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SAVE WATER SAVE ENERGY SAVE ENVIRONMENT SAVE LIFE

IGTSHE-16/88

REVIEW ON SOLAR ENERGY AND ITS POSITION IN THE PERSPECTIVE OF INDIA

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ABSTRACT

India is targeting towards the developed country and for that reason India need to focus on one of the major problem of the country that is power generation and pollution control. Solar energy is available abundantly and it is none polluting. The potential solar energy that could be used by humans differs from the amount of solar energy present near the surface of the planet because factors such as geography, time variation, cloud cover, and the land available to humans limits the amount of solar energy that we can acquire. So, India need to avail this opportunity to produce power through solar energy. Government of India has launched many schemes to promote solar energy. Through this review paper few aspects of solar energy in India enlightened

Keywords: *Energy, Power, Renewable, Solar,Pollution, Geography*

INTRODUCTION

India has been facing the energy balance crisis for many decades. The electricity generation primarily depends on coal reserves, secondly on hydro power followed by natural gas. Coal depletion has motivated the country to look for other resources to meet its energy demand. India has a tremendous opportunity for nonconventional energy sources. India is the first country to set up a separate government body for the renewable resources development, Ministry of New and Renewable Energy (MNRE) which is making special tariffs and schemes to reduce the carbon emission. The motivation of solar energy aiding the country to meet its energy demand is in exhaustibility, reliability, and ease of installation in limited period of time. The solar power generation is eco-friendly as it does not include any harmful emissions and is a noise-free operation. The installation and running costs for a long span of time is less. Moreover, the cost of solar panels has been decreasing as a sign of encouragement to increase the number of installations. The cost of solar panels has reduced from $76.67/watt in 1977 to $0.74/watt in 2013. Following this trend, the prices are expected to decrease by the end of 2017. There are a few drawbacksof solar power generation. As this process mainly dependson climatic condition, suitable battery bank has to beinstalled for longer period of operation, affecting the cost of the system. Since the power produced through eachpanel is very low, to produce a huge amount of power,more number of PV panels must be employed in seriesand parallel, which follows the requirement of a vast areanetwork. Besides these, solar energy has become anemerging strategy across the globe. (1)

India being a tropical country has a tremendousscope of generating electricity from solar radiation.Various states, such as Gujarat, Rajasthan, Madhya Pradesh,Bihar, Andhra Pradesh, Odisha, and West Bengal can trap amajor amount of solar energy. States like Madhya Pradesh,Northern Maharashtra, Gujarat, and Rajasthan receivean average of 3,000-3,200 hours of bright sunlight overa year. Remaining regions (leaving Jammu & Kashmir,northeastern states and Kerala) receive around 2,600-2,800 hours of bright sunlight over a year. Consideringsolar radiation across the country, states like Rajasthan and Gujarat receive more than 2,000 kWh/m2, while states like the ones in the northeastern part of the country, east Bihar, and north-west Bengal receive less than 1,700 kWh/m2 With this amount of solar radiation, India can achieve huge amount of energy generation. Figure 1 shows the availability of solar radiation across all the states in India.

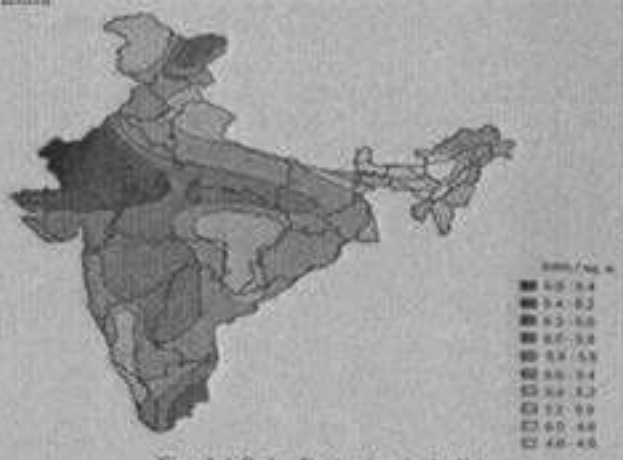

Fig: 1.1 Solar Radiation in India

1.2 Carbon emission of India: In less than two centuries of industrial revolution, the actions of human beings have led to deterioration of resources on the Earth—beautiful and fragile result of millions of years of evolution. The time has come to act, to repair and prepare for the future, so that humanity will have further progressed in its evolution in a more conscious and fair world. Today, our planet is running out of steam because it does not any longer have its own natural means to

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mpensate man's ecological print. Natural balances prove to more fragile than men have been used to
ine for decades. The erosion of biodiversity has reached a ique level in life's history on Earth. Ninety per cent CO2 ssions originate from fossil-fuel combustion and, therefore, determined by the following three main factors:

Energy demand or the level of energy-intensive activity, in particular, related to power generation, basic materials industry, and road transport
Changes in energy efficiency
Shifts in fuel mix, such as from carbon-intensive coal to low-carbon gas, or from fossil fuels to nuclear or renewable energy.

a's CO_2 emissions in 2013 continued to increase by 4.4 per to about 2.1 billion tonnes, making it the fourth largest emitting country, closely following the European Union, well ahead of the Russian Federation, which is the fifth est emitting country. This high ranking is partly caused by size of its population and economy. The workforce is nding in the industry and services sectors, partially se of international outsourcing. Per capita, India's CO_2 ssions were much lower than those of most developed tries and China. The increase in 2013 was mainly caused a 7.3 per cent increase in coal consumption, which unted for 59 per cent of India's total fossil-fuel primary gy consumption and 55 per cent of its total primary energy mption. This growth rate was lower than in the previous but much higher than those of 2010 and 2011. Coal- power production, accounting for almost 70 per cent of India's coal-related CO2 emissions, grew by about 13 ent in 2012, the highest annual growth ever. Figure 2 ows the continual growth of carbon emission in the last decades of India in comparison to the USA, China, and European Union. This clearly depicts that the pattern of emission has hugely increased with respect to the loped nations due to industrialization, whereas the loping countries can play a vital role by emphasizing on wable energy for reducing the sudden climatic change. world must almost completely decarbonize in the next 6 years, and the vast majority of fossil fuels have to be the ground, if we are to have any hope of tackling te change effectively. The warning is based on one of jor findings of "Trends in Global CO_2 Emissions 2014 " that the scientific case behind 2°C as a 'safe' level of warming—a figure that has underpinned climate ns around the globe is rapidly weakening. (2)

lar Power Generation in India: India is rapidly g as one of the most attractive markets for renewable investments in the world. Depending on the location, rage solar insolation varies from 4–7 kWh/m2 with 1,500–2,000 sunshine hours per year. With this, India's solar power reception, just on land—considering about 300 sunny days in a year—is around 5 PWh/year (~600 TW). This is too far from the current value of India's total energy consumption. We still have a lot of scope in the area of the solar and wind power generation. India introduced various

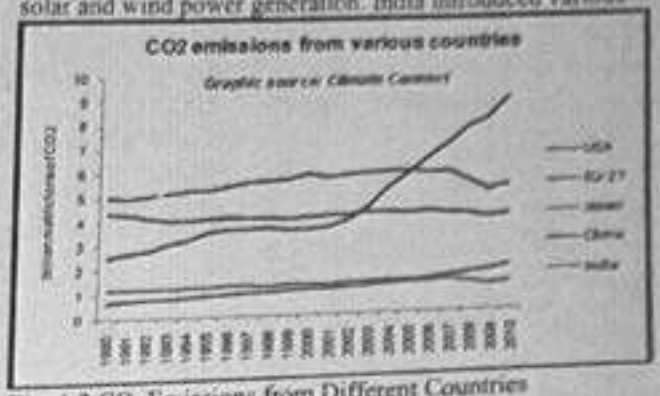

Fig. 1.2 CO_2 Emissions from Different Countries

measures which helped in the growth of renewable energy deployment in the country. These measures include both demand and supply side to promote renewable energy growth. In 2006, the rural electrification programme was the first step taken by the government of India to recognize the importance of solar power. This programme includes solar pumps, street lighting systems, solar lanterns, and solar home systems. This programme gave an idea of off-grid applications. In 2007, India brought semiconductor policy encouraging IT and electronic industries. Silicon and PV manufacturing industries were also included in this policy. This move helped in the growth of manufacturing industry. Solar mission of the Indian Railways is to achieve the target of harnessing solar energy of 10 per cent of IndianRailways energy consumption by 2020. The Indian Railways has planned to set up 1,000 MW plants in railway/private land and on railway buildings with the support from railway energy management company (REMC), a joint venture of the Ministry of Railways and the Rail Technical and Economic Service (RITES), and the Solar Energy Corporation of India (SECI), a public sector unit of the MNRE. The mission operates in the following four phases for a period of five years. The Indian Railways has planned to set up 10 MW solar-based lighting systems at about 500 stations, 4,000 level crossing gates, 50 office buildings, 400 street lights, rail coach factory (Rae Bareli) and solar water heaters, etc. Tenders for 6 MW solar plants at 200 stations and 26 rooftop sites are under evaluation. The Indian Railways have installed 1 MW grid-connected solar power plant on the rooftop of Katra Railway Station. The annual generation of the plant is about 1,445,000 units of electricity and it reduces about 10,000 tonnes of CO_2 per year. India's total solar installed capacity as on March 2014 is 2,632 MW. Figure 6 represents continual growth in the area of solar photovoltaic power generations and by the end of 2014, India had achieved 3.3 GW of total solar installed capacity and stands at 11th position in the production of solar in the world. More than 4 GW renewable energy projects were installed in the 2014–15.

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The total solar capacity installed during 2014–15 was 1,112 MW slightly higher than the target of 1,100 MW. Recently, the National Institute of Solar Energy (NISE), an autonomous institute under MNRE, has estimated India's solar potential of the order of 748.98 GW, considering only waste land and other land areas kept for installations. In 2015 itself, 400 kW rooftop solar power plant has been installed successfully at M Chinnaswamy Stadium at Bengaluru. The plant is designed to produce 5.9 lakh units in a year and also reduces about 600 tonnes of CO2 emissions over a year. The excess power generated is sent to Bescom grid with tariff of N9.56/unit paid to Karnataka State Cricket Association. (3)

1.4 Challenges of Solar Sector in India

Solar sector in India is facing many challenges, such as high cost of generation. This is because of the dependence on imports of wafers use for the manufacturing of solar cells. Solar projects are capital intensive and the lack of an effective financing infrastructure. Currently, researchand development in this field is slow due to lack of collaborative goal driven efforts. Technical innovations for improving the efficiency of the systems are necessary to exploit the potential. Another major challenge is the lack of standards which results in the fragmentation of the marketamong suppliers and manufacturers. Standardization of systems may lead to rationalization of cost as companies can invest in research and development and promote newer technology to meet the common specifications. Facilitating closer government and industry cooperation and creating awareness about the benefits of solar energy among the consumers can promote the growth of the solar sector in India.(4)

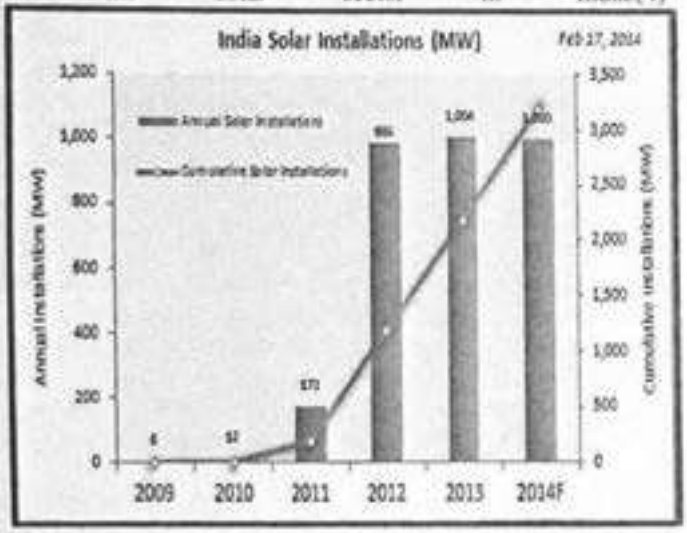

Fig: Solar Installations in India

CONCLUSION

Solar energy can play a vital role in reducing the demand supply gap in India by installing rooftop and solar parks. There are still significant barriers that need to be overcome for faster growth and adoption of latest technology. However, recent developments in regulatory, policy, and financial sectors are likely to play a prominent role in improving the attractiveness of the investments in solar sector. Cost of finance, security, access to the grid and purchase of power are the major concerns of the industries which are to be addressed. Since, the environment is well-disposed, the programme can achieve its target in the coming years and India can emerge as one of the leaders in solar energy in the world.

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