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Current Scenario and Future Scope of Solar Energy in India

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ABSTRACT: ***In terms of the worldwide need for energy, the topic of Renewable Energy Sources (RESs) has been the most appealing subject for academics in recent decades, with numerous breakthroughs, technologies, and applications becoming reality. This paper discusses the overview of solar energy, scope of solar energy, Recent achievements of the MNRE India, Major Initiatives of the MNRE Indi and current energy policies in india. Solar energy is one of the most significant kinds of renewable energy sources that will aid India's long-term growth. Solar energy presently provides 5.1 percent of India's total energy needs, which is the second largest percentage of any renewable energy source. This studies will help in future study to understand the current scenario and future scope of solar energy in india.***

KEYWORDS: Initiatives, Renewable Energy Sources (RESs), Rural, Solar energy, Thermal.

1. INTRODUCTION

Renewable energy is defined as energy derived from sources that can be replenished in a short period of time (Kabir et al., 2018). Solar energy is regarded as one of the most significant renewable energy sources among all of the categories. Solar energy now meets 5.1 percent of India's overall energy demand and 1.3 percent of the world's total demand. According to World Energy, if fossil fuel-based oil, coal, and gas reserves are exploited in the same manner, they will become extinct in less than 10 decades (Mofijur et al., 2019). In contrast to India's entire energy demand, the natural flow of solar energy is enormous. This is true from both technical and theoretical perspectives, since

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the amount of solar energy usage is dependent on the kind of emerging technology and its application. When compared to global energy consumption, the quantity of solar energy intercepted by the earth is enormous. Several nations, notably India, have implemented a large number of RESs and kept them running using diverse technologies.

Solar energy, among all the clean technologies, is an effective and simple solution to reduce greenhouse gas emissions and hence the global warming problem. In India, solar energy is received at a rate of 5000 trillion kWh per year, with around 280 to 300 bright sunny days per year, yet this enormous resource of solar energy is mostly untapped (Kannan & Vakeesan, 2016). India, which is ranked fifth in the world in terms of energy consumption, uses 3.9 percent of the world's commercial energy. There are around 1,44,942 MW of installed capacity. The quantity of solar energy used in 2007 was less than 1% of India's overall energy demand. Grid interactive solar power was 10MW in December 2010, but it increased to 3.062 GW in December 2014 and 9.2 GW in March 2017 (Timilsina et al., 2012). The MNRE has set a new goal of 100GW for solar energy use in 2017-2018. According to the MNRE's year-end evaluation report for 2017, India ranks sixth in the world in terms of solar energy use (Gulaliyev et al., 2020).

1.1 India's solar energy industry highlights:

1.1.1 Recent achievements of the MNRE India

- Solar tariffs are at their lowest point, 2.44 per unit, thanks to transparent bidding and facilitation.
- An ambitious bidding trajectory for solar energy capacity of 100GW.
- India is now the world's sixth-largest solar-power-installed-capacity country.
- A total of 62 GW of renewable energy has been built by November 2017, with 11.79 GW added since January 2017.

1.1.2 Major Initiatives of the MNRE India:

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- From January to November 2017, RESs installed 11788 MW of grid-connected electricity generating capacity, with solar power projects accounting for 5502.38 MW (46.67 percent)(Zhang et al., 2020).
- As of 30.11.2017, 1.42 lakh solar pumps have been installed throughout the country, with 1.31 lakh installed in the previous three and a half years.
- Solar projects with a total capacity of 23656 MW have been bid, with a letter of intent (LOI) for 19,340 MW issued.
- From 20,000 MW to 40,000 MW, "Development of Solar Parks and Ultra Mega Solar Power Projects" has been increased (Handayani & Ariyanti, 2012).
- Approved 35 solar parks with a total capacity of 20,514 MW in 21 Indian states.
- A total of 23656 MW has been tendered out, with a letter of intent obtained for 19340 MW.
- Following the publication of recommendations for increasing capacity from 20,000 MW to 40,000 MW under the solar park plan, three additional solar parks were granted this year in Rajasthan (1000 MW), Gujarat (500 MW), and Mizoram (23 MW).
- With a capacity of 1000MW, Andhra Pradesh's Kurnool solar park has become the world's biggest solar park(Guta, 2018).

1.1.3 Scope of solar energy in india:

- The first and most important benefit of solar energy is that it is environmentally benign. It does not emit CO2 or other hazardous gases that contribute to global warming.
- India's solar energy industry will serve as a foundation for long-term growth. Solar energy is abundant and will persist for numerous years, but nonrenewable energy sources have a limited lifespan (Kar et al., 2016).
- Solar energy will create jobs and contribute to the growth of the Indian economy. The Ministry of New and Renewable Energy is working hard to enhance India's solar energy industry. In section 6 of this document, several of the MNRE's strategies and accomplishments are discussed. In India, the solar energy industry

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is predicted to generate seven lakh employment over the next ten years. This has the potential to benefit India's rural economy (Kabeel & El-Said, 2015).

- Solar energy technology has the extra benefit of grid independence. Solar energy systems may be installed almost anyplace. It is also simply adaptable for residential usage("Design of Solar Tracking System for Capturing Maximum Amount of Solar Energy," 2019).
- Solar energy has a wide range of applications. Solar panels may be used for a variety of functions, including heating, cooking, and power generating, and many educational and business institutions are using them. It may also be found in satellites, automobile panels, calculators, and other electronic devices(Kumar & Singh, 2020).

1.2 Some Act towards the different policy:

- *Electricity Act,2003:*

The Electrical Act of 2003 was enacted to create a framework for India's electricity industry to flourish. The Central Government is required to create and publish the Electricity Policy and Tariff Policy in conjunction with other authorities for the development of power under sections 3(1) and 3(2)(Goel & Sharma, 2017). Section 4 stipulates that the central government, in cooperation with state governments, establishes and disseminates a national policy allowing rural regions to have stand-alone systems. Sections 61, 61(h), and 61(i) say that the competent commission shall determine the terms and circumstances for tariff determination, pursuant to the provisions of this act. According to Section 86(1), state commissions must promote cogeneration and the generation of electrical energy from renewable sources by implementing appropriate grid connectivity measures, as well as sell and buy electricity as a percentage of total electricity consumption in the distribution license area(Goel & Sharma, 2017).

- National Electricity Policy, 2005:

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National Electricity Policy, 2005 policy is in charge of establishing a favorable pricing for electricity generated by renewable energy sources. By 2012, it hoped to deliver power to all places that were not connected to the grid. By 2012, it wanted to raise the minimum per capita availability to 1000kWh per year(Syed et al., 2021).

- Tariff Policy in 2006:

According to section 86(1)(e) of the Act, states must acquire a minimum amount of their energy from renewable sources, and solar energy will be given a preferential pricing. Non-conventional energy sources will take time to catch up to traditional energy sources in terms of cost and efficiency.

- Integrated Energy Policy, 2006:

Its goal was to identify and estimate a roadmap for meeting the country's entire energy demands in an integrated way up to 2031-2032. It primarily focuses on the production of power from renewable energy sources (Anand, 2019).

- Rural Electrification Policies in the United States, 2006:

It sought to offer power to all families in 2009, with enough quality and dependability, and at affordable prices. It also sought to give an off-grid option for rural communities to meet their electrical needs. Each year on March 31st, the Gram Panchayat must verify and validate the village's electrified status.

- National Solar Mission of Jawaharlal Nehru (JNNSM):

The goal of the 2010 JNNSM was to forecast an energy demand target and ensure that it was met in the next years. By 2021, this mission set a goal of Solar power potential of 20,000 MW (grid-connected and off-grid), with 2000 MW of off-grid capability.

- Certificates of renewable energy, 2011:

It was enacted in 2011 to increase renewable energy capacity by balancing inter-state renewable energy generating disparities and requiring obliged organizations to satisfy

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their Renewable Energy Portfolios (RPOs) with different pricing rates for solar and non-solar power.

- Worldwide Solar Association:

The Worldwide Solar Association is an initiative of Indian Prime Minister Shri Narendra Modi to bring together the efforts of 120 nations across the world to indorse the usage of astral power and therefore decrease reliance on fossil fuels. This program was launched by Shri Modi in November 2015 at Wembley Stadium. The International Solar Alliance (ISA) forecasts a larger use of solar energy technology, which will lower manufacturing and research costs while also mitigating global warming.

- National Climate Change Action Plan (NAPCC), 2008:

The NAPCC was founded by the Indian government in 2008. It intended for long-term development in order to combat climate change. Its original objective was to accelerate the research and development of solar energy technology. It also recommended that RPOs be established at 5% of total grid-purchased and raised by 1% per year for the next ten years.

- Social Responsibility of Corporations (CSR):

It was established to stimulate private sector engagement and to contribute to national and global progress. It aspired to achieve social objectives such as pollution-free generating by channeling CSR funding from the top 500 firms as 2% of earnings to the off-grid option.

1.3 Methods of utilizing solar energy:

Because it works as an indirect source of other energies such as wind, biomass, hydro, and the ocean, solar energy is sometimes known as the "ultimate source of energy." There are two methods to use solar energy: passive and active. Passive solar energy use is the use of the sun's heat or light without changing it into other forms. Depending on the uses, the active manner of harnessing solar energy is translated into different forms. Active and passive techniques of use are shown by photovoltaic systems (PV) and

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concentrated solar power (CSP). The following are the three main methods in which solar energy is used.

- *Photovoltaic system(PV):*

The photovoltaic system (PV) is an active form of usage that is often utilized to generate power. PV systems are photovoltaic (PV) systems that convert light or photons into electrical energy. PV systems are also known as solar cells, and they are made up of silicon-based semiconducting materials (P and N-type semiconductors) as well as compounds such as GaAs or CdTe. This power generating is environmentally favorable. Small PV modules may be installed on smaller land areas and hence have a low environmental effect, while bigger PV modules may have a significant indirect impact on animals. PV modules must also be serviced on a regular basis.

- *Thermal Solar Power Plant:*

This is a method of actively using solar energy for the creation of power and heat. Parabolic reflectors, central towers, and parabolic dishes are often utilized in solar thermal power plants. These are all based on the traditional stem power plant. The installation of these plants usually requires a big space. This sort of power plant may provide electricity to small cities and hence serve as a regional growth hub. They are often used in arid locations, necessitating the construction of a grid to contaminated areas.

- *Solar Heating and Cooling Systems:*

This is a passive method of harvesting solar energy for the purpose of extracting thermal energy that may be used to heat water or other foods. Solar thermal systems are simple to install and run, hence they are often utilized in household settings.

2. DISCUSSION

Solar power is solar irradiation that might be used to create heat, biological reactions, or electricity. The total quantity of solar energy landing on Earth much outweighs existing and projected global energy consumption. This widely distributed source has

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the ability to meet all foreseeable power demands if appropriately utilized. Solar power, unlike limited fossil fuels such as coal, gasoline, and natural gas, is renewable, is expected to grow in popularity as a sustainable electricity resource in the 21st century owing to its infinite supply and nonpolluting quality.

Despite the fact that the Sun is an influential power basis and that light is by far the greatest plentiful source of electricity absorbed by Planet, its strength at the surface is rather low. This is mostly owing to the Sun's huge radial dispersal of energy. The Earth's atmosphere and storms absorb or disperse up to 54 percent of entering light, leading in relatively little further loss. Over 50% of the sunlight that reaches the earth is wavelength dependent, with the remaining 45 percent made up of infrared emission and smaller amounts of ultraviolet and various types of magnetic energy.

Solar energy has enormous potential since it provides roughly 200,000 twice the world's total daily electric-generating capacity every day. Despite the fact that sunlight power is cheap, the high cost of gathering, processing, and storing it prevents it from being used in many areas. Solar energy may be converted to either thermal (heat) or electrical (electricity), with the latter generally the greater easy.

3. CONCLUSION

At the worldwide level, the global energy problem is a major concern. The whole globe is working to improve energy safety and environment preservation by lowering reliance on conventional fossil fuels, and solar energy is proving to be a viable option. As a result, the emphasis is on solar energy technologies, which are expected to account for 5% of total power generation by 2032. India has set a lofty target for solar energy installation in the next years that is certainly attainable. Solar technologies have the potential to provide at least 35-40% of India's overall energy needs. India has lately been a global leader in the use of solar energy technology, but there is still room for development in solar installation tactics, which would need significant support not just from the government, but also from the country's young.

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