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Solar Energy: Potential and Policies of India

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Abstract - *Solar energy is acting an essential part in rewarding the electrical energy as there is small drop in this energy due to more demand and decline tendencies of conventional source of powers collapse of fuels like coal, petroleum, natural gases and constant of environmental and climatic deviations to manage active this photovoltaic connection is being done in an electrical structure to recompense and develop the energy. A photovoltaic installation in an electrical structure is made from the gathering of numerous photovoltaic units that uses solar energy to produce the electricity in a low-priced way from sun energy. Till now the usage and scope of solar energy is limited and has not extended up to crowds also the effectiveness of the system is also short due to which the output is not sufficient as associated to input as in some installed case of solar panel it has been experimental that effectiveness is not more that 27%. To make it multipurpose and additional valuable for the masses innovative trends and innovations resolve will help. These take deliberated in this paper. A numerous of technical difficulties affecting renewable energy investigation are also decorated, beside with beneficial interfaces among regulation policy frameworks. In order to help open different ways with affection to solar energy study and carry out, a future roadmap for the field of solar research is discussed.*

Key Words: Solar panels, Efficiency, renewable energy resources, Solar energy policies, Policy frameworks

1. Introduction

Solar energy is the greatest natural source of energy on this planet. This has been a change from the expenditure of conservative energy sources to the renewable energy sources terminated the way of the period. Meanwhile the solar energy is the secondary source of energy, we requirement two mechanisms to utilize it properly, i.e. a collector and storage expedient. Solar panels performance as the collector for solar energy. Production of panels would be contingent upon the radioactivity intensity, size of the panels, cleanliness of the panels, etc.

The generation of hydro power plant also differs due to discrepancy in inflow of water from catchment zone. When the volume of hydro power plant drops the power deficiency get up. The solar power plant might be installed in such a way that these may work in unison for illustration when draught is more dropping of sun is more. In this mode lack of power will be waged by the energy governed by the solar power plant. Besides, this connection is to be done in such a way that solar panel will concealment the streams or reservoir plummeting the evaporation which ornamental the capacity of dam. On the other hand, the solar panel covers this area will produce electrical power which will the improve the power generation of the system. Furthermore, by using some innovative technologies this power generated may be combined with the power grid to improve the capacity of network.

Guidelines, venture, and provisions from several governmental and non-governmental groups for solar technologies have assisted build up a compact groundwork for the manipulation of this renewable energy system. While inducements and reimbursements can be effective motivations for the growth of these markets, there are also increasing efforts to reduce the fiscal load of these policy incentives. Though, solar power supports have previously confronted sharp wounds in many nations, which may delay development within the productiveness. To return this possible deterioration, policies are fluctuating to support the organization of solar power systems for extensive power generation. Also, better subventions should be providing for domiciliary solar generators over utility-scale generators. In this article, we provide a worldwide scenario with regard to solar energy technologies in terms of their prospective, present capacity, prospects, limitations, and policies. This will help us enlarge our thoughtful on how much more we can computation on solar energy to encounter the future energy requirement.

2. Solar Energy Technologies

The entire solar energy idea is viewed as the collecting and operation of light and/or heat energy produced by the Sun and technologies (passive and active) complex in achieving such aims. A classification of current solar energy technologies is shown in Fig.1, by definition, submissive technology involves the gathering of solar energy without converting thermal or light energy into any other form (for power generation, for occurrence). Solar energy gathering, storage, and dissemination in the form of high temperature for the heating of households (especially during the winter season) exemplifies a form of passive solar expertise. On the other side, active solar system collects solar radiation and usages mechanical and electrical tools (e.g., pumps or fans) for the transformation of solar energy to heat and electric

power. The most renowned solicitation of this system is the solar water heater system.

In overall, active solar energy technology can be gathered into two groups: (i) photovoltaic technology and

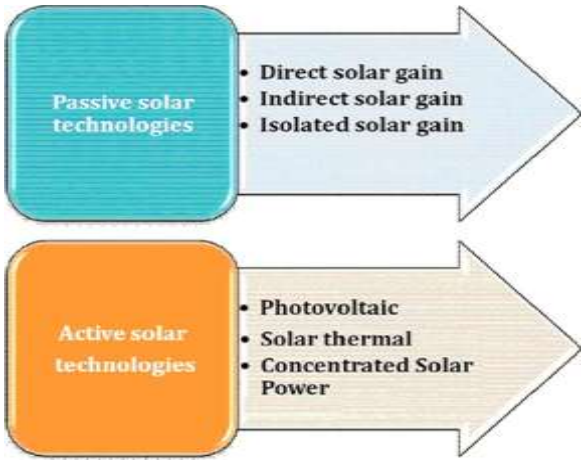

Fig.1: Classification of the present solar energy technologies.

(ii) solar thermal technology. In current years, photovoltaic technology concerning the custom of semiconductors to exchange sunlight straight into electrical energy takes convert an extremely necessary option. The concentrated research efforts of energy experts with affection to solar possibilities have helped to harvest an improved efficiency of photovoltaic technology; in circumstance of hybrid perovskite solar cells, a capable achievement (e.g., an efficiency escalation of ca. 18%) has been testified. Presently, photovoltaic technology including wafer-based cells (traditional crystalline silicon or gallium arsenide), profitable thin-film cells (cadmium telluride, amorphous silicon, copper indium gallium dieseline), and new thin-film technologies (perovskites, organic materials, quantum dots) are developing with the arrival of concentrated R & D efforts.

In solar thermal technology, solar energy is attached into thermal energy for local and/or commercial claims such as drying, heating, cooling, cooking, etc. However, on the industrial need, concentrated solar thermal (CST) methods are being used to fulfill such heating necessities while concentrated solar power (CSP) equipment are being active to generate electricity. The last includes the use of large magnification mirrors to concentrate solar energy preceding to changing it into heat energy to power a steam turbine. Four types of CSP methods are currently available on the market: (i) parabolic troughs (these deliberate sunlight on a receiver tube having a working liquid); (ii) Fresnel mirrors (use multiple flat mirrors to distillate solar sunlight on a receiver tube); (iii) power towers (an array of thousands of sun-tracking reflecting mirrors located in a field to concentrate solar radiation to a solitary point), and (iv) solar dish collectors (concentrate power through concentrating ST energy onto a single point positioned above a reflector dish).

2.1. Current Global Status for Solar Energy

The accessibility of greatest renewable energy sources (i.e., wind, solar, tidal wave, hydro, etc.) inclines to vary widely during the course of a day, season, year, even from one environmental position to alternative. A difference of the global power capacities among different renewable energy

Sr.No.	Power Generation System	2013	2014	2015
1	Total Renewable power	1578	1712	1849
2	Hydropower	1018	1055	1064
3	Bio-power	88	93	106
4	Geothermal	12.1	12.8	13.2
5	Solar PV	138	177	227
6	Concentrating solar thermal	3.4	4.4	4.8

Table -1: Comparison of the global power capacity between different renewable energy sectors (Unit: GW)

areas are scheduled in Table 1. In many countries, the use of renewable energy has been followed competitively beside with conventional energy sources, thus creation a significant influence to the national generation of power. For illustration, solar PV subsidizes a probable 7.9%, 7.6%, and 7.0% of the electricity demand in Italy, Greece, and Germany, respectively. Solar PV capabilities have developed at remarkable proportions, from ca. 3.7 in 2004–225 GW in 2015. In 2015, with a total of $161 by speculation and supplementary 59 GW (a 34% rises over 2014's total) on solar energy controlled to cumulative installations of whole solar capacity 256 GW worldwide at the end of the year. But, with nearly 100 GW of installed capacity, Europe is static the most solarized area. In 2015, the solar capacity for Europe improved by 8 GW, although the United Kingdom, Germany, and France accomplished a growth of only 5.3 GW (75%). Though, China has outrivaled with an entire installed solar power capacity of ca. 43 GW as of December 2015, thus substituting long-time table topper Germany in the global rankings. Additionally, China also has tactics to surge its solar power capacity to 150 GW by 2020.

Through such improvements, India is presently scheduling to increase its solar power capacity to an overwhelming 100,000 MW by 2022. Likewise, on the European obverse, France strategies to build a 1,000kilometer-long solar roadway, by each kilometer capable of providing sufficient clean energy to power 5000 households.

2.2. Regulation and Policy Framework

In 2015, the worldwide speculation with affection to solar energy knowledgeable an expansion, particularly in China, the USA, Africa, Latin America, the Middle East, and India. While China is predictable to maintain its leading position,

the USA is rolled to revelation strong growth in 2016, due to the expectation of the Federal Investment Tax Credit (ITC). It is similarly supposed that the USA will substitute Japan as the third major solar market, beyond the much-anticipated 10 GW mark in 2016. Though, in Europe, slow development with affection to solar power funds was detected in 2015, worldwide company funding within the solar sector (counting scheme capital/private equity, liability financing, and public market financing) was USD 25.3 billion in 2015, associated to USD 26.5 billion in 2014 In Germany, the 2014 renewable energy act established fixed principles to the procurement and compensation of PV electricity as well as charges on self-consumption. Allowing to new policies by the Spanish government PV systems through capabilities of 10–100 kW must add additional electricity to the grid without recompense, even as systems with abilities over 100 kW must be registered in command to sell electricity on the market. It is assumed that promoting efforts made in an aspiration to protected their unpackaged funds by the fossil fuel energy industry are making the governments of some European countries falter to maintain the sustenance for the solar power sector.

3. Limitations and benefits of solar energy technologies

Solar energy is a continuous power source that could offer energy safety and energy impartiality to all. Such a tendency is enormously imperative not only for persons but also for the socio-economic wealth of companies, societies, states, and nations. However, solar power is nowadays being accepted as a natural and considerable part of electricity generation in various developed and emerging countries to fulfill energy requirements. However, there are a various of limitations as well as benefits related with its use.

3.1. Limitations of solar energy technologies

High early installation charge is one of the greatest significant flaws of the solar energy system; for example, the typical price per watt for solar energy was $3.70 in the USA in early 2016. Founded on a middling solar energy system of 5 kW per domestic, the system would charge $13,000 when the Federal solar tax credit is put into deliberation (thereby dropping costs by 30%). Though, extensive payback times and small revenue streams also reduce the value of credits for such systems. Also, the efficiencies of supreme domestic solar panels are about 10–20% which is additional deficiency of solar technology. Though, more efficient solar panels are similarly available at advanced charges. The routine boundaries of other modules such as batteries, inverters, etc. are former zones with significant possibility for development. Short battery periods and the harmless dumping of finished batteries are another distress with favor to solar energy systems. Moreover, batteries are often large and heavy, thus demanding great storage space. Also, as solar panels are made from infrequent or precious metals such as silver, tellurium, or indium, insufficient amenities exist with which to reprocess spent panels. Factors related with the preservation of organizations such as a deficiency of expert manpower to encounter rising difficulties for fixing, maintenance, inspection, repair, and assessment of solar power systems are additional restraint as well. Besides, a lack of elementary technical knowledge on the operator's behalf with respect to solar power systems can consequence in uneven usage, over-charging the battery, polarity reversal, by temporary the charge controller, etc. which can all mainly damage the system. Also, the credibility of cracks inside the PV module, water intrusion, exposure to dust, and algal growth can importantly inferior the performance of the system.

3.2. Benefits of Solar energy technologies

It is well recognized that nobody can associate with the energy impending of the sun. As solar power is tentatively profuse sufficient, it is additional than skilled of fulfilling the world's electricity strains. Since solar energy is not only sustainable but likewise renewable, it is not essential to reflect the view that solar energy may finally be exhausted. Worldwide heating is considered by catastrophic possible, therefore heralding its hurtful influence on the climate, environment (including animals and plants), and human health. Power plants (especially coal-fired) are a significant foundation of greenhouse gases (GHG), which are liable for about 25% of all anthropogenic emissions. Hence, GHG emissions associated with the generation of solar power (including manufacturing, installation, operation, and maintenance) are minimal.

The efficiency of solar power skills has increased importantly in modern years and has been attended by a gradually stable decline in prices, which are predictable to descent even more. Besides, solar panels can be effortlessly fixed on roof tops and straddling onto building walls, deserving their setting up flexibility. Also, solar power systems are fewer disposed to significant disappointment because they are dispersed and composed of numerous individual solar arrays. Therefore, if any section of arrays were found to be faulty, the rest could continue to operate. However, additional solar modules could also be added over time to improve the energy generation capacity. These concepts disclose enormous advantages in the roughness and flexibility of solar power systems over all other energy sources that have previously remained recognized.

4. Solar Energy Policies of India

The Government of India has increased its focus on developing alternative resources of energies especially Solar Energy under the policies related to energy development. The solar energy is available in abundance and almost free of cost as it is available from nature. Due to rapid economic expansion India is one of the most growing markets and

expected to be second largest energy contributor in energy market in the world by 2035. Due to limited domestic fossil fuels reserve, the India has strong planning to expand the renewable energy sources for power sector.

1. To supply the electricity to all the areas included the rural areas as mandated in section 6 of electricity act. Both the Central and State Government will jointly have installed to achieve this objective at the earliest. Rural Electrification will be done for securing electricity access to the entire household in rural sector. Most of this requirement will be fulfilled by use of renewable energy sources.
2. Reliable rural electrification would be done either through conventional or non-conventional methods of electricity whichever is more suitable and economical. Non-conventional sources of energy especially Solar can be utilized even where Grid connectivity exists.
3. Particular attention is to be given to Dalit basis, Tribal areas and other weaker sections of the society the other newer resources.
4. Rural Electricity Corporation of India (REC) is the nodal agency at central govt. Level to implement these programs of electrification in rural areas. The REC will install all the goals set up by the National Common Minimum Programed ensuring timely implementation.
5. Responsibility of operation and maintenance & cost recovery could be discharged through appropriate arrangement with Panchayats, Local Authorities, BDO, and NGO etc.
6. This Great task of Rural Electrification requires cooperative efforts of all agencies like Govt. Of India, State Government and community education cell in rural areas.
7. The Electricity act 2003 has provision of restructuring the electricity industry which unbundled the vertically integrated electricity supply in each state. Now generation, transmission and distribution companies have been formed by the Regulatory Commission of state electricity board. Regulatory Commission will also specify the minimum percentage of electricity that each distribution utility must get from renewable energy sources.

5. CONCLUSIONS

Due to deterioration a feasibility of natural's fuels and watching environmental variations reasons due to conventional method of group, the use of solar energy is attractive popular and earnestness of the day. This will generate vigorous environment for the human beings which are distress from the various threats due to contamination from the installed insides. Likewise, the power generation due to hydro power plant is not also even steady due to irregular movement of water from the catchment zone. So it is determined that solar power plant might be mounted in such a way so these may work in accord with hydro and additional approaches of generation to improve the clean and green energy.

Notwithstanding a rapid weakening in solar technology costs in current years, the global costs to generate solar power quiet endure high. Inducements and refunds which are critical for the growth of the solar energy market are creation it ostensible that advanced methods are still essential to reduction the fiscal problem of various policy incentives. Conversely, the solar industry must focus additional on the excellence and growth of its technology. Additionally, researchers should also focus on civilizing the cheapness of solar power beside both conventional and other renewable energy sources.

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