

ALTERNATIVE SOURCES OF ENERGY IN SUSTAINABLE DEVELOPMENT GOALS: A STUDY ON SOLAR ENERGY

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ABSTRACT

The environment is an important part of our day-to-day life and it fulfils our basic needs such as food, shelter, and clothing. In our environment, we can find natural resources, biotic and abiotic things. For parochial interest, human beings are gradually destroying the environment and fulfilling present needs, but more and more natural resources are exhausted, which are not abundantly found in the world. Day by day, due to the population explosion, there is a danger to the environment. Basically, there are two types of energy resources, renewable and non-renewable sources of energy. Renewable sources can be recycled and abundantly found, such as solar energy, wind energy, hydropower energy, and non-renewable sources of energy are fossil fuels, such as coal, natural gas, nuclear energy, etc. Non-renewable sources of energy are found in a limited way. Through coal, thermal energy is produced, but it is harmful to the environment and exhaustible. Therefore, the government of India has initiated the International Solar Alliance with 121 countries to produce green energy through solar panels. The present research may show, how solar energy will be an alternative source of energy for environmental preservation. Through NITI Aayog, the government is focusing on renewable sources of energy for solving environmental problems. It has also kept a target that by 2050, to make India a zero carbon emission country.

Keywords: Environment, Sustainable Development Goals, NITI Aayog, International Solar Alliance

INTRODUCTION:

Since the known history, human beings have been plundering the available resources for their development. It has been a regular habit to seek more pleasure and comforts at any cost. So slowly but steadily, the term development acquired a magic spell, particularly when human beings entered into age of science, technology and industrialization. People began to follow different models of development and justify the rationality behind their model of development.

Their models of development got the name of capitalist - liberal - democratic model which came into force in different phases of human history. No one can deny the fact that over the last few decades, there has been an increase of pressure on natural resources. The irresponsible behavior and insensible character of the so-called modern people have put the earth under constant threat. In the process, the real cost of environmental damage, increasing the radiation level and depletion of Ozone layer exceeds the benefits of development. It is therefore of prime concern, how to make development process eco-friendly, so that it can be sustained for generation.

The economist, policy makers, statesman, and moreover the think-tank of civil society have come forward to warn mankind about the evil effect of uncontrolled development and shown the righteous and virtuous of path in the form of sustainable development. The concept of Sustainable development has been one of the most popular and universally accepted concepts. It is a key model of development of our age. It not only helps to understand the ongoing problems but also to undertake the most appropriate method to solve the numerous problems of the present-day world. Indeed, sustainable development is not a mere concept only; rather it is a timely check on the uncontrolled greediness of humanity.

Beyond any doubt, the future of our planet is a matter of great concern. "Through their action human have

negatively impacted on the environment, endangering the survival of the earth and the future generation. The condition has indicated changes in the behavior aiming towards more rational and efficient management of all resources that will allow less pressure and environmental impact” (Klarin, 2018; 67). Sustainable development is recognized as a globally goal for human-kind. Humanity is now compelled to pay more attention to the environment instead of development. Indeed, sustainable development focuses on the intergenerational equity in exploitation and use natural resources for material welfare.

India is now considered as a developed country. Now days, it is competing with the developed countries of the world with an aim to add more glory. For this purpose, many development projects are launched and resources are consumed on high scale that requires caring for the needs of future generation. Again, exploitation on environment new no bound over the past few decades. Therefore, NITI Aayog appeared as the most vibrant and premier policy making institution to handle the alarming situation caused by over exploitation of resources and to foster a balanced and sustainable economic development. It is really a “knowledge and innovation Hub” (NITI Aayog) which not only ensures a balanced growth of development through greater participation of states and people at large.

Energy is a fuel for development and civilization. All features to developments is a byproduct of energy utilization. However, energy crisis is considerably increased in our time. It is an acute problem in both developed as well as developing countries. India is no exception to this problem. As it is a global concern, many countries of the world have come forward to conserve nonrenewable resources and utilize the renewable energy for development purpose. Again, in this backdrop use of solar energy has been new widely accepted and preferred. But now a day’s Solar energy is used in completely different way not only to meet the different needs of the people but also used as the best alternative to conservation of nonrenewable resources for the future use. Keeping the growing utilization of solar energy all over world, NITI Aayog of India is also making sincere effort to reorient and revitalize different institutions and departments to pursue a sound policy for rational use of solar energy in multifarious ways.

Climate Change
“Climate change is one of the long-term shifts in temperature and weather patterns. Since the 1800, human activities have been the main obstacle in the climate change because of burning fossil fuels like coal and gas. This fossil fuels may generate greenhouse gas emission just like a blanket wrapped around the earth. This greenhouse gas is responsible for climate change and it includes carbon dioxide and methane. These gases come from using gasoline for driving car or coal for heating a building, for example clearing land and forest can also release carbon dioxide.

Landfills for garbage are the main sources of methane emission. Other sources such as energy, industry, buildings, agriculture and land use are also the main emitters” (<https://www.un.org/en/climatechange/what-is-climate-change>). Generally, people understand that climate change means warmer temperature. Due to several causes the temperature of earth may increase and its consequence includes- “draughts, water scarcity, rising sea levels, flooding, melting polar ice, catastrophic storms and decline in biodiversity. In 2018 UN Report, thousands of scientists and government reviewers agreed that limiting global temperature rise to no more than 1.5 C would help us avoid the worst climate impacts and maintain a livable climate. Yet based on current national climate plans, global warming will reach 2.7 C by the end of century” (*ibid*). Different types of initiative have been taken by govt for solution of climate change and protecting the environment. “There are global agreements to guide progress, such as the *UN Framework Convention on Climate Change* and the *Paris Agreement*. Climate change can be reduced by switching energy system from fossil fuels to renewable like solar or wind energy. Countries have kept a target by the year 2050, the net zero emissions and fossil fuel production must decline by roughly 6 percent per year between 2020 and 2030” (*ibid*).

Climate change is usually refereed to changes in weather patterns rising temperature, known as global warming. The attributing factor for this are the greenhouse gas emissions, like carbon dioxide, methane, due to the rampant use of modern machines and technology, based on fossil fuel. Perrings (2003) writes that the “US National Research Council, for example, defines abrupt climate change as a change of state that is sufficiently rapid and sufficiently widespread in its effects that economies are either unprepared or incapable of adapting” (USNRC 2002). UN Secretary General Antonio Guterres pointed out, “the climate emergency is a race we are losing, but it is a race we can win” (UN75). “In a 2018 UN report, thousands of scientists and government reviewers agreed that limiting global temperature rise to no more than 1.5°C would help us avoid the worst climate impacts and maintain a livable climate. Yet based on current national climate plans, global warming is projected to reach 2.7°C by the end of the century” (<https://www.un.org/en/climatechange/what-is-climate-change>, accs. 3.4.22). “There are certain global mechanisms to regulate and govern the climate change phenomenon, such as,

Sustainable Development Goals, UN Framework Convention on Climate Change, and Paris Agreement. The main focus area requiring action for the effects of climate change, includes, reduction in emissions, adapting mechanisms and effective management with strong enforcement mechanisms. While a growing coalition of countries is committing to net zero emissions by 2050, about half of emissions cuts must be in place by 2030 to keep warming below 1.5°C. Fossil fuel production will have to come down at the rate of approximately 6% every year between 2020 to 2030 as per the UN” (<https://www.un.org/en/climatechange/what-is-climate-change>, accs. 3.4.22).

The Intergovernmental Panel for Climate Change (IPCC) was a consequence of the meeting of international scientists organized by the World Meteorological Organisation and the UN Environment Programme in 1988. IPCC’s Third Assessment Report (TAR), 2001, stated that due to increase in greenhouse gas concentration over the last fifty years, the warming has occurred, which has further led to the increase in sea-level in the twentieth century. “In addition, TAR projects further warming of 1.4-5.8 degree Celsius for globally averaged surface temperature in the 21st century” (Berliner, 2003; 430). Climate change is not a state specific issue but has universal applicability thereby affecting a number of state systems and their population. Climate change may bring in disastrous to the globe affecting directly the ecosystem and ecological balance and impacting upon the agriculture and the associated economic system. Discussing the distinctive features of climate change, Perrings (2003; 2043- 44) write,

As an economic problem, climate change has a number of distinctive features. First, the climate is a global public good. Since no one country can be excluded from the benefits of mitigation by any other, every country has an incentive to 'free ride' on the mitigation actions of others. Second, the most important anthropogenic emissions behind climate change (principally carbon dioxide) are what are called stock pollutants: they build up in the system. One implication of this is that emissions control can take a long time to have any appreciable effect. If future costs and benefits are discounted at positive rates, this can mean that the present value of actions that pay off only in the far future may be quite small. Third, the system is characterized by multiple locally stable states. Small incremental changes can induce it to flip from one state into another in ways that can be either irreversible or only slowly reversible. This implies that policies relying on ex post adaptation or correction may be either ineffective (in the case of irreversibility) or effective only very slowly and at high cost (in the case of hysteresis). Fourth, future climate states are fundamentally uncertain. It is currently not possible to provide comprehensive probability density functions (PDFs) or confidence intervals for projections from the general circulation models at spatial and temporal scales that matter for national climate policy. Finally, interactions between the component parts of both the climate and the economic system are such that climate change and other policies are not independent. Policies directed at very different targets may have significant implications for climate change (Carraro 2002; Kaul et al. 2003).

“The Paris Agreement was adopted by all 196 Parties to the United Nations Framework Convention on Climate Change at COP21 in Paris on 12 December 2015. In the agreement, all countries agreed to work to limit global temperature rise to well below 2 degrees Celsius, and given the grave risks, to strive for 1.5 degrees Celsius. Implementation of the Paris Agreement is essential for the achievement of the Sustainable Development Goals, and provides a roadmap for climate actions that will reduce emissions and build climate resilience. As of April 2018, 175 parties had ratified the Paris Agreement, and 168 parties had communicated their first nationally determined contributions to the UN framework convention on Climate Change Secretariat /). The Madrid Climate Change Conference, COP25, brought the world together to consider ways to strengthen the implementation of the Paris Agreement. Held from 2 to 16 December 2019 in Madrid, the Conference came at a time when new data shows the climate emergency is getting worse every day, and is impacting people’s lives everywhere, whether from extreme heat, air pollution, wildfires, intensified flooding or droughts” (<https://www.un.org/sustainabledevelopment/climate-change>).

IMPORTANCE OF STUDY:

Development should be done in such a way that it sustains for future generations also. There are 17 Sustainable Development goals of United Nations, which is targeted to be achieved by the year 2030. Governments at the global level are taking different initiatives to achieve these 17 goals. In India, there is a Think-Tank institution named NITI (National Institution for Transforming India) Aayog that provides different suggestions to achieve these 17 goals. Among the 17 goals, goal 7 is “Affordable and Clean Energy”. There are different types of clean energy among which, solar energy is the best alternative sources of energy. So, to say, India has signed an agreement with 121 countries for the International Solar Alliance (ISA). India and France are playing a lead role in this agreement and the headquarter of ISA is also situated in Gurugram, in India.

Now a day’s solar energy is used in different ways. From household to the highest industrial hub, solar energy is

used as the best alternative. India is playing a leading role, not only in popularizing the use of solar energy, but also giving importance on the making sincere attempt to contribute substantially for development of solar action plan. This book is an attempt to show problems and benefits of the use of solar energy at the grassroot level. Government of India is giving more importance on renewable sources of energy. Solar energy is more expensive due to its various equipments, but if government introduces subsidy then in the rural area people can get benefits of the use of solar energy.

REVIEW OF LITERATURE

Khan (2018) connotes that NITI Aayog has been considered as the “Think-Tank of the Government of India and works mainly for (I) Five-year plans (ii) Fund disburser (iii) one size fits all model but NITI Aayog has advanced objectives with the changing trends in our Indian economy like, (i) decentralized, bottom-up strategy; (b) Generation of new ideas; (c) Team

India, centre and states” (2018; 73). He presents the rules, its impact on transforming Indian economy, its benefits and suggestions taking from secondary sources. While conclusion, he writes, “NITI Aayog will try to frame a proper development policy for our nation and also seek to put an end to slow and tardy implementation of policy” (2018; 76) through proper coordination and improve center-state relations.

Swaminathan & Kesavan (2016) explain about the methods of achieving the United Nations seventeen goals through Sustainable Development. Particularly in this article authors explain about Goal 2 of sustainable development that is *End of Hunger*, through achieving food security and improving nutrition and to promote sustainable agriculture. Basically, sustainable agriculture is a foundation for achieving the other goals of food and nutrition. Both the authors provide a strategy for eradication of hunger such as, producing enough food for the present and also future generation and adopt the evergreen revolution pathway for increasing crop production. Here ‘evergreen pathway revolution’ involves increase in productivity but without any ecological harm. Therefore, “it is important that we can develop a multi-disciplinary approach with community participation for developing an effective implementation strategy” (2018; 127).

Kurian (2012) depicted the importance of energy for sustainable development which is “economically viable, need-oriented, self-reliant and environmentally sound for development. In this paper, the author analyzed the role of sustainable development in the energy sector through sustainability of renewable energy, and nuclear energy. Sustainable development in energy sector can be achieved through developing competitive renewable energy sources, deployment of new energy technologies and innovation of low carbon energy sources” (2012;673). In conclusion, the author explains that formation of national energy policies and strategies for the appropriate and more effectively utilization of national energy resources in regard to furnish the requirements of a nation. Here author mentioned that renewable energy, to change the fuel mix to cleaner sources, energy efficiency and encouraging mass transport are recommended for a sustainable development policy in the energy sector.

Destouni and Frank (2010) examine some important points of renewable energy in relation to various energy committee projects. According to their view, “renewable energy sources can be expected to provide up to 35% of the global energy supply and half of the electricity production by 2050” (2010;18). Both the writes explain about the different sources of energy from renewable energy sources such as solar energy, Bio-energy, Wind energy and Water energy. They elaborate that solar energy is the best alternative sources of energy because it fulfills the demands of present needs and in the next fifty years it can become a significant global energy provider. In conclusion, author mentioned that “for the global energy, international coordination and investment in energy research and development is required for future reliance on renewable energy sources with minimal fossil fuel” (2010; 21).

Lauvergeon (2004) elaborately explain about the importance and shortcomings of Kyoto Protocol. To her, Kyoto Protocol is one of the most emblematic “institutional frameworks” to tackle CO₂ and other green gas emissions. Some shortcomings are Kyoto emission reduction target is not enough, non-inclusion of developing countries, lack of effective incentive such as carbon tax. Here the author depicted some of the measures to eradicate this obstacle, such as supplying energy at low cost to the people, ensuring security supply of resources and fighting climate change. In conclusion, author said that if we are facing many problems then we should not wait for radical change but whatever available solutions should be applied till new developed comes. Therefore, we can say that if we want to achieve sustainable energy development, we must keep our mind open, look at the facts, provide the real incentive and act now.

Kar (2015) explain that renewable energy is one of the “enablers of sustainable and inclusive growth in India.’ In

this article, the author pointed out the factors driving renewable growth and challenge faced by the Indian renewable market to achieving high penetration of renewable energy. The author believes that the future growth would largely depend on a symbiotic relationship between the policy drivers and market returns. The renewable market development can neither survive without subsidy at this growth stage, nor can it be sustained through subsidies indefinitely. In conclusion it argues that with sustained and progressive renewable policy framing and implementation by 2020, India can expand its renewable energy base from 36.5 GW to 175 GW. It can be a success if government will strike the right balance between meeting social objectives and commercial viability of renewable projects in India” (2015; 238,246).

SUSTAINABLE DEVELOPMENT

Sustainable development is very wide and comprehensive concept. It contains within itself several dimensions. It is to bring a balance between human need, natural resources and eco system. Infact it is a multi-disciplinary and very complex concept. “The concept of sustainable development is also based on the concept of development (socio-economic development in line with ecological constraints), the concept of needs (redistribution of resources to ensure the quality of life for all and the concept future generations (the possibility of long term usage of resources to ensure the necessary quality of life for future generations)” (Klarin, 2018; 68). One of the most important definition of sustainable development that “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Report, WCED 1987). From the geographical background, we can explain the word sustainable development, that it is such type of development where we are using resources in such a way that we are not compromise our present needs and we are compromising for future generations. It means we may conserve resources for our future generation and fulfill our present needs. So, we should bring a balance between the three dimension such as social, economic and ecological. If our dimensions will be trouble then it will bring effect to the country’s sustainable development. Here we also can say that sustainable development does not mean that without fulfilling present needs, we may only conserve for future generation. So, what is our basic needs we should fulfill it but not in an excessive way, along with we should preserve for our future generation. Generally, we know that sustainability of development means development should be done in such a way that resources should be sustained. There are many challenges behind it. Development requires

consumptions of resources. For example, suppose for establishing an industry, it cannot automatically run, it needs different types of elements. In Thermal power plant coal is need to generate electricity. We are bound to consume resources for development. But excessive way of consume resources it would be depletion of environment. In the name of development damage to environment, then it would lead to depletion of resources. Therefore, we should use natural resources in such a way it will be sustained future generation also. The SDGs are designed to end poverty, hunger, AIDS and discrimination against women and girls. So, to say these goals have the power to create a better world by 2030, by ending poverty, fighting inequality and addressing the urgency of climate change. The 17 SDGs are: (1) No poverty (2) Zero hunger (3) Good Health and well-being (4) Quality education (5) Gender Equality (6) Clean water and sanitation (7) Affordable and clean energy (8) Decent work and economic growth (9) Industry, innovation and infrastructure, (10) Reducing inequality (11) Sustainable cities and communities (12) Responsible consumption and production (13) Climate action, (14) Life below water (15) Life on land (16) Peace, justice and strong institutions (17) Partnerships for the Goals” (<https://www.undp.org/sustainable-development-goals>)

NITI AAYOG & SUSTAINABLE DEVELOPMENT

India is now perceived as a developed country. It is competing with developed countries of world in the sectors of economy, trade, and democratic traditions. For this purpose, there is increasing dependence for new projects that are launched and a huge number of natural resources are used, which requires caring for needs of future generation. Indiscriminate use of natural resources will bring danger for future generation. In this context, the role of NITI Aayog appears to be most vibrant and premier policy making institution to handle the alarming situation. For achieving, “a shared of vision of national development like sectors, priorities, and strategies with active involvement of states in the light of national importance, the government of India has replaced planning commission by NITI AAYOG (National Institution for Transforming India), particularly which came into existence on January 1, 2015. It is a policy making and a decision-making bank of the Government of India. And it is basically a policy think tank of Government of India and 65 years of planning commission was replaced by state government” (Khan, 2018; 73). It is also established with an “aim to promote healthy competition among the states in development

way” (*ibid*). Generally, NITI AAYOG is a Hindi word, which means “policy” and AAYOG, “a commission or an institution”. It also works as an executive body of government of India “to achieve 17 sustainable development goals and to enhance co-operative federalism by fostering the state govt of India, in the policy making process” (*ibid*). “NITI AAYOG may function in close cooperation and coordination with the Ministers of the central and state governments. The Prime Minister is the ex-officio Chairman. Its permanent executive members of the governing council are all the state Chief Ministers, the chief ministers of Delhi and Pondicherry, the Lieutenant Governor of Andaman and Nicobar and vice chairman nominated by the Prime Minister. Its members include a chief executive officer, four official members and two part time members” (Karthik & Sudhakara, 2018; p.69). NITI AAYOG has two important hubs, “Team India Hub and Knowledge & Innovation Hub”.

The main motive of “Team India Hub is the engagement of states with central government and the knowledge and innovation hub to build NITI’s think tank capabilities”.

Historical Background of NITI AAYOG:

“In 1947, the economic and social condition of India demanded for establishing potent and participative institutions as instrument of changes. For this situation, a way of Planning Commission was established in 1950. It focuses on heavy industrializing, eradicating poverty and introduction of five-year plan. The successful start to planning commission, at least to first ten years and it is because of leadership of Pandit Jawaharlal Nehru in national economic and financial stability was unparalleled, proved promising to development of India” (Mehrotra, 2015). “Now we have entered a more turbulent and dangerous period of history. Financial crisis, climate change, geopolitical shifts, technological innovations, these factors have made statecraft more difficult. In this new era, political leaders have been forced regularly to make most important decision under the conditions of stress and uncertainty. For more than 60 years, planning commission was most important institution within central govt of India. Prime Minister Narendra Modi announced the end of Planning commission in August 2014 and established a new body, NITI AAYOG (National Institution for Transforming India) in January, 2015 (Roberts; 2020).

NITI AAYOG:

Every country has some institution to achieve 17 goals of sustainable development of United Nations. India also has a body to achieve SDGs goals that is called NITI Aayog (National Institution on Transforming India). The role and importance of NITI Aayog is gradually increasing. It is also giving more importance on eradicating of poverty, zero hunger and intellectual way of using non-renewable resources. Generally, NITI Aayog gives more importance on “adoption and monitoring of the SDGs in the country and promotes competitive and comparative federalism among States and UTs. NITI AAYOG is not only just to periodically collect data on SDGs but also proactively realise the goals and targets. And also, Ministry of Statistics and Programme Implementation (MoSPI) has already undertaken a parallel to evolve indicators reflecting the SDG goals and targets. NITI Aayog has also prepared a draft mapping of goals and targets as an initial step in consultation with MoSPI. Further, the centrally sponsored schemes, including the ‘core’ and ‘optional’ schemes implemented by the Central government have been mapped. However, Ministries and States are implementing central sector schemes and state schemes respectively aligned with one or more SDGs” (NITI Aayog’s role, <https://www.niti.gov.in/niti-aayogs-role>).

Functions (<https://www.niti.gov.in/content/functions>):

- (1) To evolve a shared vision of national development priorities sectors and strategies with the active involvement of States in the light of national objectives
- (2) To foster cooperative federalism through structured support initiatives and mechanisms with the States on a continuous basis, recognizing that strong States make a strong nation
- (3) To develop mechanisms to formulate credible plans at the village level and aggregate these progressively at higher level government
- (4) To ensure, on areas that are specifically referred to it, that the interests of national security are incorporated in economics strategy and policy
- (5) To pay special attention to the sections of our society that may be at risk of not benefiting adequately from economic progress
- (6) To design strategic and long-term policy and programme frameworks and initiatives, and monitor their progress and their efficacy. The lessons learnt through monitoring and feedback will be used for making innovative improvements, including necessary mid-course corrections
- (7) To provide advice and encourage partnerships between key stakeholders and national and international like-minded Think tanks, as well as educational and policy research institutions.
- (8) To create a knowledge, innovation and entrepreneurial support system through a collaborative community of national and international experts, practitioners and other partners.
- (9) To offer a platform for resolution of inter-sectoral and

inter departmental issues in order to accelerate the implementation of the development agenda.

(10) To offer a platform for resolution of inter-sectoral and inter departmental issues in order to accelerate the implementation of the development agenda.

(11) To maintain a state-of-the-art Resources Centre, be a repository of research on good governance and best practices in sustainable and equitable development as well as help their dissemination to stake – holders

Solar Energy

Energy is one of the vital factor for the economic and social development of any country and without it the social platform will be collapsed. Energy is required for civilization and further development. This development will then be a byproduct of energy utilization. In 21st century, energy crisis is a major problem and it is increasing gradually, and is experienced both in developed and as well as developing countries. The scenario of global energy is changing rapidly due to rising energy prices, diminishing in the field of energy availability and security, and growing of environmental concern. If we look into the history, it is seen to have an expansion increase in the rate of environmental degradation. The rate of population growth and consequent demand for water, food and energy in turn has affected the same population that has doubled from 3.2 billion since 1962 to 7.2 billion in 2015. This increase in demand may be expected to further rise to 35 percent by 2030. The growing demand on the one side and the increasing dependence on fossil fuels on the other hand to meet the energy demands have severe environmental implications. Non-renewable energy resources such as coal, gas, oil, uranium, etc., are being used and its continual uses brings the threat of its depletion. The exploitation of these non-renewable resources has put pressure on the energy sector. Hence, we need to have alternative sources of energy for continual mankind dependence.

Generally we know that the word renewable energy comes from natural sources; such as wind, solar, hydro and biomass and has the potential to meet the growing energy recruitments. Traditionally, renewable energy sources “have been used for heating, cooking, steam production and also for powering mills to grind grains”. These sources are now being exploited considerably. There are several benefits arising because of the using renewable energy apart from being environmentally sustainable (Venkatesan, 2017).

We are giving more importance to alternative or renewable energy sources for world’s future development. Geothermal, hydro-power, wind, tide and solar energy are the alternative non conventional energies. A large scale of electricity is produced by hydro-electricity plants and it adds 20% of total energy supply (Aijo, 2018). Wind energy is also considered competitive,

alternative and ecofriendly electrical energy production in coastal and windy regions. It is seen that climate change also effects wind based electrical energy. Back up energy such as hydro electric and gas are also necessary for successful operation of wind-based systems which limits its possibility as a good reliable energy source. The best alternative energy is solar energy, which is renewable, ever available and eco-friendly. Through solar energy, electric power can be generated, because it has the power to meet the rising energy demands, since the number of solar radiations shining on the earth is ~ 1.76 multiply 10 terawatts (TW) (Singh, 2020). It is predicted that fossil fuels will be depleted in the future. Therefore, researchers across the world are now focusing on renewable energy sources for producing electric power.

Importance of Solar Energy

Energy from the sun in the form of radiation is abundant and clean providing opportunities to generate energy from this renewable energy. The solar energy falling on the earth can be harvested in two different forms such as: (1) electrical energy from solar panels, and (2) thermal energy from concentrated solar power (Singh, 2020; 2). The main work of solar panel is to convert the sun-light into electricity. In thermal solar plants, the light is concentrated from large area to small areas. Although, the energy produced by thermal plants is higher than the solar panels but it is more dangerous for environment. So that the alternative energy is more important in present day. India is a major energy producer and a consumer. “India ranks at the fifth position among the countries of the world when it comes to the size of its energy economy, measured by combined revenue of energy companies. The country also ranks third on renewable energy investment and future plans. India electricity production from coal is about 75% and it is predicated that coal reserves in the country will last up to 2050. In India more than 65.07% of people live on village area and till now more than a half of people has not been electrified and remain without electricity. Therefore, to face this type of increasing demand, solar energy is the best alternative to cater the energy needs and bridge the demand-supply gap” (*The Economics Times*, May 06, 2020).

Solar energy is used in different way not only to meet the varied needs of the people, but also to as the best alternative for conservation of non-renewable resources for the future use. It is seen that in both, developed and developing countries of the world are now focusing on using renewable energy, which is cost-effective alternative technology to provide electricity power to rural and remote areas. After seventy-five years of independence in India, still there are village where electrification programs have not reached to people. Further, people of remote area do not get 24x7 hours electric supply. Therefore, solar energy is the best alternative to produce energy. Successful adaptation of new technology with effective internalization of renewable energies can be achieved when the different contributing factors, such as policy, institutional mechanism, technology build-up, financing schemes and sustainable local industry infrastructure are properly established. Solar energy is such a type of alternative energy that produces energy without harming the environment. The advantages of using solar energy are:

The following suggestive steps could sweep away all the obstacles and make the path clean.

(1) Mass awareness programme must be undertaken by the governments of developing countries suggests to make the people aware of use and benefit of solar energy. Otherwise, people cannot come forward to use it with a complete heart.

(2) Government of developing countries should extend its helping hands in providing subsidy facilities on installation and maintenance solar panels.

(3) Farmers of village area must be made target group and training must be imparted to them from time to time. It must be ensured that all kinds of irrigation work must be done through use of solar energy.

(4) Special monitoring agency must be established at local level, state level, national level and international level in order to sphere head the solar energy programme.

(5) A concrete and complete action plan for the accomplishment of developmental goal as regard to solar energy must be prepared carefully and implemented it in later and sprit. Target must be fixed to provide necessary help and assistance to every household. (6) Selected NGO are to be empowered and put them in between government and people as a coordinator.

(7) All the government of different countries should come to conclude a common agreement that they would not provide environmental clearness certificate to any factories and industries, unless they have installed solar energy project.

(8) Public private partnership should be accelerated in popularizing solar energy project. (9) Every government of world should introduce a special course on use of solar energy in different educational institution and students are asked have the courses compulsory as they are the future citizen of India.

(10) An International Think-Tank group should be constructed to throw sufficient light to the policy makers and state man of different countries of the world.

(11) Mass educative awareness programme should also be undertaken for sustainable consumption of energy.

(12) Every government should open a special department of use of solar energy to meet the developmental goals.

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