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Significance of Grid Connected Rooftop Solar Photo Voltaic in Kolkata and other Urban Spaces of West Bengal

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The threat of climate change has been a matter of concern, globally. India too has pledged voluntarily at Paris Climate Conference in 2015 (COP21), the 2015 Paris Climate Conference to reduce carbon emission intensity, create an additional carbon sink by increasing forest coverage and also to increase the share of renewable in the power mix. To meet up with the target set by the central nodal agency for Renewable Energy, several states have been adopting measures to increase the renewable energy proportion.

Availability and affordability of land has been a major challenge in the state of West Bengal. Given this background, this Briefing Paper has tried to analyse the significance of utilising the unused free rooftop spaces in Kolkata and other urban areas of West Bengal to implement grid-connected rooftop solar power plants.

Introduction

The Prime Minister of India, Narendra Modi, at the COP21 voluntarily pledged that the country will produce 175 Gigawatt (GW) of renewable power by 2022, of which, 100 GW of power is to be attained from solar energy. 40 GW of this is to be achieved from rooftop solar photo voltaic (PV) systems (residential as well as commercial establishments) and the remaining 60 GW from large and medium scale grid connected solar projects. The country now has an installed power generating capacity of 42.85 GW from the renewable energy (RE) resources, which is more than 14 per cent of the total installed capacity (303.118 GW). However, the installed capacity of solar in the country is only 6.76 GW.

To meet the national target, the Ministry of New and Renewable Energy (MNRE), Government of India, has set solar power targets to be achieved individually by states. West Bengal has been given a target of 5,336 MW to be achieved from solar power by 2021-2022. Currently, the installed power generating capacity from the renewable resources contribute only a miniscule 1.3 per cent (132.27 MW) of the total power generating capacity (9,984 MW) in the state. The state had an installed solar power capacity of only 7.21 Megawatt (MW), as on March 07, 2016.

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Significance of Grid-connected Rooftop Solar Power

Kolkata has an annual average solar insolation of 4.67 kWh/m^2/day. The city is endowed with almost 280-300 sunny days a year. However, when compared to the rest of India, except North East India, parts of Bihar, UP and Jammu & Kashmir the potential to generate power from solar energy is much less. In addition to this, availability and affordability of vast area of land in the state has been a challenge.

A 1 MW solar power plant approximately requires 4.5-5 acres of land (for crystalline technology). It involves high capital investment. To meet the Renewable Purchase Obligation (RPO) and Solar Purchase Obligation (SPO) targets, many states are now undertaking schemes to promote rooftop solar programmes. The benefits of having grid connected rooftop solar power plants in the state are manifolds:

- Economic utilisation of the unused rooftops
- Reduced energy bills for end consumers
- Lesser initial investment (for battery less grid connected rooftop solar plants)
- Shaving of peak power load on the power utilities
- Helping the Electricity Distribution Companies (DISCOMs) to achieve their RPO/SPO targets (for grid-connected rooftop solar plants)

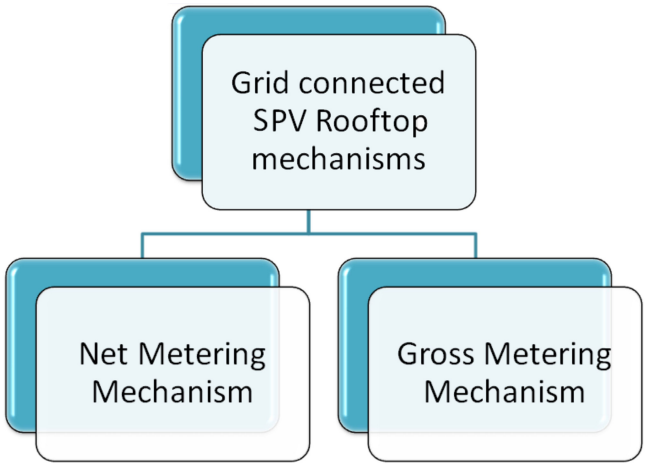
Two mechanisms, which are commonly practiced world-wide for implementation of grid-connected rooftop solar programmes are:

- Net Metering Mechanism: It is a billing mechanism that credits solar energy system owners for the electricity they add to the grid
- Gross Metering Mechanim: A metering arrangement where the electrical energy generated from the SPV cells is exported to the grid. Consumer pays the bill on the actual basis of energy exported to the grid

West Bengal: Policy Review

The state implemented a policy on '*Co-generation and Generation of Electricity from Renewable Sources of Energy*' in June 2012 to popularising RE in the state. The policy highlights potential of various RE sources in the state. The policy had a set a target to achieve 1,040 MW of RE power by the end of 2017 and 2,706 MW by the end of 2022. It further had set a target to harness 82 MW of solar power through grid interactive projects by 2017. It also had aimed to achieve a target of 16 MW of small and rooftop SPV installations by the year 2017.

Figure 1: Types of Grid connected SPV Rooftop Mechanisms



However, the state government recognised the significance of implementing a dedicated policy focussing on rooftop solar mechanism. Given that, the state still has a long way to travel, before it can achieve the revised targets set by the MNRE; the Power Department, with considerable inputs from the state DISCOMs and the state Nodal Agency for RE, West Bengal Renewable Energy Development Agency (WBREDA) is in the process of finalising a policy on Grid Connected Rooftop Solar.

Business Models – Grid Connected Rooftop Solar Mechanism

Many business models of grid-connected rooftop solar mechanisms have become popular across the country. These models have been selected and customised depending largely on local demand. The Government of West Bengal needs to comprehend the end-consumer demands and take into consideration feedbacks from the state power utilities and the WBREDA, before finalising the model, which it wants to adopt. Depending upon the demand the models can also be customised.

Model I: Individual Ownership

In this model, the rooftop owner can apply to the respective DISCOM to set up a rooftop solar plant. Upon receiving the approval from the DISCOM, the owner with the help of a channel partner of the MNRE, installs the SPV system on the rooftop. The owner pays the capital expenditure incurred by the channel partner for setting up of the power plant. As the system starts to generate and feed power to the grid, metres installed by the DISCOM calculates the amount of energy drawn in from the grid and the amount fed into the grid. Thereby the DISCOM charges the consumer accordingly in his energy bill. The consumer gets the benefit of having a reduced energy bill, as compared to the situation when the owner was drawing the entire power from the grid.

Table 1: Expected Roles of Regulatory Institutions and Policymakers to Popularise SPV Rooftop Scheme in West Bengal

	Central Institutions	State Institutions	Expected Roles
Regulators	Central Electricity Regulatory Commission	West Bengal Electricity Regulatory Commission	• Promoting RE through new or amended regulations • Imposing stricter penal provisions on the utilities failing to meet the RPO and SPO targets • Determining the power tariff
Policymakers	MNRE, Government of India	WBREDA, Government of West Bengal	• Promotion of RE and the rooftop SPV market in the state • Facilitating investment-friendly policies and creating infrastructure to lure the entrepreneurs to invest in RE • Developing market-linked schemes and mechanisms to promote RE • Developing a value chain of solar PV in the state • Capacity building of end consumers towards the benefits of the rooftop SPV scheme • Job creation

Model II: Public Private Partnership

The rooftop owners lease out their unutilised rooftops to a private entrepreneur (third party project developers) who, after undertaking the feasibility study, applies to the respective DISCOM to install the Grid Connected Rooftop Solar plant. Upon receiving the approval from the DISCOM, the entrepreneur sets up the rooftop solar power plant. The entrepreneur pays a monthly rent to the rooftop owner for using the roof space. The generator (the entrepreneur) earns from the generation based revenue earning mechanism from the DISCOMs. The developer earns the money back from the generation and also ensures that the system operates hassle free. The advantage of involving a third party developer is that, they are technically competent to maintain the systems. Also, for the DISCOMs, it becomes easier to interact with a group of developers than interacting with several building owners.

Recommendations to Promote Rooftop Grid Interactive Solar Market

Market driven schemes and programme, strengthening the existing value chains, implementing robust administrative decisions and legal courses against the defaulters, strengthening the state nodal agency and educating the consumers and other relevant stakeholders about the necessity and benefits of the mechanism are required to promote the rooftop grid interactive solar market in the state.

Market-driven Schemes, Policy and Programme

The need to design schemes to encourage private investment and develop a market driven mechanism, to promote the grid connected rooftop solar segment has become fairly relevant. A dedicated policy on grid-connected rooftop solar can provide the required boost to the sector. The government should take initiatives to link the rooftop solar market with livelihood generation at local levels. It is important to link private entrepreneurs, financial institutions, policymakers and the bilateral and multilateral funding agencies to design a self-sustaining programme which would encourage the rooftop solar segment.

Strengthening Value Chain

It is essential to strengthen the existing value chain and thereby improve linkages between service providers, market players, financial institutions, regulators,

A Success Story, Learning Lesson and Initiatives

In 2015, Deshapriya Park of Kolkata became the first park in the country to install battery-less grid interactive solar lighting systems. The park is now illuminated by 50 numbers of LED lamps, each of 180 watt capacity, backed up by grid connected battery-less SPV modules. The new LED lights have replaced the erstwhile 400 watt sodium vapour lamps in the park. The solar PV modules generate electricity during the day time and feed the entire power generated, to the grid and during night time the LED lights are illuminated by drawing power from the grid. An automatic control system operates the entire lighting system, which turns on the lights automatically during evening and turns off in the morning. This carbon-neutral lighting system has been put in place by the Kolkata Municipal Development Authority (KMDA), the civic body of Kolkata.

Earlier the bills of the park used to be to the tune of approximately ₹17,000, but have now been drastically reduced to less than ₹2,000. Taking a cue from the success of this plant, the KMDA has put an emphasis on implementing rooftop grid connected solar systems in many other parks of the city.

Leading Bengali news *daily,* Ei-Samay, reported on August 10, 2016 that the state government is taking an initiative to undertake a programme to install rooftop grid-connected SPV panels on government offices. The state government is also currently implementing a programme to install rooftop solar power plants of capacities 10 kilovolt-ampere (KVA) on 1000 schools in the state.

policymakers, DISCOMs and consumers. Improving upon after sales service can also provide the required boost to the sector.

Robust Administrative Decisions

The existing West Bengal Municipal (Building) Rules, 2007 provides a mandate towards installing SPV/Solar Thermal for buildings with a height of above 14.5 meters (under clause 174). However, absence of proper monitoring and lack of strict penal actions has made a mockery of this mandate. Strong administrative decisions and proper legal courses against defaulters have the capability to accelerate the market to an extent.

Strengthening the State Nodal Agency

WBREDA has a mandate to promote RE in the state and create an environment conducive to their commercialisation through innovative projects. However, due to lack of adequate resources the agency has failed to cope up with the expectations. The agency now is meagrely limited to executing projects. WBREDA should be given the task of designing policies and creating a market to encourage the private entrepreneurs. If the state has to meet the RPO, SPO targets and also achieve the revised solar power target set by MNRE, the state Nodal Agency needs to be strengthened in terms of resource allocation. They also needs to be empowered with discretionary powers in the field of RE.

Capacity Building and Awareness Programme

There is a need to undertake mass awareness programmes and build capacities of end consumers, if rooftop solar programme has to become popular in the state. The socio-economic benefits should be made aware to end users. In addition to this, there is a need to develop customised training programmes for officials of power utilities, financial institutions and policymakers on the need and benefits of rooftop solar. Regular updates on circulars and mandates of the central nodal agency, schemes of institutions like Reserve Bank of India and National Bank for Agricultural and Rural Development are to be included in the training curriculum.

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