

# **SOLAR INDIA and JNNSM**

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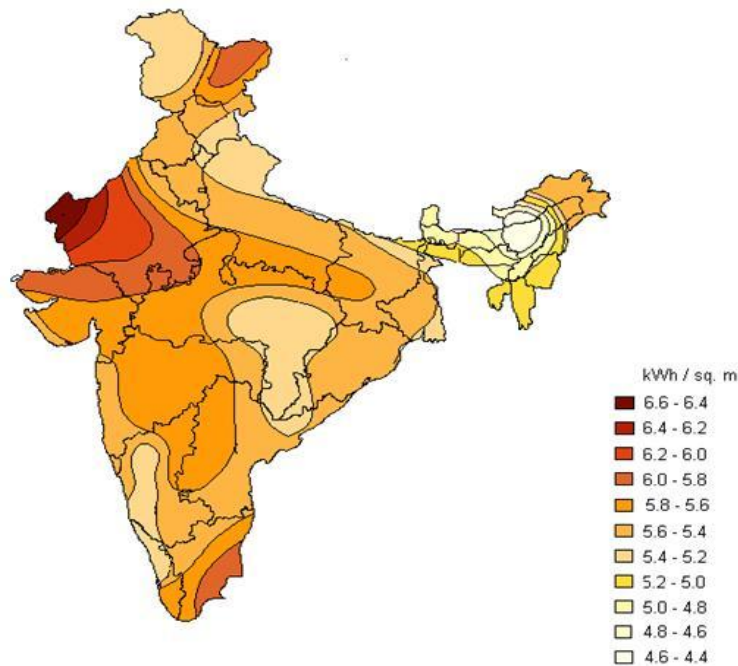
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## INTRODUCTION

India is an energy starved country whose economy is growing at a breakneck speed. The current installed generation capacity is about 162 GW which, with high T&D losses, translates into a peak time shortage of 12.7% and this is the situation when more than 400 million Indians still don't have access to electricity. India currently faces a threefold challenge of meeting the current demand, fighting climate change and attaining energy security. This implies that nuclear power and renewables would play a very crucial role in India. India unfortunately has very limited potential for wind power and that for geothermal is still unknown, but luckily India gets good sun fall almost all through the year. Solar power in India has huge potential and it is environment friendly as it has zero emissions while generating and is obviously the most secure.

### Importance and Relevance of Solar Power in India

- ❖ *Cost of power:* The solar panels available in the market today are very costly which makes the initial investment required very high, which in turn makes it prohibitive in a poor country like India. JNNSM aims at bringing this cost of power to grid parity by 2022 and at par with coal based power plants by 2030. But this would require global investments in R&D at a very large scale. Although it is a costly alternative for now, but going forward, with the progress in technology its cost will come down. Contrasting this aspect of solar with that of coal makes it a clear favourite as the cost of producing electricity using coal will only go higher as mineral reserves deplete in India and then we would be forced to import most of the total requirement, which will come at a further higher price. Couple these with some major investments in developing the required infrastructure for importing coal and the transportation cost involved and we get to understand that solar has now become inevitable.
- ❖ *Scalability:* India is blessed with a huge and still untapped potential in terms of solar power as it receives high insolation. We get about 300 clear and bright sunny days per year, receive 4-7 kWh per square meter per year i.e. 1500-1700 kWh/m<sup>2</sup>/p.a. adding upto 5 zillion kWh per year. This potential, even at 10% conversion rate would mean an availability which is many times more than what India may need. The only concern regarding scalability is the availability of space as megawatt size plants occupy a lot of land. The size of land may vary according to the intensity of sun in the area of the plant (as per an estimate by Tata BP Solar, generating 100 MW in Delhi would require about 500 acres of land for much less in Rajasthan). The following solar map shows the region wise levels of insolation in India.



Source: [www.mapsofindia.com/maps](http://www.mapsofindia.com/maps)

- ❖ *A Distributed Source of Energy:* The solar form of energy provides the opportunity to generate power on a distributed basis enabling rapid generating capacity addition with very short lead times. It becomes much more important in case of countries like India which have poor T&D infrastructure.
- ❖ *Reaching Out to the Rural India:* Solar power is very useful especially from the rural electrification point of view. In India, hundreds of millions of rural consumers are still not connected to the grid, and ones connected either don't receive quality supply or get no supply at all. Solar power has the capacity to completely revolutionize the prevalent scenario and change the living standards in the remote villages of India by efficiently meeting the electricity and heating needs of the people out there.
- ❖ *Environmental Impact:* The best thing about solar is that it's environmentally benign as it produces no carbon or greenhouse gases or any other toxic waste while generating, doesn't burn oil, coal or gas to generate electricity. In addition to these, at solar power plants there are no chances of an environmentally devastating accident. In fact, the only pollutant which factors into solar power are those involved in the construction and transportation of its component parts. Implementing solar on a large scale would reduce India's carbon footprint to a tiny fraction of its current levels.
- ❖ *Security of Source:* Energy security is very high on our national agenda and we are working very hard with our global partners to diversify the source of the resources that we use to generate the requisite amount of energy to run our economy. Solar is the most secure of all known resources. It may not be the cheapest source of energy as of now, unlike coal, but it is, and will always be, available in abundance and is waiting to be

exploited. It is one source of energy we will never run out of, one source of energy which will always be available with us irrespective of how the geopolitics changes.

## **JAWAHARLAL NEHRU NATIONAL SOLAR MISSION**

The Jawaharlal Nehru National Solar Mission (JNNSM) was launched by the Prime Minister, on January 11 2010, under the National Action Plan for Climate Change (NAPCC) with the aim of promoting an eco friendly and sustainable growth while marching towards energy security for the nation and enhancing India's contribution to meet the global challenge of climate change. It aims at establishing India as a world leader in solar energy by creating policy conditions conducive to stimulate investments in installation and R&D.

### **Objectives and Targets**

The objective of JNNSM is to transform India into a global leader in solar power by spreading awareness and promoting investments with the help of policies which encourage such initiatives. The National Solar Mission has set a target of generating 22,000 MW in 3 phases, 20,000 MW for grid-connected 2000 MW for off-grid applications. The first phase spans from the remaining period of the 11th Plan at the time of launch and first year of the 12th Plan (up to 2012-13), the 2<sup>nd</sup> phase would be the remaining 4 years of the 12th Plan (2013-17) and the 13th Plan (2017-22) would be the 3rd Phase. There are provisions for mid-term evaluation of the progress made, review of capacity and targets of the subsequent phase according to the perceived cost and technological progress.

The first phase of the mission is focussing on two aspects: promoting off grid system applications and a modest capacity addition in the grid. And the second phase would target on aggressive capacity addition and improving the solar penetration. The targets stated in the JNNSM are:

- ❖ To create an enabling policy framework for the deployment of 20,000 MW of solar power by 2022.
- ❖ To ramp up capacity of grid-connected solar power generation to 1000 MW within three years – by 2013; and an additional 3000 MW by 2017 through the mandatory use of the renewable purchase obligation by utilities backed with a preferential tariff. This capacity can be more than doubled reaching 10,000MW installed power by 2017 or more, based on the enhanced and enabled international finance and technology transfer.
- ❖ To create favourable conditions for solar manufacturing capability, particularly solar thermal for indigenous production and market leadership.
- ❖ To promote programmes for off grid applications, reaching 1000 MW by 2017 and 2000 MW by 2022

- ❖ To achieve 15 million sq. meters solar thermal collector area by 2017 and 20 million by 2022
- ❖ To deploy 20 million solar lighting systems for rural areas by 2022.

*Source: JNNSM mission document*

## **Mission strategy Phase 1**

The first phase (up to march 2013) of the mission targets majorly on two aspects,

1. *Off-grid and Decentralized applications*
2. *Capacity addition to the grid*

It provides an enabling framework to support entrepreneurs in order to develop markets. Supporting viable business models to enhance the spirit of investors is another focus in this phase. The success of the scheme depends big time on the flexibility factor that it has incorporated as the market is currently demand-driven, and that is why it offers a wide range of incentives where an interested investor can tailor the best suited package as per his/her requirements.

### **1. Off-grid and Decentralized Solar Applications**

The off-grid applications include meeting energy requirements both in the form of electricity and heat. The main objectives of this section of the scheme are:

- To promote off-grid applications for meeting the targets set in the JNNSM.
- To create awareness about the usage of solar systems
- To encourage and promote sustainable business models
- To support channel partners and potential beneficiaries
- To organize consultancy services and seminars, awareness campaigns
- To help replace kerosene and diesel, wherever possible

Various off-grid SPV applications which have a maximum capacity of 100 kWp per site and decentralized solar thermal applications are eligible for being covered in this scheme. Even mini-grids for rural electrification with applications upto 250 kW stand to benefit from it. To help promote technology upgradation and expansion in production facilities soft loans would be made available to SME manufacturers through Indian Renewable Energy Development Agency (IREDA). Various channel partners are being used for facilitating faster implementation and minimizing transaction cost and time. These channels are:

- ❖ *RESCOs (renewable energy service providing companies):* These companies install, own and operate the renewable energy systems.
- ❖ *Financial and Microfinance institutions:* These institutions are mainly into providing loans to the consumer and accessing the interest subsidies through refinancing.

- ❖ *Financial Integrators:* These firms serve the manufactures and service providers by integrating different sources of finance available for them.
- ❖ *System Integrators:* These entities are the ones which provide design, supply, integration and installation and O&M to the clients.
- ❖ *Programme Administrators:* Administrators include central and state ministries and departments, state nodal agencies, utilities, PSUs and reputed NGOs. These bodies are responsible for implementing the scheme.

### **Funding Patterns**

Because of the high set up cost, proper funding arrangements are of crucial importance in order to build an encouraging environment for solar generation. Funding is available in two modes:

- A. *Project Mode:* To avail the facilities through this mode there needs to be a project report and monitoring arrangements. The project report would, inter alia, include client details, technical and financial details and O&M specifications. The total cost is funded through a mix of debt & equity, where promoter's equity contribution has to be at least 20%. MNRE provides a combination of 30% subsidy and/or 5% interest bearing loans. Further a benchmark project cost is worked out by the MNRE, on which a capital subsidy of 60% is given. However, in case of special category states like north eastern states, Himachal Pradesh and Uttarakhand, 90% subsidy would be given. These subsidies can be accessed only by the 'Programme Administrators'.
- B. *Market Mode:* Through market mode different 'Channel Partners' are enabled to access various capital subsidies and soft loans. The channel partners would tie up with some lending institutions and these lenders would get into an agreement of refinance with IREDA, then IRDEA gets fund handling charges by MNRE at the rate of 2%.

### **Incentives**

Although, off-grid connections are meant for personal or small scale users, it does take off the burden of generation and distribution to quite an extent. Apart from this, using solar energy to either supplement or complement one's energy requirements helps in fighting climate change and reducing country's carbon footprint. So it makes sense to promote its usage and so a slew of incentives have been announced to encourage the potential investors for participation. These benefits are provided in forms of RE vouchers, capital subsidies, interest subsidies and green energy bonds.

### **Release of Funds**

Release of funds under JNNSM is conducted in two ways. For the projects which are to be developed by administrators (government ministries, PSUs and NGOs), fund release could be

front-ended, it would be done in two instalments, 70% on sanction and 30% on completion. Release of funds in case of private channel partners would be back-ended i.e. it will be in the form of reimbursement of the cost incurred and would be given after a proper verification of completion and efficiency of the project.

## **2. Adding Generation Capacity**

The second objective of the first phase of JNNSM is to add capacity to the grid by installing both 'Large PV and thermal plants' as well as 'Small and Rooftop PV systems'. In order to facilitate generation, a concept of 'Bundled Power' has been introduced, which means that the costly power generated through solar plants would be bundled with the cheaper power available under the unallocated quota of the MoP generated at NTPC coal based plants. And this bundled power would then be sold to the distributors at a price determined by CERC. NRVN would act as the nodal agency for procuring the power generated from solar plants through PPAs. The objectives of these bundled power related guidelines are to:

- Facilitate quick start up of the JNNSM
- Ensure serious participation from investor for its projects
- Expedite implementation of the projects
- Boost the confidence of the potential developers
- Promote the solar manufacturing industry

The projects under the grid connected system are broadly divided in to two categories: rooftop & small solar plants and large solar power plants.

### **A. Rooftop and other small solar power plants**

The projects under this scheme are those which are meant for very small scale generation and can further be categorized in two types.

- a) Projects connected at HT level:* Those projects whose generation capacity is between 100 kW and 2 MW and is connected to the grid at HT level (below 30 kV) will fall under this category. The envisaged capacity addition in the first phase through these plants is 90 MW.
- b) Projects connected at LT level:* The projects which have a capacity less than 100 kW and are connected to the grid at LT level will come under this category. These plants are expected to add 10 MW in the first phase.

### **Roles and Responsibilities of various entities for projects under this category:**

- ❖ *State governments:* State governments are required to designate a competent authority which would be empowered to issue pre-registration certificates. These certificates are required for being registered with the programme administrator(s) and reporting on progress of implementation of projects.

- ❖ *State Distribution Utilities:* The state utilities would have to buy power from the developers under PPA at a tariff decided by the concerned SERCs, and would have to make the necessary arrangements for evacuation of power. Utilities are also responsible for providing 'Certificate of Power Purchased' to the programme administrator on a monthly basis.
- ❖ *Programme Administrators:* For these projects, IREDA would act as a 'Programme Administrator'. IREDA will be responsible for registration of projects seeking GBI (Generation Based Incentives), maintenance of progress reports of projects, issuing certificates conforming GBI and disbursement of GBI to the distributors.

## **B. Large Solar Power Plants**

This category includes power plants which have large generation capacity ranging from 5 MW to 100 MW and would connect to the transmission substation at 33 kV and above. Projects under this category can be subcategorized in two types:

- a) *Solar PV Projects:* PV projects would have a capacity of 5 MW with a variation of  $\pm 5\%$ . To promote local manufacturing of solar products, it's been made mandatory for these projects to procure components locally from 2011-12 onwards.
- b) *Solar Thermal Projects:* The minimum capacity of the thermal projects would be 5 MW while the maximum would be 100 MW. And these projects are expect to make 30% of the procurement locally, excluding land.

### **Penalties for Delays:**

In order to ensure quick implementation in order to achieve the targets set for the first phase, several disincentives for delays have been proposed in the JNNSM. Solar PV plants should be commissioned within 12 months of signing the PPA, while in case of solar thermal plants it is 28 months. Any delay in the commissioning and NVVN would start to encash the performance bank guarantee deposited by the developers. Following is the manner in which these guarantees would be encashed:

- Delay of upto 1 month: NVVN would encash 20%
- Delay of more than 1 month and upto 2 months: NVVN would encash 40%
- Delay of more than 2 months and upto 3 months: NVVN would encash all of the remaining.

### **Role of State Governments:**

State government would play a very crucial role in the development of large solar plants. They would be responsible for appointing a state level agency to facilitate speedier implementation of the projects. State government will provide support to the developers in



providing better access to the site area, land acquisition, water allocation and connectivity to the transmission substation.

## **The Road Beyond Phase 1**

JNNSM has appreciated the need and importance of keeping the targets and policies flexible in a demand-driven market so as to be able to incorporate the best possible option available at any time. It clearly stipulates that the targets and guidelines of any subsequent phase would be based upon the learnings from the previous ones, evolving changes and other anticipated factors.

## **Solar Manufacturing in India**

India is well endowed to take a global leadership position in solar, it has already built a PV manufacturing capacity of 700 MW and is growing rapidly. To further this pace of growth certain measures are being recommended. For example, zero import duty on raw materials, low interest rate loans, incentives under SIPs, single window clearance facility and creating a few solar manufacturing tech parks which will consist of manufacturing unit, research institutes, offices and housing. These would help the nation in gaining an edge over all the competitors and enable us to make the most the opportunities available.

## **Research and Development**

Major R&D programmes are about to be launched in India which would focus on bringing the cost down, improving the efficiency of the existing system, testing hybrid generation, developing cost effective storage and improving the space intensity. These programmes in R&D will deal with five categories:

- I. Basic research focussing on long term aspect of innovation
- II. Applied research based on improving the existing system
- III. Technology validation & demonstration
- IV. Development of R&D infrastructure
- V. Support for incubation and start ups

## **Human Resource Development**

With the rapid expansion expected in the solar energy sector, there would be a huge demand for skilled manpower and it would include engineering, management and R&D. The total estimated workforce required by the end of 2022 is around 1,00,000. To develop such an asset would require some rigorous steps in collaborating with top notch colleges and establishing new ones dedicated to this purpose.

## **International Collaborations**

In order to keep up with the pace the innovations going on around the world and benefitting from them, it's imperative that we collaborate with others and this has been adequately recognized in the policies of MNRE. The collaborations are currently being worked out

through joint research and technology transfer and industry partnership. MNRE has made several bilateral and multilateral arrangements with various countries, a research programme with the European Union is being felicitated, bilateral programmes under the Asia Pacific Partnership Programme with Japan and Australia are being implemented. With US also there is a project under implementation which would focus the radiation data collection.

## **Current Status**

Back home the ambitious JNNSM is about to take off, the biddings for the first phase is being carried out, under which projects worth a total capacity of 650 MW would be awarded to 40 of the 350 bidders. CERC has set a price of Rs.17.91 for per unit of PV power and the ones ready to take the biggest discounts will be awarded. In the bidding process, there are three sets of bidders who are likely to emerge winners. First is the companies who are in manufacturing would be able to go deeper on discounts, big companies are the second group who can afford these rates easily and third group is of the newly formed companies who would be aggressive to get started with. But just getting the start is not good enough as there would be cases where experienced companies who have implemented similar projects would lose out in the process of bidding. Few days ago, even Tata, the biggest private generation company in India, announced that it would not be bidding for the projects because it thinks that making profit at such high cost would be very difficult. Such cases would hamper the quality of the very foundation of solar mission. Projects execution done by the companies with financial strength and experience brings long term benefits and quality and these two things are of the essence for something as ambitious as JNNSM.

## **Conclusion**

Using the power of sun to meet our energy requirements has numerous advantages and is harmless to the environment as it allows the user to attain an ecologically sustainable growth and India duly recognizes the potential of this solar energy. It is reflected by the targets set in JNNSM and the enthusiasm with which it has been launched. India is one of the global leaders in using solar and is making sincere efforts to improve fast and gain substantial generation capacity, but a lot would depend on the success of JNNSM and how the industry takes these opportunities. Investments in conducting R&D and developing a pool of human resource are critical for the way forward. But all said and done, it's time we looked up to SUN.

## **References and Links**

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