Solar Power Transforming the Face of Rural India: Climate Justice for All

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Abstract. The word “environment” is difficult to define. Its normal meaning relates to surroundings. The environment itself is a combination of physical, chemical and biological factors surrounding an organism. Environment provides us a number of renewable and a non-renewable energy source such as solar power, wind-energy, natural gas, hydropower, biofuels, coal, petroleum etc., Renewables energies are playing a vital role in augmenting Grid powers, provide energy access reducing consumption of fossil fuels and also provides India to pursue low carbon pathway. There are so many steps taken by the international community in order to promote the solar energy. The Sustainable Development Goal 7 ensures access to affordable, reliable, sustainable and modern energy for all. The Paris Climate Change Agreement, 2015 has given hope for the carbon emission mechanisms that must be followed by the state parties. In our daily lives, the community as a whole must focus on reducing our daily energy consumption, migrating to renewable resources, using greener transport and adopting environmentally friendly technologies. Being a collective problem, climate change and emission of carbon needs collective solution. It is not new to the developing nations as solar products often low quality and negative experiences with substandard generic products damaged the receptivity of the potential consumers. It is important to note here that affordable price and high-quality standard products should be produced in the country itself. The solar power project will reduce and lead to carbon emission. In this paper, the importance of solar power and its usage for rural India will be discussed in detail in order to ensure the green environment.

1. Introduction
With the pace of globalization and industrialization, demand for electricity is increasing at an alarming rate. This has contributed to global warming by the emission of Green House Gases. It is pertinent to note here that in most of the developed and developing countries, the conventional source of energy that is coal and thermal is used for the primary production of electricity. After understanding the challenges resulted from global warming, the world nations have recognized the value of optimally utilizing the renewable resources that are available for the purpose of production of electricity. And more than 130 nations have successfully implemented it. Developing and building a successful project on solar energy needs more than having the largest solar plants.

The population is constantly growing and thereby the demand for water, food and energy is increasing. In result of which, the environment is affected. The world energy demand is expected to increase by
35 percent by 2030. Solar energy is considered an environmentally sustainable and friendly option when non-renewable resources or coal, gas, oil and uranium reserves that are depleting day by day. It is pertinent to note here that renewable energy acquired from natural sources like wind, solar, hydro and biomass has the capacity to address various and growing demands for energy. It is worthwhile to note here that India as a consumer of energy, is also a major energy producer. India is currently ranked seventh in the world as the largest energy producer, responsible over about 2.50 per cent of the world’s overall annual energy output. evidently India is facing huge energy demand. More than 75% population in India is residing in village. India ranked fifth in case of production and consumption of electricity. The Bridge to India and the GTM research report says India faces a perfect storm of factors that will boost solar photovoltaic adoption in the coming years at a rapid pace. India solar industry has immense potential for rapid growth Days aren’t too far for most gadgets to be powered by a rechargeable battery bank with solar energy [1]. There are so many renewable energy technologies for domestic use such as Photovoltaic’s, Solar thermal energy, Micro inverters etc., Photovoltaic’s is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Solar thermal is yet another method. Perhaps, an innovation for utilizing solar power for thermal energy -‘heat’. There is on more technology used in renewable technology such as Micro inverters. It is an alternative approach to the single-inverter system commonly used on homes. There are success stories in some of the state in India regarding renewable energy such as Gujarat. Gujarat is one of India’s industrially based states [2]. The per capita electricity consumption in Gujarat is far more than the average consumption in India. In addition to this, the Government of India has successfully lit the homes with the implementation of Jyotigram project, 24x7 uninterrupted power supplies to all. It is worthwhile to note here that Gujarat is fourth leading state in terms of installed solar power capacity with 1,160 MW. The Government of India in its latest “Energy Statistics 2011” has called Gujarat as the 2nd best state in renewable energy sources and describes it as best geographically suited for solar and wind energy production. The state is blessed with solar radiation for approximately [3] 300 days in a year. This policy is termed as “Solar Power Policy-2009”. There is another policy namely Solar Power Policy, 2015. The Ministry of New and Renewable Energy is also involved in the implementation of research and development scheme in the areas of renewable energy. The Ministry of New and Renewable Energy is the Government of India’s nodal Ministry that develops and deploys new and renewable energies to supplement the energy needs. The prime aim of this Ministry is to enforce for cost-competitive, convenient, safe, affordable and reliable energy supply options to the country.

2. **International Perspectives of Solar Power Transformation**

Solar energy is free and clean and renewable. It is true that sun will keep making energy for millions of years. Through a variety of power, solar structural designs and artificial photosynthesis, solar energy, radiant light and heat from sun are harnessed. Germany is one of the leading countries in production and consumption of electricity from solar photovoltaic [4]. Japan has remained consistent in formulating and implementing the policies for promoting non-renewable use. It has heavily focused on solar for meeting the future electricity demand need in Japan. China is one of the leading countries in making successive use of renewable source of energy for production of electricity. It is the major contributor to carbon emission ranked after the USA. The geographical location of China makes it favorable for deployment of many renewable sources of energy. It is also true that looking at the high rate of economic growth and development, the demand for primary source of energy is also increasing at an alarming rate.

3. **Solar Energy and Climate Change**

The climate change is showcased as major global issue. India being the nation that primarily depends on agriculture is undoubtedly one of those nations who are much vulnerable to be directly threatened by the growing menace of the climate change. Climate change is estimated to have serious adverse effects on India’s growth as it aggravates the pressures on natural resources and the environment.
associated with rapid urbanization, industrialization, and economic growth. Water resources, marine habitats, biodiversity, and agriculture production are the sectors with the greatest exposure to such impacts. Since there is a developmental process, it is much tougher for the developing nations to get on the tune with the developed nations while the climate change issues are in the scene and for India [5]. On the other side solar energy is playing major role in order to reduce the greenhouse gases. In result of which, climate will change automatically and maintain environmentally friendly atmosphere in totality. There are evident that solar energy is most suitable one in order to reduce the pollution on earth also.

4. The Contribution of Engineering Sector
Today the world is full of technological innovations that are astonishing. Once the existing innovations were venerated but the same innovations are appearing to be great contributors of climate change issues. For instance, various sectors like the manufacturing, construction and heavy engineering, transportation provides for the greenhouse gas emission and impacts on climate change[6]. The obligation upon the world nations rests upon the formulation of legislative framework at national and international level for these kinds of climate change issues. Provided, along with the legislative framers it is also the duty of the engineering sector to join hand to resolve the climate change problem. The onus of solving climate change related issues is vested on the engineering research and development community also. There are several ways to address the greenhouse gas emission challenges, however, practical hurdles tend to slow down the development of solutions – including affordability of such mechanisms and investment in the innovation or Research and Development. The engineering sector who are involved in creating new innovation has realized that many of the past inventions are the primary reasons for the present climate change issues like the emission of carbon. Every innovation, especially, relating to the engineering sector, have to ensure that such technological innovations would promote environmental friendliness. In India, under the Ministry of Environment, Forest and Climate Change Government of India, Clean Technology and National Clean Development Mechanism Authority in engaged in the approving Host Country Approval projects in sectors of energy efficiency, fuel switching, industrial process, municipal solid waste, renewable energy and forestry[7]. It is well established that India has appropriate mechanism as mandated by the Kyoto Protocol and the Paris Agreement discusses on the mechanisms for the reduction of greenhouse gas emission. Adversely, there are few national level and state level policy for clean mechanisms and few ineffective legislations that involves the engineering sector with proper fund for the implementation of the clean mechanisms in the technological innovations. The larger investment in the engineering sector- innovation, research and development- will provide opportunity to implement the international obligation for solving climate change issues. In the decision making of the implementation of policies and formulation of effective legislations the experts and young minds belonging to the engineering sector have to involved effectively. It is pertinent to note here that India has proved how it is leading as a pioneer in solar energy consumption as compare to the other developing nations. There were so many missions introduced by the Indian Government in which one of the mission is Jawaharlal Nehru National Solar Mission which was introduced in 2010. The government of India is taking all the possible steps in order to bring India in the realm of nations who are strong in solar energy power sector.

5. Indian Government and the Solar Energy
The first report by the Ministry of Renewable Energy, presented to the Lok Sabha in December 2019 for demand for grants, elaborated on the solar energy and its effective utilization by India. The Ministry of New and Renewable energy is the nodal Ministry of Government of India for all matters relating to new and renewable[10]. The report of the above ministry consists of India’s plans on utilization of the renewable energy which the Government of India is executing the pledge by 2030, in the Paris Accord for 40 % of its installed power generation capacity that will be based on the renewable[11]. The Report also details for investing in the North East because these regions have poor
solar and less wind energy. It also proposed financial allocations for various schemes for 2019-2020 where under the Grid interactive Renewable power, for solar power nearly 2479.90 Crore rupees of Budget Estimate was made which is higher when compared with the budget estimates made for other renewable energy. This report also established the two externally aided projects which is executed by the Ministry of Renewable Energy one of which is “promoting business models for increasing penetration and scaling up of solar energy”[12]. This Report also stated the effect of Goods & Services Tax which is of 5% imposed on the devices and spare parts of the renewable energy especially the Solar Power Generating Systems- such as solar lanterns & lamps. Further utilizing solar powers potential in meeting out the energy requirements for the cooking, hot water usage by both commercial, industrial sectors and also by the residential purpose[13]. The report also provided the details of the bid and the tender documents when made will also be expected to include the details for the measures taken during back up of solar power due to grid instability or the situations of unavailability of transmission line. Creating of awareness among the consumers for the growth of rooftop solar generation is also mentioned in the report under the formulation of future policies relating to solar power [14]. The Ministry of Renewable Energy also provide the details of the potential of solar energy is about 750 GWP which was assessed on the availability of land and solar radiation in the country. The Ministry of Renewable Energy Report also furnished the targets by the National Solar Mission that is panned to be achieved by 2022. Under this the projects of Solar Park Schemes – setting up for 50 Solar Parks and Ultra Mega Solar Power Projects, Schemes of Grid-Connected Solar PV Power projects by the Central Public Sector s etc., their details and effectiveness of such projects are furnished in the report. The report basically discussed about renewable energy and its ways and means for achieving the lot in order to use the renewable energy [15]. It is important to note here that energy demands have increased in most of the sectors such as agriculture, industry, commercial and residential and it is expected to grow more also. In order to fulfil the needs of the sectors discussed above, renewable energy can be considered as one of a potential resource.

6. Conclusion

Many policies were framed to promote renewable energy technologies, and many developed countries have adopted feed-in policies but developing countries are in infant stage by way of enacting laws and policies in order to strength the renewable energy particularly solar energy. Many of the developing nations are involved in utilizing renewable energy technologies as a cost effective alternative to grid supply for providing electricity to rural and remote areas. However, In developing countries electricity supply is already very high and renewable energies such as photovoltaic technology can be connected for the same [16]. It is important note here that if the individual countries decides to succeed in solar power energy sector it should decide based on ground reality as it is depending upon policies regarding solar energy, technology, financial schemes etc., It is right time that Government should create awareness about renewable energy sources to people and encourage to adopt such technologies which can harness the abundantly available solar energy [17]. There is another problem that current economic and social system is still based on traditional source of energy and their distribution system and it will take some time to admit renewable energy sources. It was in July 2020, the Prime Minister of India, inaugurated Asia’s largest 750MWRewa solar plant, which is estimated that it would avoid 15.4 lakh tonnes of carbon dioxide generation every year. Additionally, this is the first project fund sanctioned by the World Bank and Clean Technology Fund in India. Moreover, the construction sector and real estate sector have to consider the advantage of the usage of solar power as it is one of the sectors which is dominated by the private investment giants where it contributes to a country’s economy [8]. For example, Real Estate Regulation Act, 2016, Section 4(e) Section 32(e) provides for using renewable energy and using of environmentally sustainable and affordable energy[9]. The construction sector is already contributing for GHG emission. Therefore, for compensating the GHG emission due to the waste produced by the construction materials, the real estate sector can compensate with the utilization of solar power as a legislative mandate. The countries like India have to consider utilization of solar energy, as legislative mandate, in all sectors which
provides for the GHG emission. In India there are many national and state level policies for the utilization of solar energy in big projects and there must be effective legislative mandate which pave way in utilization of renewable energy- the solar power to the small projects, apartments and small scale industries. Conversely, the mechanism used must be of standard quality and affordable [18]. Conclusively, when the question of the quality and standard of the solar equipment and solar cells & modules are tabled before-the answer is-India is predominantly depending upon other countries like, China, Malaysia and Vietnam. The Ministry of renewable energy insists for BIS standard for such kind of imported equipment, which is again doubtful. Therefore, if the indigenous equipment are given priority, it would result in maintaining both standard and affordability of solar products and utilization of solar energy will be effective and efficient.

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