

A Review on Potential of Solar Energy in India.

Madan Yadav

Research Scholar
Faculty of Management and Commerce
Manipal University, Jaipur- 303007
madan Yadav@hotmail.com

Dr. Saurabh Sharma

Associate Professor
Faculty of Management and Commerce
Manipal University, Jaipur- 303007 drsaurabh.sharma@jaipur.manopal.edu

Abstract

Day by day the world progression is towards the alternative source of energy apart from conventional energy resources (coal, gas, and oil etc.). Increasing pollution, scarcity of resources, oil crisis in 1973, monopoly of OPEC (Organisation of the Petroleum Exporting Countries) admiring countries in a powerful irresistible way to switch over to other source of energy. Solar energy is the most important alternative resource of the world and has a large potential of green energy. India has 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. Jawahar Lal Nehru National Solar Mission (JNNSM) is one of them launched on 11th January 2010, under National Action Plan on Climate Change (NAPCC–2008). In this paper, we have made an effort to summarize the availability, current status, promotion policies and future potential of different form of solar energy in India.

Keywords: Solar Energy, Solar policy, Climate, Renewable, Resource.

Introduction

World is progressing fast in every aspect of life and every country wants to be part of this growth. Growth need energy. Energy sources are mainly of two type:

1. Conventional (coal, gas, and oil etc.)
2. Non-conventional (wind, tides, solar, geothermal heat and biomass etc)

The most challenging thing in front of the world is how to accomplish the requirement of energy. Due to the limitation and rapid reduction of the conventional resources, increasing pollution, monopoly of organisation like OPEC (Organisation of the Petroleum Exporting Countries) compelling the world to think about the alternate source of energy. Due to this scenario most of the countries are emphasizing on the development of renewable (Non-conventional) energy resources. In the renewable energy resources, solar energy is a tremendous source of energy and most developed. The sun is the planet's

most powerful source of energy but unused source of energy by humans. Solar energy is abundant and offers a solution to fossil fuel emissions and global climate change. The rate of energy received by the earth from solar energy is approximately 1,20,000 TW (1TW = 10¹²W or 1 trillion watt) (Kapoor, Pandey, Jain, Nandan 2014). This is much high from both the current annual global energy consumption rate of about 15 TW, and any additional requirement in future (Kapoor, Pandey, Jain, Nandan 2014).

Power sector contribute significantly to the growth of country's economy. The first serious attempts to deploy the technology were made with the formation of Department of Non-Conventional Energy Sources (DNES) in 1982, though the history of research and pilot demonstration go back to 1960s. Sun heat can directly utilized for water heating, room heating, vaporization etc. Solar water heating systems are in high demand. There are no toxic by products or emissions. Solar power is a clean, environmental friendly source of energy (Veeraboina, Ratnam 2012). Typically 30–40% of a family's electricity bill is devoted to water. Sun Heat's system can save the individual family electricity bill from 70% to 90% of the total amount spent on heating water (Veeraboina, Ratnam 2012). The system generally meets all of the summer time heating needs.

Solar Potential in India

"India is a tropical country, where sunshine is available for longer hours per day and in great intensity. India has a great potential for solar power. The solar radiation incident over India is equal to 4–7 kWh per square meter per day with an annual radiation ranging from 1200–2300 kWh per square meter. It has an average of 250–300 clear sunny days and 2300–3200 hours of sun shine per year (Sharma, Tiwari, Sood, 2018).

Vision of Indian government is to be energy-efficient developed economy, shifting from economic activity based on fossil fuels to one based on non-fossil fuels and from reliance on non-renewable and depleting sources of energy to renewable source of energy. The government continuously upgrading scientific, technical and managerial talent with sufficient financial resources to develop solar energy as main source of power to economy. It will transform the lives of people. In India there is huge gap between the energy generation and energy consumption (Akshay Urja, 2010).

India's electricity needs can be met on a total land area of 3000 km² which is equal to 0.1% of total land in the country (Sharma, Tiwari, Sood, 2018). Government of India emphasis is to increase the share of solar energy generation and launched Jawaharlal Nehru National Solar Mission (JNNSM). JNNSM is a major initiative of the Government of India with active participation from States to promote ecologically sustainable growth while addressing India's energy security challenge. The first Phase of Jawaharlal Nehru National Solar Mission (JNNSM) was implemented between 1st April 2010 and 31st March 2013.

Table.1 Solar Mission- JNSM Targets

S. N.	Application Segment	Target for Phase I (2010-13)	Target for Phase II (2013-17)	Target for Phase III (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	1000-2000 MW	4000-10000 MW	20000 MW

Source: www.mnre.gov.in

During first year of first phase (2010-11) a target of 32 MW solar PV off grid systems and 5 lakh square meter solar thermal collector area was set. The targets are to be achieved through various channel partners mentioned in the scheme. As on February 2011, the achievements figures are 38.5 MW for off grid photovoltaic (PV) systems and 1.2 Lakh square meter solar thermal collector area (MNRE 2015).

The policy visions to install 22,000 MW through grid connected and off grid power plants. As on April 2014, India total installed capacity through grid connected solar power plants has crossed 2.2 GW with major contribution coming through grid connected solar photovoltaic (PV) power plants (Ministry of power, 2015)..

Table.2 Shows the categories wise current status of installation of urban solar energy.

Source	Cumulative capacity
Rural /Semi Urban Biogas Plant	42,77,000 MW
SPV Street Lighting System	1,21,634MW
SPV Home Lighting System	6,19,428 MW
SPV Pump	7,495 MW
Solar Cookers	6,64,000 MW

Source: www.powermin.nic.in

The amount of solar energy produced in India in 2007 was less than 1% of the total energy demand (Wiki, 2018). Phase 1 of the Mission was largely focused on grid-connected projects. To achieve 500 MW of PV and 500 MW of solar thermal, the central government conducted two batches of reverse auctions. With an installation of 1,700 to 1,900 kilowatt hours per kilowatt peak (kWh/KWp) in 2010, 468.3 MW was added in 2011. In total 150–200 MW of solar power was installed in the country by December 2011 (Solarindiaonline, 2017). Table.3 shows the state wise current installed capacity of the solar power.

Table.3 Status of solar power in India

State	MW Power	% Power
Andhra Pradesh	127.85	4.00%
Chhattisgarh	4.00	0.30%
Delhi	2.50	0.19%
Gujarat	654.80	49.80%

Haryana	7.8	0.59%
Jharkhand	4.00	0.30%
Karnataka	9.00	0.69%
Madhya Pradesh	132.00	9.15
Maharashtra	20.00	1.38%
Odisha	13.00	0.99%
Punjab	9.00	0.69%
Rajasthan	510.25	38.89%
Tamil Nadu	15.00	1.14%
Uttar Pradesh	12	0.91%
Uttrakhand	5.00	0.38%
West Bengal	2.00	0.15%
Total	1,442.10	100%

Source: Ministry of New and Renewable Energy source (MNRE), Jawaharlal Nehru National Solar Mission Phase II – Policy Document

Emerging Future of Renewable Energy in India

By end September 2014, the installed grid connected solar power had increased to 2,766 MW and India expects to install an additional 10,000 MW by 2017, and a total of 20,000 MW by 2022 (JNNSM, 2015). Table.4 display a state wise distribution of renewable energy generation, tentative target set by the ministry of new and renewable energy under the 12th financial plan.

The State Government of Andhra Pradesh is developing a solar farm cluster called solar city on a 10,000 acre land at Kadiri in Anantapur district. Solar city is expected to attract investments worth Rs. 3000 crore in the first phase. Four firms (Sun borne, Lance Solar, AES Solar and Titan Energy) have signed a memorandum of understanding with the State to set up their units there (12th Year Plan 2012-17).

These companies will be the anchor units in solar city and have a combined capacity of 2000 MW. Karnataka Power Corporation Ltd. has implemented two projects– each of 3 MW power capacities and has awarded a third project of same capacity recently. The solar plants, located in Kola and Chickadee districts, have been implemented under the Arunodaya scheme for ensuring assured power supply to rural areas, especially irrigation pump sets (Ministry of power 2015). These photovoltaic (PV) power plants are intended as tail end support/powering of irrigation pumps.

Table.4. Tentative State-wise break-up of Renewable Power target to be achieved by the year 2022 So that cumulative achievement is 1,75,000 MW.

State/UTs	Solar Power (MW)	Wind (MW)	SHP (MW)	Biomass Power (MW)
Delhi	2762	-	-	-
Haryana	4142	-	25	209
Himachal Pradesh	776	-	1500	-
Jammu & Kashmir	1155	-	150	-
Punjab	4772	-	50	244

Rajasthan	5762	8600	-	-
Uttar Pradesh	10697	-	25	3499
Uttrakhand	900	-	700	197
Chandigarh	153	-	-	-
Northern Region	31120	8600	2450	4149
Goa	358	-	-	-
Gujarat	8020	8800	25	288
Chhattisgarh	1783	-	25	-
Madhya Pradesh	5675	6200	25	118
Maharashtra	11926	7600	50	2469
D. & N. Haveli	449	-	-	-
Daman & Diu	199	-	-	-
Western Region	28410	22600	125	2875
Andhra Pradesh	9834	8100	-	543
Telangana	-	2000	-	-
Karnataka	5697	6200	1500	1420
Kerala	1870	-	100	-
Tamil Nadu	8884	11900	75	649
Puducherry	246	-	-	-
Southern Region	26531	28200	1675	2612
Bihar	2493	-	25	244
Jharkhand	1995	-	10	-
Orissa	2377	-	-	-
West Bengal	5336	-	50	-
Sikkim	36	-	50	-
Eastern Region	12237	-	135	244
Assam	663	-	25	-
Manipur	105	-	-	-
Meghalaya	161	-	50	-
Nagaland	61	-	15	-
Tripura	105	-	-	-
Arunachal Pradesh	39	-	500	-
Mizoram	72	-	25	-
North Eastern Region	1205	-	615	-
Andaman & Nicobar Island	27	-	-	-
Lakshadweep	4	-	-	-
Other	-	600	-	120
All India	99533	60000	5000	10000

Source: http://planningcommission.gov.in/plans/planrel/12thplan/pdf/12fyp_vol2.pdf

Conclusion

Country like India has much unbalanced in electricity production. Production is less and consumption is much. Solar power is very good option in India to increase power production. This is also very good for our environment protection and economic development. Solar power is unlimited source of

energy and India also have suitable climate for this energy but need better ideas to increase efficiency and decrease production cost. Indian government launched some schemes for production of solar power and achieved successes but need education and publicity in society for these schemes so that people take initiative for the use of renewable energy as much as at a place of conventional energy sources. Currently we are generating 4.59% of solar energy of total produced renewable energy installed capacity in India. It is very low in comparison of total installed capacity of renewable energy and scope is very much for this solar photovoltaic (PV).

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