

INITIATIVES FOR SOLAR ENERGY

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The Government of India has recently declared its Intended Nationally Determined Contributions (INDCs) towards realizing the ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC). The plan is for reduction in the emissions intensity of its GDP by 33 to 35 per cent from 2005 level, by 2030 and to create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030. In order to meet this ambitious target, renewable energy is expected to play a crucial role in our country. India's emission reduction targets are in-line with the National Solar Mission target of 100 GW solar energy by 2022. Out of this 100 GW, 60 GW is to be achieved through grid-connected utility scale solar plants and 40 GW through grid-connected solar rooftop projects. Government of India is speedily moving towards achieving this target by creating a supportive and conducive environment in terms of technology, policy and financial aspects.

Grid-interactive solar power in India stands at 6762.85 MW and solar photovoltaic (PV) systems installed as captive or off-grid units at 313.8 MW. The grid-connected solar power is being commissioned under various Government Schemes. As on 31st Jan 2016, most number of projects is being installed under State solar policies (Table 1). In order to achieve such an aggressive target of 100 GW, Ministry of New and Renewable Energy (MNRE), Government of India has proposed and developed a state-wise plan for this. Also, state governments are proactively proposing and introducing suitable policies and regulations to expedite grid connected solar rooftop capacity addition in the country. Solar Energy Corporation



of India (SECI) has been entrusted by MNRE for implementation of a Grid connected Rooftop pilot project.

Solar Development Schemes and Programmes in India

With around 250-300 sunny days a year nationwide, solar energy's potential in India is immense. The annual radiation varies from 1600-2200 kWh/m², equivalent energy potential to it is about 6,00 crore GWh of energy per year. The Government of India has been able to recognize and utilise this potential through supportive policies and initiatives. It all started with the launch of The National Action Plan on Climate Change (NAPCC) by the Prime Minister's Advisory Council on Climate Change in 2008. The NAPCC comprised of eight missions to map out integrated strategies to develop key national goals from climate change's perspective. National Solar Mission emerged from it and was later termed as Jawaharlal Nehru National Solar Mission (JNNSM). It focused on both solar photovoltaic (PV) and solar thermal technologies. Each programme/scheme/initiative

Table 1: Commissioning status of grid connected solar power projects in India (in MW)

Total MNRE Projects	Under State Policy	Renewable Purchase Obligation (RPO)	Renewable Energy Certificate (REC) Scheme	Private Initiative (rooftop)	Central Public Sector Undertakings	Total Commissioned Capacity (till 31.01.2016)
1503.781	2676.655	150	697.42	100.847	119.51	5248.213

at the Central Government's level is explained in details as follows.

Jawaharlal Nehru National Solar Mission (JNNSM)

The JNNSM was launched on 11th January 2010; with a target of 20 GW of grid-connected solar capacity addition by 2022. Its focus is to increase the usage of solar PV and solar thermal technologies majorly in urban areas, commercial and industrial establishments. It aims to reduce the overall cost of solar power generation in India by

- (i) a stable and long term policy
- (ii) large scale deployment targets
- (iii) extensive Research and Development and
- (iv) focus on domestic production of raw materials, components and products

It also emphasises on promoting off-grid solar power technology systems for rural households, decentralized off-grid applications such as solar lighting systems, solar water pumps and other solar-power based applications to meet the energy needs of rural India. The capacity addition target is planned in three phases (Table 2).

Table 2: Capacity addition targets for JNNSM

Category	Phase 1-Target Upto 2013	Phase2-Target (cumulative) (2013-2017)	Phase 3-Target (2017-2022)
Utility grid power including rooftop	1,000-2,000 MW	4,000-10,000 MW	20,000 MW
Off-grid Solar applications	200 MW	1000 MW	2000 MW
Solar Collectors	7 million m ²	15 million m ²	20 million m ²

The phase-2 is under process and around 1504.23 MW of grid-connected solar power projects were commissioned in 2015-16.

As part of the phase-2 of JNNSM, "Off-grid and Decentralized Solar Thermal Applications" Scheme (Capital Subsidy Scheme for Installation

of Solar Thermal Systems) is continued as a sub-scheme. Under this scheme are solar thermal applications such as solar water/air heating, solar steam generation, solar thermal refrigeration and cooling and solar thermal power pack including hybrid with solar PV.

The cumulative targets of JNNSM for solar capacity addition were surged to 100 GW of solar by 2022, comprising of 60 GW of large and medium scale grid-connected solar power projects and 40 GW of grid -connected solar rooftop projects. The total investment required for accomplishing the goal of 100 GW will be around Rs. 6,00,000 crores. In the first phase, the Government of India is providing Rs. 15,050 crore as capital subsidy. It will be provided for rooftop solar projects for Viability Gap Funding (VGF) based projects to be developed through the Solar Energy Corporation of India (SECI) and for decentralized generation through small solar projects. The Ministry of New and Renewable Energy (MNRE) intends to achieve the target of 100 GW with targets under the three schemes of 19,200 MW. Apart from this, solar power projects with investment of about Rs. 90,000 crore would be developed using bundling mechanism with thermal power

Concept of Renewable Purchase Obligation (RPO) and Renewable Energy Certificate (REC) Mechanism

Renewable Purchase Obligation (RPO) and Renewable Energy Certificate (REC) Mechanism are the two major drivers to achieve the solar capacity addition targets in India. As per Section 86(1) (e) of the Electricity Act, 2003, the State Commission has been mandated to promote cogeneration and generation of electricity from renewable energy sources. In this regard, various State Commissions have put significant emphasis on developing regulations for Distribution Licensees under their jurisdiction.

According to the Electricity Act, 2003 and the amendment to the National Tariff Policy, the State Electricity Regulatory Commissions (SERCs) were mandated to determine a percentage of the power which has to be procured from renewable sources, known as Renewable Purchase Obligation (RPO). In case of solar, RPO

is minimum 0.25 per cent by 2012-2013 which is to be increased to 3 per cent by 2021-2022. But considering the revised target of 100 GW from solar power by 2022, notching up the RPO for each state is significant to achieve the desired capacity addition. An amendment was recently announced in the National Tariff Policy, as per which 8 per cent of electricity consumption by March 2022, has to be from solar.

Renewable Energy Certificate (REC) mechanism is a market based instrument that help entities comply with their renewable purchase obligations (RPO). One Renewable Energy Certificate (REC) is treated as equivalent to 1 MWh. If distribution companies, open access consumers and captive consumers have failed to produce their share of renewable energy, they can purchase renewable power or RECs to meet their obligations.

It is segregated into solar and no-solar RPO thereby aimed at addressing the mismatch between availability of RE resources in state and the requirement of the obligated entities to meet the RPO targets. It can be traded through Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL). REC is traded within the floor and forbearance price as determined by Central Electricity Regulatory Commission (CERC), mentioned in Table 3.

Table 3: Floor and forbearance price determined by CERC (w.e.f. 01.01.2015 – 31.03.2017)

Price	Non-Solar REC (Rs/MWh)	Solar REC (Rs/MWh)
Forbearance	3,300	5,800
Floor	1,500	3,500

Development of Solar Cities Programme

The Solar City Programme aims at reduction in projected demand of conventional energy by minimum 10 per cent at the end of five years, through energy efficiency measures as well as increased renewable energy penetration in the city. The idea is to encourage the local government to adopt clean energy technology interventions. In a Solar City all types of renewable energy based projects like solar, wind, biomass, small hydro,



waste to energy etc. may be installed along with possible energy efficiency measures depending on the need and resource availability in the city. As on 11.04.2016, a master plan for developing solar cities has been constituted for 36 cities in the country.

International Solar Alliance (ISA)

International Solar Alliance is an initiative by the Government of India to accelerate the deployment of solar energy for universal energy access and energy security for the future. The initiative was launched at the Conference of Parties (21st) to the United Nations Framework Convention on Climate Change. The collective aim is to undertake initiatives to reduce the cost of technology and finance for solar projects and to identify financial instruments to mobilize \$ 1000 billion worth of investments by 2030 to promote affordable energy. It is an alliance of 121 solar- resource rich countries lying approximately between tropic of Cancer and tropic of Capricorn. India has offered to host ISA at by National Institute of Solar Energy (NISE's) premise and also a contribution of \$ 15 million to create as a corpus fund.

Integrated Power Development Scheme (IPDS)

Integrated Power Development Scheme (IPDS) was launched by the Government of India in Varanasi on 18th September 2015. Aim of the scheme was to extend financial assistance against capital expenditure to all state power departments and both State and Private Distribution Companies (DISCOMs) to ensure 24/7 power supply to all. The focus of the scheme is to-

- strengthen the sub-transmission network,
- metering,
- IT application,
- customer care services,
- provisioning of solar panels,
- installation of rooftop solar in all government buildings and
- the completion of the ongoing works of Restructured Accelerated Power Development and completion of the Reforms Programme (RAPDRP)

A budgetary support of Rs. 45,800 crores has been provided to the IPDS Scheme for its entire implementation period.

Remote Village Electrification Programme

Ministry of New and Renewable Energy (MNRE) is also focused on the promotion and deployment of solar for decentralized applications such as-

- solar home systems (SHS),
- solar photovoltaic (SPV) power plants,
- small hydropower plants in rural areas,

wherever grid extension is not techno-economically feasible. It also offers energy services for community facilities, water pumping for irrigation and drinking water supply, and livelihood and income-generating economic activities in the village. As per MNRE, till (July 2015), it has sanctioned 13,059

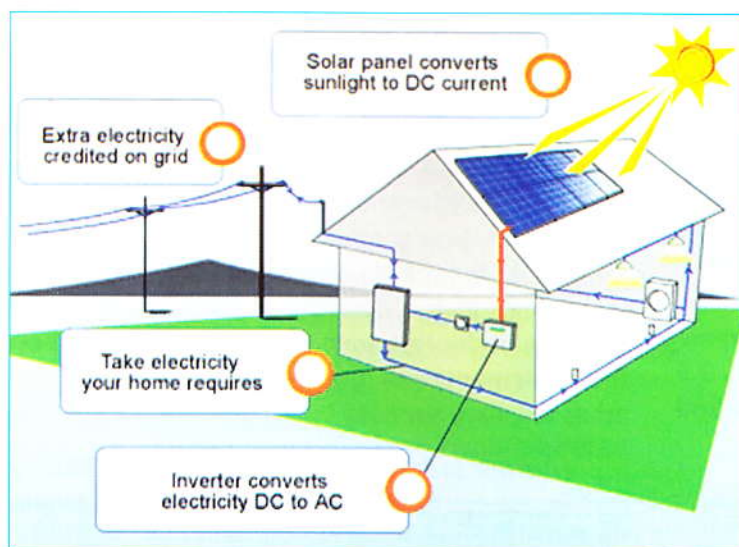
villages/hamlets during the period 2007-14, out of which 11,308 had been completed/ electrified.

Scheme for Development of Solar Parks and Ultra Mega Solar Power Projects in the country commencing from 2014-15 and onwards (i.e. from the year 2014 – 15 to 2018 – 19)

Solar Energy Corporation of India (SECI), a central public sector enterprises under MNRE, would implement the Scheme of developing solar parks each with a capacity of 500 MW and above in all the states of the country. For solar park development, land procurement for solar power projects, infrastructure like transmission system, water, road connectivity etc., would be developed through the State Governments. As on date, 21 states and 33 solar parks of 19,900 MW of capacity have been approved.

Other Schemes and Sub-Schemes to Expedite Solar Deployment in the Country

Amalgamation of Solar Photovoltaic Water Pumping System for Irrigation under the "Sub-Mission on Agricultural Mechanization (SMAM)": Ministry of Agriculture (MoA) and Ministry of New and Renewable Energy (MNRE), Government of India, have introduced solar energy pumping system under the Sub-Mission on Agricultural Mechanization (SMAM). Solar irrigation pump sets for agricultural use have been placed under the list of farm machinery component. The funding pattern is in line with MNRE with capital subsidy being provided for DC pump sets and AC pump sets.



MNRE Lighting Scheme 2016- Capital Subsidy Scheme for Installation of Solar Photovoltaic Lighting Systems: It is a sub-scheme of the off-grid applications scheme 2015-16 and is based on the promotion and dissemination of White LED (W-LED) based solar photovoltaic lighting systems. MNRE has signed a Memorandum of Understanding (MoU) with NABARD to promote solar home lighting systems to rural areas through MNRE-NABARD subsidy and bank linkages.

Off-grid and Decentralized Solar Cooker Programme: As part of the Off-grid and Decentralized Solar Applications (Phase 2, JNNSM), the Off-grid and Solar

Cooker Programme aims at promoting off-grid cooking applications like cooking/baking/frying using Solar Device (Box and Dish Type solar) with Central Financial Assistance from MNRE.

Suryamitra Skill Development Programme: It is a program implemented by National Institute of Solar Energy (NISE) to train 50,000 personnel within a period of 5 years (2015-16 to 2019-20). As on 30.9.2015, about 360 Suryamitras were trained under the scheme.



New loan scheme to promote rooftop solar power projects announced by IREDA: The scheme will provide loans at interest rates between 9.9 and 10.75 per cent to system aggregators and developers.

Pilot-cum-Demonstration Project for Development of Grid Connected Solar PV Power

Plants on Canal Banks and Canal Tops: SECI and MNRE provide subsidy to develop pilot-cum-demonstration projects on canal banks and canal tops. As on date, 50 MW of canal tops and 50 MW of canal banks plants have been sanctioned.

Grid-Connected Solar PV Power Projects by Defence establishments and Para Military Forces: It is expected to set up of over 300 MW of grid-connected and off-grid solar PV projects on defense and paramilitary establishments through viability gap funding. It is a sub-scheme under JNNSM (Phase 2/3). The minimum and maximum capacity which can be sanctioned is 1 MW and 20 MW respectively.

Implementation of Scheme for setting up 1000 MW of Grid Connected Solar PV Power projects by PSUs and GOI organizations: Through Viability Gap Funding, a 1000 MW of grid-connected solar to be sanctioned for three years (2015-16 to 2017-18) to be set by CPSUs and other organizations under the Government of India.

Scheme for Decentralized Generation of Solar Energy Projects by Unemployed Youths & Farmers: It is expected that about 10 GW solar projects could be setup under this scheme. A central grant of 4,750 crores has been allocated against this scheme. The subsidy would be eligible for projects with capacity ranging from 0.5 MW to 5 MW.

Way Forward

India is moving forward in adapting to solar energy at a very high pace, but challenges in terms of metering arrangements, standardization and finances are still being worked upon. In order to create favourable conditions for up-scaled and competitive solar energy penetration at both centralized and decentralized levels, more integrated policies and schemes should emerge and thereby create a conducive policy and regulatory framework for speedy deployment of solar energy technology in the country. In order to maintain the pace of deployment, it is essential to focus on the implementation, operation, maintenance and other ancillary services.

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