



An Analysis of Solar Energy in India with Respect to Prospects and Policies

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ABSTRACT

Solar energy is a renewable source of energy that is gaining ground because of the benefits it offers. India has tremendous scope of generating solar energy. The geographical location of the country stands to its benefit for generating solar energy. The reason being India is a tropical country and it receives solar radiation almost throughout the year, which amounts to 3,000 hours of sunshine. This is equal to more than 5,000 trillion kWh. Almost all parts of India receive 4-7 kWh of solar radiation per sq meters. This is equivalent to 2,300–3,200 sunshine hours per year. States like Andhra Pradesh, Bihar, Gujarat, Haryana, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, and West Bengal have great potential for tapping solar energy due to their location. Since majority of the population lives in rural areas, there is much scope for solar energy being promoted in these areas.

Keywords: Solar energy, India, ANERT, Missions

INTRODUCTION

Solar power in India is a fast-developing industry. The country's solar installed capacity reached 37.627 GW as of 31 March 2020. India has the lowest capital cost per MW globally to install [solar power](#) plants.

The Indian government had an initial target of 20 GW capacity for 2022, which was achieved four years ahead of schedule. In 2015 the target was raised to 100 GW of solar capacity (including 40 GW from [rooftop solar](#)) by 2022, targeting an investment of US\$100 billion. India has established nearly 42 solar parks to make land available to the promoters of solar plants. In a decade ending on 31 March 2020, India expanded its installed solar power capacity by 233 times from 161 MW to 37,627 MW.

The [International Solar Alliance](#) (ISA), proposed by India as a founder member, is headquartered in India.

ADVANTAGES OF SOLAR ENERGY IN INDIA

Some of the advantages of solar energy which makes it all the more suitable for India are as follows:

- ❖ This is an inexhaustible source of energy and the best replacement to other non-renewable energies in India.
- ❖ Solar energy is environment friendly. When in use, it does not release CO₂ and other gases which pollute the air. Hence it is very suitable for India, India being one of the most polluted countries of the world.
- ❖ Solar energy can be used for variety of purposes like as heating, drying, cooking or electricity, which is suitable for the rural areas in India. It can also be used in cars, planes, large power boats, satellites, calculators and many more such items, just apt for the urban population.
- ❖ Solar power is inexhaustible. In an energy deficient country like India, where power generation is costly, solar energy is the best alternate means of power.
- ❖ You don't need a power or gas grid to get solar energy. A solar energy system can be installed anywhere. Solar panels can be easily placed in houses. Hence, it is quite inexpensive compared to other sources of energy.

SOLAR ENERGY POWER IN INDIA: FUTURE

In solar energy sector, many large projects have been proposed in India.

- ❖ Thar Desert has some of India's best solar power projects, estimated to generate 700 to 2,100 GW.
- ❖ On March 1st, 2014, the then Chief Minister of Gujarat, Narendra Modi, Inaugurated at Diken in Neemuch district of Madhya Pradesh, India's biggest solar Power Plant.
- ❖ The Jawaharlal Nehru National Solar Mission (JNNSM) launched by the Centre is targeting 20,000 MW of solar energy power by 2022.
- ❖ Gujarat's pioneering solar power policy aims at 1,000 MW of solar energy Generation.
- ❖ In July 2009, a \$19 billion solar power plan was unveiled which projected to produce 20 GW of solar power by 2020.

NATIONAL SOLAR POTENTIAL

With about 300 clear and sunny days in a year, the calculated [solar energy](#) incidence on India's land area is about 5000 trillion [kilowatt-hours](#) (kWh) per year (or 5 [EWh/yr](#)). The solar energy available in a single year exceeds the possible energy output of all of the [fossil fuel](#) energy reserves in India. The daily average solar-power-plant generation capacity in India is 0.20 kWh per m² of used land area, equivalent to 1400–1800 peak (rated) capacity operating hours in a year with available, Kerala's largest floating solar power plant was set upon the [Banasura Sagar Dam](#) reservoir in [Wayanad district, Kerala](#). The 500 kW (kilowatt peak) solar plant of the [Kerala State Electricity Board](#) (KSEB) floats on 1.25 acres of the water surface of the reservoir. The solar plant has 1,938 solar panels which have been installed on 18 Ferro concrete floaters with hollow insides. commercially-proven technology.

India has a huge potential for generating green electricity from the renewable energy sources. To promote the green energy, government of India launching many schemes for the renewable energy resources. Jawaharlal Nehru National Solar Mission (JNNSM) is one of them launched on 11th January 2010, under National Action Plan on Climate Change (NAPCC– 2008).

Government of India is trying to improve the share of energy generation from the solar energy and launched Jawaharlal Nehru Solar Mission. Under First Phase of 200 Jawaharlal Nehru National Solar Mission (JNNSM) to be implemented between 1st April 2010 and 31st March 2013.

TYPES OF SOLAR ENERGY IN INDIA

Solar energy can be classified into two categories depending upon the mode of conversion and type of energy it is converted into. Passive [solar energy](#) and active solar energy belongs to the mode of conversion and solar thermal energy, photovoltaic solar power and concentrating solar power.

- Passive solar energy: This refers to trapping sun's energy without using any mechanical devices.
- Active solar energy: This uses mechanical devices to collect, store and distribute the energy.
- Solar thermal energy: This is the energy obtained by converting solar energy into heat.
- Photovoltaic solar power: This is the energy obtained by converting solar energy into electricity.
- Concentrating solar power: This is a type of solar thermal energy which is used to generate solar power electricity.

JAWAHERLAL NEHRU NATIONAL SOLAR MISSION - TARGETS 20,000MW BY 2022

The Jawaharlal Nehru National Solar Mission, also known as National Solar Mission, is one of the eight key National Mission's which comprise India's National Action Plan on Climate Change(NAPCC). NAPCC was launched on 30th June 2008 which identified development of solar energy technologies in the country as a National Mission. Finally on January 11, 2010 approved National Solar Mission.

The Solar Mission recommends the implementation in 3 stages leading up to an installed capacity of 20,000 MW by the end of the 13th Five Year Plan in 2022.

It serves twin purposes:

- i) Long term energy Security
- ii) Ecological Security

YEAR – WISE TARGETS UNDER NATIONAL SOLAR MISSION

| YEAR – WISE TARGETS UNDER NATIONAL SOLAR MISSION | |
|--|-----------------------|
| Year | Tendering targets(MW) |
| 2019 – 20 | 30,000 |
| 2020 – 21 | 30,000 |

OBJECTIVES OF NATIONAL SOLAR MISSION: is to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible.

Other than energy and ecological security the Solar mission will also has the advantage of permitting the decentralized distribution of energy, thereby empowering people at the grass root level". Also "India is a tropical country, where sunshine is available for longer hours per day and in great intensity. The daily average solar energy incident over India varies from 4 to 7 kWh/m² with about 1500–2000 sunshine hours per year, depending upon location resulting in an aggregate incident radiation of about 5000 trillion KWh/yr. This is far more than current total energy consumption. For example, even assuming 10% conversion efficiency for PV modules, it will still be thousand times greater than the likely electricity demand in India by the year 2015. Solar energy, therefore, has great potential as future energy source. Based on this vision a National Solar Mission is being launched under the brand name "Solar India".

The Mission will adopt a 3-phase approach,

- Spanning the remaining period of the 11th Plan and first year of the 12th Plan (up to 2012-13) – Phase 1,
- The remaining 4 years of the 12th Plan (2013-17) – Phase 2 and
- The 13th Plan (2017-22) – Phase 3

The immediate aim of the Mission is to focus on setting up an enabling environment for solar technology penetration in the country both at a centralized and decentralized level. Also the Mission anticipates achieving grid parity by 2022 and parity with coal-based thermal power by 2030.

MISSION TARGETS

To achieve the above mentioned target of **20,000 MW by 2022** by 3 phase approach under prevailing conditions is not an easy job, in short the mission needs supporting policies and incentives to achieve the target. The mission targets 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; 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. The ambitious target for 2022 of 20,000 MW or more, will be dependent on the 'learning' of the first two phases, which if successful, could lead to conditions of grid-competitive solar power. The transition could be appropriately up scaled, based on availability of international finance and technology.
- To create favorable 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.

Proposed Roadmap

The aspiration is to ensure large-scale deployment of solar generated power for grid connected as well as distributed and decentralized off-grid provision of commercial energy services. The deployment across the application segments is envisaged as follows:

Table

| S. No. | Application segment | Target for Phase I (2010-13) | Target for Phase 2 (2013-17) | Target for Phase 3 (2017-22) |
|--------|--|------------------------------|------------------------------|------------------------------|
| 1. | Solar collectors | 7 million sq meters | 15 million sq meters | 20 million sq meters |
| 2. | Off grid solar applications | 200 MW | 1000 MW | 2000 MW |
| 3. | Utility grid power, including roof top | 1,000-2000 MW | 4000-10,000 MW | 20000 MW |

ANERT

ANERT is headed by a Director appointed by the Government who is the Member Secretary of Executive Committee and the Governing Body. ANERT is guided by an Executive Committee chaired by the Chairman, Secretary power dept; and a Governing Body chaired by the Minister of Electricity, Govt. of Kerala to provide guidelines for ANERT's activities in various energy related areas.

During the past 25 years, ANERT has been contributing significantly to the development and exploitation of New and Renewable Energy sources of the state.

So far, ANERT has established a power generating capacity of 3 MW of Solar photovoltaic panels which have generated 4.2 million units of electricity; conserved 70.9 million units conventional electricity through its energy conservation program by sparing a generation capacity of 33.2 MW. Supplied solar hot water equivalent to hot water heated by 32.5 million units of electricity. Generated 0.85 million units of electricity through its biomass gasification and biogas program and conserved 0.18 million tones of fire wood through its Improved Chulha program.

VISION

Harness maximum possible Renewable Energy to offset consumption of conventional electricity and fossil fuels.

MISSION

- Acquire develop and demonstrate suitable renewable energy technologies
- Estimate resources put in place conducive policies
- Identify barriers introduce policy options and popularize use of renewable energy
- Increase capacity through renewable sources
- Enhance energy efficiency by energy conservation and management efforts
- Maximize the renewable energy mix

OBJECTIVE

The object of the Agency is to gather and disseminate useful knowledge in the various fields on Non-conventional Energy, Energy conservation and Rural Technology, conduct studies, demonstrate, Implement and support implementation of schemes and projects in these fields, thereby deal with the problems arising out of the rapid depletion on Non renewable energy sources, update the technologies used in rural areas as well as introduce appropriate new technologies with an aim to reduce drudgery, increase production and improve the quality of life.

FUNCTIONS

In order to achieve the above objectives, the Agency may engage itself in activities as are exemplified hereunder.

1. Liaise with other agencies in the country or abroad in the fields of Non-conventional Energy, Energy Conservation, and Rural Technology.
2. Co-operate and affiliate, if necessary with institutions, associations or bodies in India or abroad;
3. Establish and to maintain technical libraries and / or information centers, and to collect and collate information regarding alternative sources of energy, energy conservation and rural technologies.
4. Develop and support centers of documentation, publication service, maintenance and supply of data including patent literature, current status reports etc in the area of energy sources, energy management, and rural Technology.
5. Act as Nodal Agency for externally sponsored projects on Non-conventional Energy and Rural Technology.

6. Take special steps including that of conducting training courses to develop a group of Scientists and technologies working in the field of energy sources and rural technologies and to identify and encourage research and development in the related areas, as also to institute and award fellowships, prizes, and medals and to issue certificates;
7. Establish and maintain workshop and manufacturing units to further the objects of the Agency.

MINISTRY OF NEW AND RENEWABLE ENERGY

In 1982, a separate Department of Non-Conventional Energy Sources (DNES) was created in the Ministry of Energy to look after all the aspects relating to New and Renewable Energy. The Department was upgraded into a separate Ministry of Non-Conventional Energy Sources (MNES) in 1992 and was re-christened as Ministry of New and Renewable Energy (MNRE), in October 2006.

SOLAR RADIATION RESOURCE ASSESSMENT STATIONS IN INDIA

Fifty-one solar radiation resource assessment stations have been installed across India by the [Ministry of New and Renewable Energy](#) (MNRE) to create a database of solar-energy potential. Data is collected and reported to the Centre for Wind Energy Technology (C-WET) to create a solar atlas. In June 2015, India began a ₹40 crore (US\$5.6 million) project to measure solar radiation with a [spatial resolution](#) of 3 by 3 kilometers (1.9 mi × 1.9 mi). This solar-radiation measuring network will provide the basis for the Indian solar-radiation atlas.

There are three major technologies that are successful in solar power plants. These are as mentioned below.

1. **Concentrated Solar Power Plant**
2. **Thermal Solar Power Plant**
3. **Photo-voltaic Solar Power Plant**

Concentrated Solar Power Plants: These [solar power](#) plants use lenses, mirrors and tracking systems to focus on a large area of sunlight into a small beam. This focused light is used to run conventional steam turbines or power generating engines.

Thermal Solar Power Plants: This is basically a heat dependent solar technology that was used in solar power plants. In this technology, the sun rays are focused to a point by using solar collectors so that appropriate high temperature can be obtain to generate electricity.

Photo-voltaic Solar Power Plant: It is the most common and popular technology that is used in solar power plants. In this technology, [solar panel](#) converts sunlight into electric current by using photoelectric effect.

CONCLUSION

Total solar installed capacity is **50.33 GW** as of 2022. The Indian government has an initial target of **20 GW** capacity of 2022, which was achieved four years ahead of schedule. In 2015 the target was raised to 100 GW of solar capacity (including 40GW from roof top solar) by 2022, targeting an investment of US ₹ 100 billion

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