

SOLAR POWER: Challenges, Mission and Potential of Solar Power in India

Deepak Sharma¹, Pooja Khurana²

¹Assistant Professor, Dept. of Mechanical Engineering, Sarvottam Institute of Technology & Management, U.P, India

²Assistant Professor, Dept. of Civil Engineering, Sarvottam Institute of Technology and Management, U.P, India

Abstract - Solar power is the most ongoing and flaming subject undergoing intense study across the globe. Every country is trying their best to save non-renewable resources for future generations, in order of which they are trying their handover various renewable resources for sustainable future, and solar energy is being most current and widely accepted natural resources for tropical countries. India being a tropical country, has taken an initiative way back to promote solar energy as the prime source of power in country. The study focuses on the technical and economic barriers for development of solar power technology in India. And the central government policies to support solar power development and the future goals in the field.

Key Words: Solar power, Sustainability, Challenges, Policies, Mission, Potential.

1. INTRODUCTION

Energy has encyclopedic role in today's life and influencing the whole civilization. Everything that we are using or can be seen around us is run by electricity. Therefore, power sector is one of the most important sectors having resounding future. As we know that most of the amount of electricity is produced from the Non-Renewable energy resources (Coal, Gases, oils) leaving them to be available at deficit rate and shortfall of which lead to increase price of other commodities. India has an 'indomitable capability' of generating clean electricity through Renewable energy resources such as wind energy, solar energy, hydro-energy, geothermal energy etc. without generating noxious carbon by products.

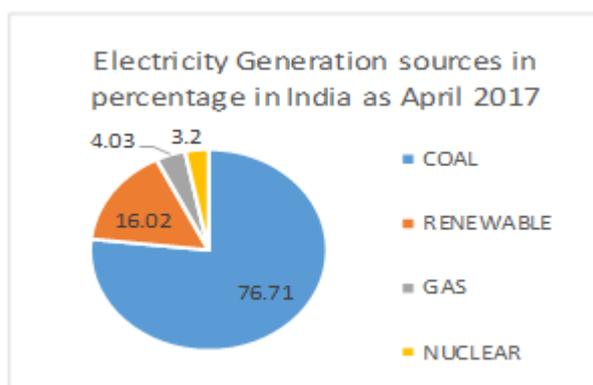


Fig - 1: Electricity generation 2017

1.1 Challenges

Today, the world uses energy at a rate approximately 4.1×10^{20} joules/yr. equivalent to a continuous power consumption of 13 trillion watts, or 13 terawatts (TW). Even with aggressive conservation and energy efficiency measures, an increase of the Earth's population to 9 billion people, accompanied by rapid technology development and economic growth world-wide, we will be forced to produce more than double the demand for energy (to 30 TW) by 2050, and more than triple the demand (to 46 TW) by the end of the century. Near about 6.5 billion tonnes of carbon from fossil fuel get plunge into the atmosphere every year, results in deteriorating the health of humans as well as, also has proven to be a great threat in extinction of various animal species. India holds 4th position in production of greenhouse gasses in world, contributing to global warming.

Table - 1: Greenhouse Gas Producing Nation's

| Sr. no. | Country name | Greenhouse gas % |
|---------|----------------|------------------|
| 1 | China | 30 |
| 2 | United states | 16 |
| 3 | European union | 10 |
| 4 | India | 7 |

1.2 Solar Energy Potential

Renewable energy resources will play an important role in the future and India has tremendous energy potential, near about 900 GW energy from the Renewable sources can be produced (750 GW from solar power, Bioenergy - 25 GW, Small Hydro - 20 GW and Wind energy - 102 GW). 120,000 terawatts of solar energy strikes the Earth continuously, which is more than 10,000 times the world's total energy consumption i.e. it is widely available even in the most aggressive energy demand scenarios. India is situated in the sunny belt due to which, out of 365 days India gets 300 days of sun light. India's ambition is to solve the problem of energy with the help of renewable energy sources and Solar Energy has been identified as one of the most capable renewable sources to compete the conventional energy sources to reduce carbon and harmful gasses emission in India. The renewable power has secured 2nd position after Thermal power.

2. Solar – Mission

India was the 1st country in the world to set up a Ministry of non- conventional energy resources (MNRE) in early 1980. It is the nodal Ministry of the Government of India for all matters related to new and renewable energy. The broad aim of the Ministry is to develop and deploy new and renewable energy for supplementing and fulfilling the energy requirements of the country. For the strengthening and making the concept more familiar to the common people, Government of India launched Jawaharlal Nehru National Solar Mission (JNNSM) on 11th January 2010. JNNSM- is divided into three phases, targeting different energy goals, 2010- 2013, with the aim of installing at least 1000 MW of grid-connected solar capacity. The second phase is from 2013 to 2017, and the third stage from 2017 to 2022.

Table – 2: Phases of Jawaharlal Nehru National Solar Mission (JNNSM)

| Application segment | Target for phase 1 (2010-13) | Target for phase 2 (2013-17) | Target for phase 3 (2017-2022) |
|---|------------------------------|------------------------------|--------------------------------|
| Solar collectors | 7 million sq. m | 15 million sq. m | 20 million sq. m |
| Off-grid applications | 200 MW | 1000 MW | 2000 MW |
| Utility grid power , including roof top | 1000 – 2000 MW | 4000 – 10000 MW | 20,000 MW |

2.1 Government support and Policies for solar Energy

India has promised to reduce its rate of greenhouse gas production at the United Nations Conference on Climate Change in Paris, 2015. For achieving the said goal, In January 2016 the Prime Minister of India Shri Narendra Modi and the President of France Mr. François Holland has setup the headquarters of the International Solar Alliance (ISA) in Gwalpahari, Gurgaon.

International Solar Alliance (ISA) is an Indian approach towards energy sector. It is an alliance of trust between the 121 rich countries; all are lying fully or partially between the tropic of Cancer and tropic of Capricorn. ISA was jointly started by the Prime Minister of India and the President of France on 30 November 2015 at Paris. India reached at 14th position in 2018 according to Climate Change Performance Index (CCPI) 2018 out of 56 nations.

The ministry of new and renewable energy has setup a company name as Solar Energy Corporation of India (SECI), to take the responsibility of the implementation and execution of the solar mission. The SECI has support to NVTN (National thermal power corporation’s Vidyut Vyapar Nigam) in the first phase. SECI has been set up with an

Authorized Share of Rs. 2,000 crore and Rs.304 crore, released by the Govt. of India.

A non-banking financial institution name as The Indian Renewable Energy Development Agency Ltd. (IREDA), under the Ministry, sanctioned loans of Rs.7027.19 crore and disbursed Rs.4850.24 crore against the annual target of Rs.10,000 crore and Rs.6,100 crore respectively.

National Institute of Solar Energy (NISE) supports solar energy by giving their contribution via labs, workshop, testing department etc. such as: (i) Setting up of 500 kW SPV power plant (ii) Up-gradation of solar cell test facility. (iii) Up-gradation of Solar Thermal Labs. (iv) Establishment of R&D monitoring cell. (v) Expand of battery test facility. (vi) Establishment of IT cell. (vii) Renovation of work shop facility. (viii) Enlarge SPV water pumping test facility and other labs. (ix) Up-gradation of SPV module test facility. (x) Housing of the Secretariat of the International Solar Alliance. NISE also supported capacity building activities under National Solar Mission.

The Government of India has been provided Rs.15,050 cr. subsidy to promote solar capacity addition in the country . This capital subsidy will be provided for solar projects in many cities and towns. Solar power projects with investment of about Rs. 90,000 cr. would be developed using bundling method with thermal power.

The Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) is a new scheme introduced in 2014-15. DDUGJY scheme is to fix & support the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) Scheme. RGGVY was struggling to separate to agricultural and non-agricultural feeders. The Budget Estimate for 2016-17 was Rs.3000 crore.

2.2 Solar Projects in India

Solar plant in Tamil Nadu of capacity 750 MW is the world’s largest plant. The Plant consist 3.80 lakh foundation, 25 lakh solar modules, 27000 meter of structure, 576 inventors, 154 transformer, 6000km cable wires used, 8500 personnel worked for an average about 11MW of installation. But it is not sufficient for our future needs if we want to be dominating country in world by 2050. We require at least 100 solar plants for defeating other country like china and only solar energy is the key to become world king of renewable resources by 2050.

Table – 3: Solar Plants Installed In India

| S. No. | State/UT | Solar potential (GW) | Installed Capacity (MW) |
|--------|-------------------|----------------------|-------------------------|
| 1 | Andhra Pradesh | 38 | 979.65 |
| 2 | Arunachal Pradesh | 9 | 0.27 |
| 3 | Assam | 14 | 11.18 |

| | | | |
|--------------|------------------|------------|----------------|
| 4 | Bihar | 11 | 95.91 |
| 5 | Chhattisgarh | 18 | 135.19 |
| 6 | Goa | 1 | 0.05 |
| 7 | Gujrat | 36 | 1158.5 |
| 8 | Haryana | 5 | 53.27 |
| 9 | Himachal Pradesh | 34 | 0.33 |
| 10 | Jammu & Kashmir | 111 | 1 |
| 11 | Jharkhand | 18 | 17.51 |
| 12 | Karnataka | 25 | 327.53 |
| 13 | Kerala | 6 | 15.86 |
| 14 | Madhya Pradesh | 62 | 840.35 |
| 15 | Maharashtra | 64 | 430.46 |
| 16 | Manipur | 11 | 0.01 |
| 17 | Meghalaya | 6 | 0.01 |
| 18 | Mizoram | 9 | 0.10 |
| 19 | Nagaland | 7 | 0.50 |
| 20 | Odisha | 26 | 77.64 |
| 21 | Punjab | 3 | 545.43 |
| 22 | Rajasthan | 142 | 1317.64 |
| 23 | Sikkim | 5 | 0.01 |
| 24 | Tamil Nadu | 18 | 1590.97 |
| 25 | Telangana | 20 | 973.41 |
| 26 | Tripura | 2 | 5.02 |
| 27 | Uttar Pradesh | 23 | 239.26 |
| 28 | Uttarakhand | 17 | 45.10 |
| 29 | West Bengal | 6 | 23.07 |
| 30 | Delhi | 2 | 38.78 |
| 31 | UTs & others | 1 | 88.68 |
| Total | | 750 | 9012.69 |

2.3 Barrier - Technical / Economical

There is Absence of proper Financing Mechanism due to which lot of problem rises. Most state electricity boards are facing bankruptcy. The current source of international funding is too little. We can get more fund from the Green Climate Fund but for that, developing countries will have to work together.

Availability of Land and its possession is the biggest problem in India because solar power plant requires very large area. It is very difficult task to search a land with assurance that the land being used is not forest or agricultural land.

Intensity of sun light is not same in overall India at same time due to different geographical condition. Cost of solar cell is very high due material cost and fabrication cost if possible other new material for solar cell may help reduce fabrication cost and last but not least, at night the hours when demand for energy is at its highest are the same hours the sun is nowhere to be found.

Solar power plant need water for cleaning panels and mirror. The problem is that solar power plants are generally situated in hot and dry area where water shortage problem is present. So to managing the water facility increases the price of electricity.

Still we are facing the impact of monsoon on solar panels. Reliance solar panels have been damaged when the rains hit very hot panels due discolorations. [15] Same problem was accoutered in KPCL plant situated in Karnataka. [16]

3. CONCLUSIONS

The Ministry of new and renewable energy, government of India is trying to increase the power capacity and achieve the target of 100 GW by 2022. The study depicts that the status of solar energy is satisfactory in India as per our geographical condition and there is need to fulfil the gap between Indian solar policy and international solar policy. We require tremendous mechanism for solar energy to reduce communication gap between local people and government bodies that would increase awareness on solar energy. High installation cost of solar energy is the prime issue, thus, it becomes important to support and subsidize the solar power rates and influence the local people to make step towards the non- conventional energy source. India can achieve number one position in solar energy production in the world, providing when our government policies are framed for betterment of the existing and new solar projects and also imparting awareness to the people, as these projects bring several employment opportunities with them. Together, the government and the people can work for better and sustainable future.

REFERENCES

- [1] Fig – 1: SOURCE: Central Electricity Authority- Growth of electricity in India.
- [2] Book- Basic research needs for solar energy utilization.
- [3] Table: 1 Source: Boden, T.A., Marland, G., and Andres, R.J. (2017). National CO2 Emissions from Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring: 1751-2014
- [4] Annual report 2016-17 by MNRE (Ministry of New and Renewable Energy)
- [5] Load Generation and Balance Report, Central Electricity Authority, Ministry of Power, Government of India. Central Electricity Authority. 2015-16.

-
- [6] <http://mnre.gov.in/mission-and-vision-2/mission-and-vision/>
- [7] <http://www.mnre.gov.in/>
- [8] Book-Facing the sun (policy for sustainable grid – connected solar energy) by Centre for science and environment.
- [9] Table: 2 Source: Anon, “Jawaharlal Nehru National solar Mission – Towards Building Solar INDIA” india.gov.in/allimpfrms/alldocs/15657.pdf
- [10] <http://pib.nic.in/newsite/PrintRelease.aspx?relid=134681>
- [11] <https://economictimes.indiatimes.com/news/politics-and-nation/indias-global-rank-up-for-reducing-greenhouse-gas-emissions/articleshow/61657901.cms>
- [12] Sharma BD. Performance of Solar Power Plants in India. Central Electricity Regulatory Commission New Delhi. 2011
- [13] Outcome budget of Ministry of power 2016-17
- [14] <http://mnre.gov.in/file-manager/annual-report/2016-2017/EN/pdf/4.pdf>
- [15] Central Electricity Regulatory Commission (CERC). “Explanatory Memorandum for Benchmark Capital Cost norms for solar PV solar thermal 2011-12
- [16] Central Electricity Regulatory Commission (CERC). “Explanatory Memorandum for draft terms and conditions for determination of tariff for Renewable energy sources 2012.