



## A Study on Solar Rise: Favourable Time for Embracing Sustainable Solar Energy in The Next Decade

### KEYWORDS

Solar PV, National Solar Mission, carbon emissions, energy security.

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**ABSTRACT** Solar PV technology converts sunlight directly into electricity, is among the fastest growing segments of the renewable energy industry in India. Solar PV already established in many countries including India, and set to become one of the key technologies of the 21st century. Some of the factors driving the growth of this segment are concerns towards carbon emissions, energy security and the rising prices of fossil fuels. Union Cabinet on 15.06.2015, stepped up India's solar power capacity target under the National Solar Mission by five times, reaching 1,00,000 MW by 2022, which will principally comprise of 40 GW Rooftop and 60 GW through Large/Medium Scale Grid Connected Solar Power Projects.

### INTRODUCTION

India being a tropical country receives adequate solar radiation for 300 days, amounting to 3,000 hours of sunshine equivalent to over 5,000 trillion kWh. Almost all the regions receive 4-7 kWh of solar radiation per sq mtrs with about 2,300-3,200 sunshine hours/year, depending upon the location.

Solar PV technology converts sunlight directly into electricity, is among the fastest growing segments of the renewable energy industry. It is already well established in many countries including India, and looks set to become one of the key technologies of the 21st century. Some of the factors driving the growth of this segment are concerns towards carbon emissions, energy security and the rising prices of fossil fuels.

Traditional solar cells are made from silicon, and are generally the most efficient. Thin-film solar cells made from amorphous silicon or non-silicon materials such as cadmium telluride are the second-generation solar cells, and are gaining a greater share in overall installations.

Third-generation solar cells use a variety of new materials and nanotechnology etc. for designing high efficiency PV materials. These systems are expected to rapidly become cost effective for use by utilities and industry. [1]

The generation of solar electricity coincides with the normal peak demand during daylight hours in most places, thus mitigating peak energy costs, brings total energy bills down, and obviates the need to build as much additional generation and transmission capacity as would be the case without solar PV.

### INDIA'S SOLAR POLICY

The National Solar Mission was launched on the 11.01.2010 which has set the ambitious target of deploying 20,000 MW of grid connected solar power by 2022 and aimed at reducing the cost of solar power generation in the country through (i) long term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products. It has been envisaged to achieve grid tariff parity by 2022. As per NSM, it has emphasised the importance of the mission as:

*"The importance of this Mission is not just limited to providing large-scale grid connected power. It has the potential to provide significant multipliers in our efforts for transformation of India's rural economy. Already, in its decentralized and distributed applications, solar energy is beginning to light the lives of tens of millions of India's energy-poor citizens. The rapid spread of solar lighting systems, solar water pumps and other solar power-based rural applications can change the face of India's rural economy. We intend to significantly expand such applications through this Mission. As a result, the movement for decentralized and disbursed industrialization will acquire an added momentum, a momentum which has not been seen before."* [2]

### REVISED NSM TARGETS

#### From 20,000 MW by 2021-22 to 1,00,000 MW

The Union Cabinet on 15.06.2015, gave its approval for stepping up of India's solar power capacity target under the National Solar Mission by five times, reaching 1,00,000 MW by 2022. The target will principally comprise of 40 GW Rooftop and 60 GW through Large and Medium Scale Grid Connected Solar Power Projects. With this ambitious target, India will become one of the largest Green Energy producers in the world, surpassing several developed countries.

The total investment in setting up 100 GW will be around Rs. 6,00,000 cr. In the first phase, the Government of India is providing Rs. 15,050 crore as capital subsidy to promote solar capacity addition in the country. This capital subsidy will be provided for Rooftop Solar projects in various cities and towns, 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 1,00,000 MW with targets under the three schemes of 19,200 MW. [2], [3]

Apart from this, solar power projects with investment of about Rs. 90,000 crore would be developed using Bundling mechanism with thermal power. Further investment will come from large Public Sector Undertakings and Independent Power Producers (IPPs). State Governments have also come out with State specific

solar policies to promote solar capacity addition. [3]

### INDIAN SUSTAINABLE SOLAR

#### Solar power tariff at record low, drops to Rs 4.34 a unit

The solar power tariff fell to an all-time low, with Finland-based energy firm Fortum Finnsurya Energy quoting Rs 4.34 a unit to bag the mandate to set up a 70-mw solar plant under NTPC's Bhadla Solar Park tender.

"This (Rs 4.34 a unit) is the lowest solar tariff so far in India. This has happened because of confidence in the balancesheet of NTPC and solar parks that come with all clearances and confidence in the market," as stated by MNRE, Joint Secretary, Tarun Kapoor.

In November 2015, the solar power tariff had touched an all-time low of Rs 4.63/unit following aggressive bidding by the US-based SunEdison, the world's biggest developer of renewable energy power plants. Before that the lowest tariff was Rs 5/unit in MP bid by Sky Power.

In the e-reverse auction process conducted by NTPC for the selection of grid connected solar PV projects that bid out 420 mw in six blocks of 70 mw each. The other winners included Rising Sun Energy Pvt Ltd (two blocks for Rs 4.35 a unit), Solairedirect (two blocks for Rs 4.35 a unit) and Yarrow Infrastructure (one block for Rs 4.36). [4]

In the past, SunEdison had won a bid to sell solar power from a 500 megawatt plant in Andhra Pradesh under the National Solar Mission at Rs 4.63 per kilowatt-hour (kwh or unit). SunEdison had offered tariff lower than SoftBank Group Corp of Japan and Chinese solar product maker Trina Solar Ltd in the auction.[4]

#### Government of India going to tenders for 2-4 GW solar power

The government is planning to bring out large tenders for producing 2-4 giga-watts (GW) of solar power, Union Minister Piyush Goyal said at Brisbane during his visit in February 2016.

"We are looking at coming out with 2-4 GW of solar power tenders. This will lead to economies of scale as large players will come as well as large capital..." Goyal told reporters on the sidelines of the India-Australia Energy Dialogue here. [5]

The country's grid-connected solar power generation capacity has crossed the 5,000 MW mark. The government has set an ambitious target of generating 100 GW of solar power by 2021-22 under the National Solar Mission. It is envisaged to generate 60 GW ground mounted grid-connected solar power and 40 GW roof-top grid interactive solar powers to meet the target.

The Power ministry has also fixed year-wise targets to monitor the solar power generation in the country. The target for the current year is 2,000 MW and 12,000 MW for the next year. The Renewable Ministry is putting all endeavored through various Central and State governments schemes to achieve the target. It has also initiated several schemes for development of solar parks and ultra mega solar power projects. Tenders for around 18,000 MW of solar projects are being issued.

The Power, Coal and Renewable Energy Minister said the tariffs for solar power can come down by another 10 per cent from the record low of Rs 4.34 per unit last month.

In November last year, the solar power tariff had touched an all-time low of Rs 4.63 per unit following aggressive bidding by the US-based SunEdison, the world's biggest developer of renewable energy power plants. Also, the government will encourage roof top solar projects as well as come out with ways to encourage farmers to start small solar power projects, he added. [5]

Industry body CII is also leading a delegation to the four-day India-Australia dialogue, which will witness roundtable meetings between the government of the two countries as well as businesses from both sides on energy related issues.

#### Heading to become top five solar markets

Now an impression has been created that solar power could be the panacea for solving all issues related to climate change and energy independence for India.[6] There is no doubt that India loves the Sun god and the country as a whole is bestowed with more than 300 sunny days which makes it very attractive option to generate electricity. To overcome the electricity shortage solar fundamentals are so compelling in India that the sector is bound to grow vividly with India likely to become one of the largest solar markets globally in the next 3 years. India is already on track to add more solar capacity than Germany in 2015 and enter the top five solar markets globally. By changing the solar specific Renewable Purchase Obligation (RPO) target for 2022 from 3% to 10.5% of all power consumption in the country yet to be ratified under the Electricity Act 2003 – India plans to increase its solar capacity from 20 GW by 2020 to 100 GW by 2022. [6]

The 100 GW target is split between 60 GW of utility scale projects and 40 GW of rooftop and other small grid-connected projects. Both central and state governments have announced a number of schemes and policies to accelerate solar project development. The central government has taken the lead with the National Solar Mission (15 GW of projects by 2019) and initiatives such as the solar parks policy and an interest rate subvention scheme. Many states, including Andhra Pradesh (5 GW), Telangana (5 GW), Maharashtra (7.5 GW), Tamil Nadu (3 GW) and Karnataka (2 GW) have followed with huge targets. There will be several challenges to achieving these plans, including land acquisition, transmission and financing. But the biggest challenge will be the enforcement of RPOs and the poor bankability of India's distribution companies (DISCOMs). As electricity is a concurrent subject, i.e., the center and the states both legislate on it but the states have the option to disregard the central government directives. [6]

#### CONCLUSIONS

The outlook for the solar sector in India is extremely positive, driven by powerful underlying fundamentals such as the rising cost of conventional power, environmental concerns, falling costs of solar power, high solar irradiation, a high power deficit and the ability of solar to quickly bring power generation capacity online. These fundamentals coupled with several state and central government initiatives should result in India becoming one of the largest solar markets in the world.

However, there is still a huge catch: the sun is available only for half a day and hence excessive over reliance on solar power can be very hazardous during darkness. [6]

The generation of solar electricity coincides with the nor-

mal peak demand during daylight hours in most places, thus mitigating peak energy costs, brings total energy bills down, and obviates the need to build as much additional generation and transmission capacity as would be the case without PV.

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