viable solar market and accelerate the RTS

installation, a variety of policy recommendations are given below:

- The Odisha government recommends solar power generation for government offices by RTS using the RESCO model. However, some modifications to the policy are required. The government can make it mandatory for government offices to ensure the production or/and consumption of 30-50% of total electricity consumption within a time-bound manner from RTS or other clean energy sources. For the transition, the government should provide all financial assistance.
- Other eastern states should follow Odisha's RESCO model implementation for government buildings, including virtual net metering (VNM), with some mandatory installation norms as suggested in the previous point.
- Once the government makes it mandatory for government offices to consume at least 30-50% of electricity from RTS, different options should be provided to them. Multiple offices in remote locations or groups of residential buildings can be brought together to form Solar Energy Producer Groups (SEPG) to avail the facility of RTS installation in the CAPEX (Capital Investment) model with their investments.
- The 'National Portal on Solar Rooftops' is operating on a first-come-first-serve basis. However, due to the increase in electrical noise at the distribution end due to multiple small grids feeding into the network, the larger installation should be given preference over the smaller ones. Small RTS producers should be encouraged to form SEPG.
- One large SPV installation is better than four small ones. To reduce the impact of multiple grid feeders and the resulting electrical noise loss, the portal should identify the small-capacity SPV plants and integrate their demand in one location with larger units.
- National portals for RTS should have the options for users' feedback and review. This may involve star ratings for DISCOMs, solar PV modules, and installers. This would be helpful for customers in their decision-making and make suppliers accountable.
- Larger industries like mining, iron/steel, leather, chemicals, etc., in Odisha, Jharkhand, and West Bengal should install RTS units on the roofs of their industries to earn carbon credits, which will benefit the industry and the state.
- Captive thermal power producers should be mandated to fulfill all non-factory (such as office space, residential, etc.) electricity needs from RTS.
- To further accelerate the RTS installation, state governments should provide consumers an EMI (equated monthly installment) option to promote the state DISCOM-based RTS installation.
- For smaller RTS units (<10 kW), off-grid systems installation should be promoted with CFA or EMI schemes.
- Every Panchayati Raj Institution and Urban Local Body should be advised to spend 10% of their annual grant on generating solar power.
- State governments should initiate the pilot project to have more solar villages in line with Gujarat's Modhera village model, with joint funding of government and households.
- To attract industries to set up their factories, the state government should

ensure the participation of local vendors in all solar schemes, including the RTS.

- There must be a region-wide review meeting, either online or onsite, for idea exchange to accelerate green power generation. This will create healthy competition for all the nodal agencies and DISCOM units.
- Awareness of diminishing conventional fuels, global warming, and alternate energy resources should be compulsory in all schools and colleges to cultivate the green concept of energy production.
- A mandatory societal awareness initiative (in person or through online media) should be included for the research scholars availing of the MNRE fellowships.
- A separate unit in the industry and Research and Development (R&D) institutions of energy should take the initiative to train workers for quality checks of the SPV plants.
- Skill development programs for operation and maintenance (O&M) should be done on priority. The eastern states should also consider the contribution of women workers for O&M by skilling them under the scheme of MNRE entitled 'Women in Renewable Energy.'
- Similar to the RESCO model, in any solar RTS installation, the SPV installer (company) should also consider the maintenance of the RTS plant at least until the payback period (depending on the SPV capacity) to ensure uninterrupted power supply to the consumers, that will build trust in society for RTS-PV options.
- For states like Odisha and West Bengal (vulnerable to cyclone risks), there should be rooftop solar panel insurance

schemes for natural disasters like cyclones, and state nodal agencies should take care of such policies.

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