

ROLE OF SOLAR POWER IN ENVIRONMENTAL PROTECTION IN INDIA

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Abstract: Energy is an indispensable input for a human being and the economic growth of the country. At present, demand for energy is rapidly raised on the back of consumption of energy is increasing due to the population growth, industrialization, modernization of the society, etc. In the global level, most of the countries are using fossil fuel sources for lighting, cooking, and other purposes. The conventional sources are unfavourably affected on the environment similar to greenhouse gas emission, air pollution, climate change, and global warming. In order to overcome these problems, generating renewable energy sources like solar energy is an indispensable. Among the sources of renewable energy solar energy is one of the best important sources of the renewable energies which can be transformed into electrical, thermal and chemical forms. The objectives of the study are (i) to know the overview of solar power scenario in India and (ii) to explore the environment protection using solar energy. The finding of the study shows that the solar energy is received the highest potential as compared to other renewable energies. Out of installing grid-connected renewable power capacity in India, highest share was generated from the wind power (52.27 per cent), as followed by solar power (27.13 per cent), Bio-power (13.39 per cent) and Waste to power (0.18 per cent). Hence, the study shows that solar energy is possible to reduce environmental constraints such as Co₂ emission, global warming, etc. It also gives additional benefits like employment opportunities, energy security, and a clean environment. Therefore, it is necessary to extend solar power to the environmental protection of the country through government initiatives.

Index Terms - Solar Energy, Environment, Climate Change, Conventional Sources.

I. INTRODUCTION

Energy is an indispensable input for a human being and it is the essential ingredient for economic growth of the country. Across the world, demand for energy is rapidly growing that certainly increases the economic development of the country whereas, an alarming increase in the consumption of energy which is unmet. In India, the total installed capacity of electricity was increased from 1, 68,048 MW as on 31st March 2008 to 3, 77,122 MW as on 31st March 2017. The compound growth rate was registered as 8.42 per cent. Besides, 70.83 per cent of the total installed capacity of electricity was generated from the thermal plants with an installed capacity of 2, 67,129 MW. The total renewable energy sources exclude hydropower was 15.56 per cent with an installed capacity of 58680MW. The remaining sources of Hydro and Nuclear were accounted for 11.81 per cent and 1.80 per cent respectively (Energy Statistics, 2018). The majority of the electricity was generated from the thermal plants that are fully based on fossil fuels like coal, oil, and natural gas. These are damaging economic development, environment, and human life. The traditional fossil fuel-based energy sources are facing growing pressure on a host of environmental fronts, with perhaps the most serious challenge confronting the future use of coal (Akella, Saini, & Sharma, 2009). Today, the major threat to environmental is global warming which is challenging every countries of the world. Among the causes of global warming, Carbon dioxide (Co₂) emission is the major factor that is highly emitted from the combustion of fossil fuels like coal, oil and natural gas (Sathis, 2012).

However, India is agreed to the 21st session of the Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC), which was held in Paris during November and December, 2015. The mandatory objectives of the convention are to peak greenhouse gas emissions as soon as possible, to minimize the global average temperature increase above pre-industrial levels to well below 2°C, and to pursue efforts to limit the increase to 1.5°C. Among the 195 countries, India was one of the parties. The Paris Agreement, which entered into force on 4 November 2016, needs parties to put forward their best efforts through “Nationally Determined Contributions” (NDCs). These NDCs represent targets and actions for the post-2020 period. India ratified its some contributions as followed by to reduce the emissions intensity of its GDP by 33-35 per cent from 2005 levels by 2030, to achieve about 40 per cent cumulative electric power capacity from renewable energy based sources by 2030 with support of transfer of technology and low cost international finance including from Green Climate Fund (GCF). Besides, to create an additional carbon sink of 2.5 to 3 billion tonnes of Co₂ equivalent by additional forest and tree cover by 2030. To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, remarkably agriculture, water resources, Himalayan region, coastal regions, health, and disaster management(www.iea.org). As a result, India has

ratified the Paris agreement in terms of its scope and impact, and it is probably the most far-reaching international agreement for the protection of the environment.

Therefore, India needs an alternative way to generate electricity, enhance energy security and reducing greenhouse gas emissions. A non-conventional source is one of the environmentally friendly sources of energy. Among the renewable energy sources, solar energy is the best and more potential sources of energy in the future. Solar energy leads to the mitigation of environmental contamination and achieves sustainable development.

II. STATEMENT OF THE PROBLEM

India is one of the countries in the world which focuses on energy and environmental protection. The consumption of energy is increasing on the back of increasing population, urbanization, industrialization, and modernization of society. However, India's per capita use of energy is significantly increased with a compound annual growth rate of 3.54 per cent during the period of 2011-2012 to 2016-2017 (Energy Statistics, 2018). Use of the conventional energy sources are impacted on the environment, public health and gradually lead to economic crisis. According to the Greenpeace report, 1.2 million peoples are died every year by outdoor air pollution and loss of the economy due to this is found to be 3 per cent of the GDP. In India, nearly 304 million of people are still living without access to electricity, and 500 million people are without access to clean energy sources. They are depending and using the traditional sources like solid biomass, kerosene, diesel using for cooking, lighting cooling, heating etc. (GOI, Draft National Energy Policy, 2017). Thus, 4.8 lakh people died due to household air pollution in India (PHFI, 2018).

Air pollution is a very serious issue in India. Nevertheless, any reduction of the quality or quantity of any of this essential resource constitutes a major problem to human health. According to the World Health Organization, India has placed 14 out of the 15 most polluted cities in the world (Times of India, 2018). Besides, India's energy demand is mostly fulfilled by fossil fuels sources. It is fully depleting sources and un-favorable to the environment. According to trends in global Co₂ and total greenhouse gas emissions report reveals that the carbon emission was increasing in 2017 as compared to previous years which is reached 3.6 Gt (Olivier, et.al, 2017). These conventional source based energy sources are damaging fully damaged by environment and obstruction to the sustainable development of the country.

III. OBJECTIVES OF THE STUDY

The present study is based on two objectives

1. To understand the solar energy scenario in India.
2. To explore the scope of environmental protection through solar power in India.

IV. METHODOLOGY

The present study is wholly based on secondary sources of information. This information is collected from the articles in reputed journals, government reports, and magazines. Besides, the data were collected from the Annual Report 2017-2018 of the Ministry of New and Renewable Energy (MNRE).

V. RESULTS AND DISCUSSIONS

The present study focused on environmental protection through the use of renewable energy sources like solar energy. Solar power is the best and suitable source for grid and off-grid locations without any damage to the environment. Solar power based applications like a solar lantern, solar water pump, solar home system, solar street lights are increasing in day by day in India. Hence, solar power is helping to eliminate the environment problems.

5.1. Solar Energy Scenario in India

Sun is the main source of energy for every living organism in the earth like human being, flora and fauna (Bijarniya et al., 2016). Solar energy is available in plenty of source of the earth and readily available free source of energy. Solar power happens to be the most suitable clean energy and is quite eco-friendly. The total amount of solar energy occurrence on the earth's surface is around 1.5×10^{18} kW h/per year, which is about 10,000 times the current annual energy consumption of the whole world. India receives a huge amount of solar energy which is around 5–7 kW h/m² for 300–330 days per year. It is enough to achieve the inclusive development of the country in all sectors. Solar energy is making to use mainly in two different ways that are the solar thermal and solar photovoltaic system. Solar thermal means that uses the sun's heat to produce hot water or air, cook food, drying materials etc. The solar photovoltaic means that the uses sun's energy to directly converting electricity for lighting home and building, running motors, pumps, electric appliances. Solar Photovoltaic panels and solar thermal are the main sources for direct electricity generation from solar energy (Mohanty et al, 2017).

Renewable energy is playing a significant role in the power sector of India. At present, 18 per cent of India's total installed capacity of electricity was constituted by renewable energy and its total installed capacity of renewable energy is 62846.86 MW. Of which solar power is accounted by 4.5 per cent whereas among the renewable energy solar power was registered in 25 per cent of installed capacity (Mercom report, 2017).

Table 1: Achievement in Grid Connected Renewable Power MW (as on 31.12.2017)

S.No	Renewable Energy sources	Cumulative Achievement MW	Percentage
1	Wind Power	32848.46	52.27
2	Solar Power (Ground mounted and Roof Top)	17052.37	27.13
3	Small Hydro Power	4418.15	7.03
4	Bio Power (Biomass & Gasification and Bagasse Cogeneration)	8413.80	13.39
5	Waste to Power	114.08	0.18
	Total	62846.86	100.00

Source: Annual Report 2017-2018. (MNRE, India).

Among the renewable energy grid-connected renewable power capacity in India, highest share was received from wind power in 32848.46MW (52.27 per cent) followed by solar power 17052.37MW (27.13 per cent) which includes ground mounted and rooftop types. Besides, the Ministry of New and renewable energy report says that the presently India has the fourth and sixth global position in wind and solar power deployment respectively. The Bio-power (Biomass & Gasification and Bagasse Cogeneration) is contributed in 13.39 per cent with an installed capacity of 8413.80MW followed by Waste to power is shared to 0.18 per cent with an installed capacity 114.08.

However, solar power is an emerging source of India, as well as its potential of power, was regarded in 750GW, this estimate was based on the wasteland available in the country. Among the States in India, Rajasthan in the Northwest and Jammu Kashmir in the North both have a high amount of wasteland availability that means more potential. Of which the state of Rajasthan has the largest area of desert namely “Thar Desert” and that can be producing 142 GW of solar power. As well as, in the Ladakh and other regions of Jammu Kashmir’s huge wasteland and can be generated 111GW of solar power (Manju, and Sagar, 2017).

The government of India has announced a National Action Plan on Climate Change (NAPCC) in June 2008 which includes eight major national missions. Of which, solar energy is being part of the center piece. This mission’s major aim is to utilize the solar energy for electricity generation, mitigation of CO₂ emission and other purposes. The Jawaharlal Nehru National Solar Mission (JNNSM) was launched by India in January 2010, using a three-phase approach; the mission’s objective is to establish India as a global leader in solar energy, by creating the policy conditions for solar technology diffusion across the country as quickly as possible. The initial target of the mission of installing 20 GW grid-connected solar power plants by the year 2022 was enhanced to 100 GW to be achieved by the same target year. The solar parks and Ultra Mega Solar power projects were decentralized by Ministry of New and Renewable Energy in December 2014. The first and large type of solar Park was formulated in Gujarat which is called “Charanka Solar Park” in India with contiguous developed land and transmission connectivity. In the beginning, the stage was planned to set up as a minimum of 25 Solar Parks and Ultra Mega Power Projects with targeting to 20,000MW solar power installed capacity within five years from 2014-2015. Now it is revised to extended by Cabinet to setup at least 50 solar parks with 40,000 MW total installed capacity (MNRE, 2017-2018).

The price of solar panel was decreased year by year. It is support to enhance the solar energy industry for generating and deploying the electricity as well as reducing environment impacts. The recently solar tariffs was breached in Rs 2.50 per KWh which is the first during the period of 2017 that results that the making solar power is lower than coal-based power (Mercom report,2017). Nowadays it is used to domestic, industrial and services sectors in India like using the grid power, decentralized distributed electrification deploying renewable energy technologies such as solar home system, solar street lights, and provides cost-effective options for meeting lighting, cooking and fulfill energy gap.

5.2. Role of Solar Energy in Environment Protection

Environmental protection is a vital role to attain the sustainable development goals of the country. In 1976, the government of India has revise the constitution of India due to enhance and protect the environment. The environmental protection and natural improvement is the duty of the state and the fundamental duty of every citizen in the country whereas it is part of the fundamental rights to every people. According to Honorable Supreme Court of India in 1991, “Right to live is a fundamental right under Article 21 of the Constitution which includes the right of enjoyment of pollution free water and air for full enjoyment of life (Srikanth, 2018). According to the global trends in Co₂ emission report (2016), it reveals that the burning of fossil fuel sources is emitted the Sulphur Dioxide, Nitrogen Dioxide, and Particulate Matter which are the main reasons for Co₂ emission.

However, environmental contamination has been increasing in the world. Majority of the problems are creating in the form the fossil fuels sources which lead to an impact on environmental constraints. India’s majority of the electricity production generated from fossil fuel sources. Besides, millions of the people are living in hamlets and un-electrified villages, this place is very difficult to access the electricity connection because those are located in thick forests, and mountains. Further, it is considerably difficult to generate power by other means on the account of higher cost. These regions are considered absent from the grid-connected system can be more economically effective and practical. People are mostly using fossil fuel sources like firewood, animal wastes, and kerosene for cooking and lighting purposes. Thus, solar power is playing a vital role in environmental protection and mitigates environmental problems in India.

Solar energy provides a clean and environmentally friendly source that will help to a possible solution to the generation of electricity in grid way and also provide off-grid locations through decentralized solar energy technologies such as solar home system, solar street lights, solar power plant, solar water pump, solar lantern etc. In the remote villages, solar off- grid system plays a crucial role in the people. It is encouraged with economic activities due to the long working hours and business hours made available by solar lighting. Replacing the kerosene lamps with solar-powered lights are decrease the threat of health problems and fire accident related to using the kerosene. In addition to that, consumption of kerosene was decreased it leads to minimize the kerosene subsidy. The standard of living has also increased due to increased income, the scope of recreation, increased awareness of development, higher literacy rate, etc. Further, solar power is without emitting local air pollution or acid rain precursor gases, water pollution, or noise. The modules are typically roof mounted or require very little ground space, so solar photovoltaic-based rural electrification also avoids the troublesome land use impacts related with grid-connected power lines and few methods of electricity generation (Pramanik, 2012).

Solar Energy Technologies offer significant environmental benefits when compared to the fossil fuel energy sources which contribute to sustainable development. The use of solar energy technologies is positive impacts on the environment like no degradation of the quality of water supplies, retrieval of degraded land, and decreased in the number of required power transmission lines (George, 2016). In addition, to that solar power system is to increase the system efficiency it will meet the sustained load demands, and also free of cost, the installation cost of the solar power plant is high but its operating cost is almost insignificant. Nearly 1.4 million solar home systems can mitigate the 0.8 million ton of Co2 Per year (Hoque et.al, 2014).

VI. CONCLUSION

Solar energy is a socially, economically, and environmentally suitable source for producing electricity in India. The potential of renewable energy sources in India, solar energy is received the highest potential as compared to other renewable sources. Among the installed grid-connected renewable power capacity of India, highest share was generated from wind power in 32848.46 MW, followed by solar power which includes ground mounted and rooftop types were in 17052.37MW. The Bio-power is also contributed in significant installed capacity of 8413.80MW, followed by Waste to power. Therefore, solar energy is one of the best ways of producing electricity without any environmental impacts. It helps to have a sustainable development goal. Solar energy is definitely to protect the environment and provides a clean environment which is essential for attaining sustainable development goals.

REFERENCES

- [1] Energy Statistics 2018, Ministry of New and Renewable Energy, Published by Government of India. (http://mospi.nic.in/sites/default/files/publication_reports/Energy_Statistics_2018.pdf).
- [2] Akella, A K, R P Saini, and M P Sharma. "Social, Economical and Environmental Impacts of Renewable Energy Systems." *Renewable Energy* 34 (2009): 390–96. doi:10.1016/j.renene.2008.05.002.
- [3] E. E. (Stathis) Michaelides, *Alternative Energy Sources, Green Energy and Technology*, Published by Springer-Verlag Berlin Heidelberg, 2012. <https://www.iea.org/policiesandmeasures/pams/india/name-155210-en.php?>
- [4] Energy Statistics 2018, Ministry of New and Renewable Energy, Published by Government of India
- [5] Draft National Energy Policy NITI Aayog, Government of India Version as on 27.06.2017(http://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017.pdf)
- [6] <https://phfi.org/wp-content/uploads/2018/12/first-comprehensive-estimates-of-the-impact-of-air-pollution-india.pdf>.
- [7] http://timesofindia.indiatimes.com/articleshow/63997130.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
- [8] J.G.J. Olivier, K.M. Schure, J.A.H.W. Peters, "Trends in global CO2 and total greenhouse gas emissions: 2017 Report", published by PBL Netherlands Environmental Assessment Agency, The Hague, 2017, pp.1-69.
- [9] N.L. Panwar, S.C. Kaushik, and Surendra Kothari, "Role of Renewable Energy Sources in Environmental Protection: A Review", *Renewable and Sustainable Energy Reviews*, Vol. 15, 2011, pp. 1513–1524.
- [10] Mohammad Shahabuddin, Sabiha Ahmed, Avinash Mohan Bhattacharya and Pramod Kumar Verma, "Environment protection through renewable energy sources", *International Journal of Applied Research*, Vol. 2(9), 2016, pp. 97-99.
- [11] Caleb Mensah and Mary Magdalene Mensah, *Climate Change and the Viability of Renewable Energy in Ghana*, Innovative Energy Research, 2018, Vol. 7(2), 2018, pp.1-9.
- [12] Jay Prakash Bijarniya, K.Sudhakar, Prashant Baredar, "Concentrated solar power technology in India: A review", *Renewable and Sustainable Energy Reviews*, Vol. 63, 2016, pp. 593–603.
- [13] Sthitapragyan Mohanty, Prashanta K. Patra, Sudhansu S. Sahoo, Asit Mohanty, "Forecasting of Solar Energy with Application for a Growing Economy like India: Survey and Implication", *Renewable and Sustainable Energy Reviews*, Vol. 78, 2017, pp. 539–553.

- [14] India Solar Market – September 2017 Market Drivers and Challenges”, Published by Mercom Communications Report, 2017.
- [15] Annual Report 2017-2018, Published by Ministry of New and Renewable Energy, Government of India.
- [16] S. Manju, Netramani Sagar, “Progressing towards the development of sustainable energy: A critical review on the current status, applications, developmental barriers and prospects of solar photovoltaic systems in India”, Renewable and Sustainable Energy, Vol. 70, 2017, 298–313.
- [17] Annual Report 2017-2018, Published by Ministry of New and Renewable Energy, Government of India.
- [18] India Solar Market – September 2017 Market Drivers and Challenges”, Published by Mercom Communications Report, 2017.
- [19] R. Srikanth, “India's sustainable development goals – Glide path for India's power sector”, Energy Policy, Vol. 123, 2018, pp. 325–336.
- [20] J.G.J. Olivier, K.M. Schure, J.A.H.W. Peters, “Trends in global CO₂ and total greenhouse gas emissions: 2017 Report”, published by PBL Netherlands Environmental Assessment Agency, The Hague, 2017, pp.1-69.
- [21] Monjure Alam Pramanik, “Impact of Solar Electricity on Rural Development a Study of Some Villages in Dinajpur and Thakurgaon of Bangladesh”, Technology in Sustainable Energy, 2012, pp.55-59.
- [22] Roni George, and Arun Ouseph Babu, “Environmental Impacts Of Solar Energy Technologies”, Imperial International Journal of Eco-friendly Technologies, Vol.1 (1), 2016, pp.75-79.
- [23] S.M. Najmul Hoque, Barun Kumar Das, Mohd. Rafiqul Alam Beg, “Evaluation of energy payback and CO₂ emission of solar home systems in Bangladesh”, Procedia Engineering, Vol.90, 2014, pp. 675 – 679.

