A Review on Solar Energy Potential And Future world

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Abstract

Development of solar power technologies is considered to be key solutions toward fulfilling a worldwide increasing demand for energy. Because of population explosion and technological advancements It is therefore important to go for reliable, cost effective and endless renewable energy source for energy demand arising in future. Solar energy, among other renewable sources of energy, is a promising and freely available energy source for managing long term issues in energy crisis. Solar industry is developing constantly all over the world because of the high demand for energy while major energy source. fossil fuel, is exhaustible and other sources are costly. It has become a weapon to develop economic status of developing countries and to sustain the lives of many underprivileged people as it is now cost effective after a long aggressive researches done to expedite its development. The solar industry would definitely be a best option for future energy demand since it is superior in terms of availability, compared to other renewable energy sources with respect to cost effectiveness, accessibility, capacity and efficiency. In this review, we will discuss the Energy Demand, global potential of solar energy technologies, their Drawback and advantages, and their future scope

Keywords 1, Solar energy Technologies 2, Renewable energy 3,Future world

1. Introduction

The sun is a major source of inexhaustible free energy (i.e. solar energy) for the planet Earth. Currently, new technologies are being employed to generate electricity from harvested solar energy. These approaches have already been proven and are widely practiced throughout the world as renewable alternatives to conventional non hydro technologies. It is important to note that the population has increased by 2 billion just in one generation and major contribution has been given by developing countries. Preventing an energy crises in one of the most casual issues of the 21st century. Energy demand is therefore increasing fast as to meet the requirements of growing population in the world. Different countries in the world have their own strategies, plans, policies and control measures to establish themselves in the world. As of the population growth and development initiatives, resources available in the world are getting depleted[1].Considering energy sources is therefore very important as they play a key role in satisfying the need of the world and living population. Accessible energy is not sufficient to people, because of several reasons such as developmental profile of a country, economic status of people and nature of technological advancements of the country[2]. Developing countries are now put into pressure to search for the sources of energy as their population growth is high and they are seeking for economic development to become economically viable [3].When economic development takes place, energy demand also increases since it is proportional to economic growth. Different techniques are proposed for increasing energy generation capacity ,many peoples are still living in non-electrified areas of developing countries .So the nonrenewable energy sources would not definitely meet energy demand since they are exhaustible and limited source of energy [4].

All the countries should be in a position to use the Different resources to recover energy, for setting up an environment conducive for human survival for long time. However, it is not Implemented in actual practice since many countries relay on exhaustible energy sources than renewable energy sources. In future, continuous use of non-renewable energy sources may lead to climate change, which may in turn end up with heavy natural disasters damaging

ecosystems of the planet[5].It is therefore vital to go for renewable energy sources which play a Important Role for the betterment of the future world[6].Considering renewable energy sources such as solar energy, wind energy, hydropower and geo-thermal, is play a important role in this area as they are eco- friendly [7].Among all the sources, solar energy could be a best option for the future world because of so many reasons: First, solar energy is the most abundant energy source of renewable energy and sun emits it at the rate of 3.8_1023 kW, out of which approximately 1.8_1014 kW is intercepted by the earth [8].Second, it is a promising source of energy in the world because it is inexhaustible[9].According to different study survey it is found that global energy demand can be fulfill by use of solar energy as it is unlimited[10]. Asian countries have highest potential to receive solar radiation compared to other countries as sunshine duration in such countries is high in an year. It is important to note that much of solar radiation is not used and basically wasted [11].

Another major prospect with regard to solar research is associated with the current drive toward reducing global carbon emissions, which has been a major global environmental, social, and economic issue in recent years [12]. Therefore, the adoption of solar technologies would significantly mitigate and alleviate issues associated with energy security, climate change, unemployment, etc. It is also anticipated that its use will play an important role within the transportation sector in the future as it does not require any fuel transportation. In this article, we provide a global scenario with regard to solar energy technologies in terms of their potential, present capacity, prospects, limitations, and policies. This will help us expand our understanding on how much further we can count on solar energy to meet the future energy demand.

2.Comparisons Of Potential Of Solar Energy Technologies

solar energy exhibits the highest global potential since geothermal sources are limited to a few locations and the supply of biomass is not ubiquitous in nature[13,14]. A number of factors (e.g.,
latitude, diurnal variation, climate, and geographic variation) are largely responsible for determining the intensity of the solar influx that passes through Earth's atmosphere [15]. The average amount of solar energy received at Earth's atmosphere is around 342 W m−2, of which ca. 30% is scattered or reflected back to space, leaving ca. 70%(239 W m−2) available for harvesting and capture [16]. The annual effective solar irradiance varies from 60 to 250 W m−2 worldwide [17].

In comparison, the sunniest places of the planet are found on the continent of Africa. As theoretically estimated, the potential concentrated solar power (CSP) and PV energy in Africa is around 470 and 660 petawatt hours (PWh), respectively [18]. However, in the regions other than Africa (like south-western United States, Central and South America, North and Southern Africa, Middle East, the desert plains of India, Pakistan, Australia, etc.), such potential is only limited to generate125 gigawatt hours (GWh) from a 1 km2 land area [19].

Australia has the highest solar radiation per square meter of all continents and is estimated to have the best solar energy resource in the world. On the Australian continent, a relatively high daily solar irradiance of 4–6 kWhm−2 has been reported [20]. Comparable levels of solar radiation were also observed in the desert areas of northern and southern Africa, the southwestern United States, adjacent areas of Mexico, and regions of the Pacific coast off South America [19].

The whole solar energy concept is regarded as the harvesting and utilization of light and heat energy generated by the Sun and technologies (passive and active) involved in achieving such goals [21]. A classification of present solar energy technologies is shown in Fig. 1. By definition, passive technology involves the accumulation of solar energy without transforming thermal or light energy into any other form(for power generation, for instance) [22]. Solar energy collection, storage, and distribution in the form of heat for the heating of homes(especially during the winter season) exemplifies a form of passive solar technology. On the other hand, active solar system collects solar radiation and uses mechanical and electrical equipment (e.g., pumps or fans) for the conversion of solar energy to heat and electric power. The most well known application of this system is the solar water heater system.

Fig.1 Classification of the present solar energy technologies.

Active solar energy technology can be further grouped into two categories: (i) photovoltaic technology and (ii) solar thermal technology [23]. In recent years, photovoltaic technology involving the use of semiconductors to convert sunlight directly into electrical energy has become a highly desirable option [24].Currently, photovoltaic technology involving wafer-based cells (traditional crystalline silicon or gallium arsenide), commercial thin-film cells (cadmiumtelluride, amorphous silicon, copper indium gallium diselenide),and new thin-film technologies (perovskites, organic materials, quantum dots) are progressing with the advent of intense R & D efforts[25].

In solar thermal technology, solar energy is harnessed into thermal energy for domestic and/or commercial applications such as drying ,heating, cooling, cooking, etc. [26,27]. However, on the industrial scale, concentrated solar thermal (CST) technologies are being used to fulfill such heating requirements while concentrated solar power (CSP)technologies are being employed to generate electricity. The latter involves the use of high-magnification mirrors to concentrate solar energy prior to converting it into heat energy to power a steam turbine [28].Four types of CSP technologies are currently available on the open market: (i) parabolic troughs (these concentrate sunlight onto a receiver tube containing a working liquid); (ii) Fresnel mirrors (use multiple flat mirrors to concentrate solar sunlight onto a receiver tube); (iii) power towers (an array of thousands of sun-tracking reflecting mirrors positioned in a field to concentrate solar radiation to a single point), and(iv) solar dish collectors (concentrate power by focusing ST energy on to a single point situated above a reflector dish) [29].

2.1. Present Global Status For Solar Energy

In many countries, the use of renewable energy has been pursued competitively along with conventional energy sources, thereby making a significant contribution to the national generation of power [30]. For example, solar PV contributes an estimated 7.9%, 7.6%, and 7.0% of the electricity demand in Italy, Greece, and Germany, respectively [31]. Solar PV capacities have grown at phenomenal rates, from ca. 3.7 in 2004–225 GW in 2015 [32]. However, with nearly 100 GW of installed capacity, Europe is still the most solarized continent. In 2015, the solar capacity for Europe increased by 8 GW, while the United Kingdom, Germany, and France achieved an increase of only 5.3 GW (75%) [34]. However, China has excelled with a total installed solar power capacity of ca.43 GW as of December 2015, thereby replacing long-time table topper Germany in the global rankings [33]. Moreover, China also has plans to increase its solar power capacity to 150 GW by 2020.

According to the American Solar Energy Industries Association, the total solar PV capacity of the USA could reach 45 GW by 2017 [35]. In Australia, solar power has become the foremost source of new power, producing 913 MW against 774 MW derived from wind power in 2015 [36]. This was applauded as a huge drive towards replacing conventional coal-based power generation and achieving a greener earth.

In India, the installed solar power grid reached a capacity of 3743(March 2015), 6762 (March 2016), and 8062 MW (July 2016).With such developments, India is currently planning to increase its solar power capacity to a staggering 100,000 MW by 2022 [37]. Similarly on the European front, France plans to construct a 1,000-kilometer-longsolar roadway, with each kilometer capable of providing enough clean energy to power 5000 homes [38].

3. Drawback And Advantages Of Solar Energy Technologies

Solar energy is a constant power source that could provide energy security and energy independence to all. Such a propensity is hugely important not only for individuals but also for the socio-economic prosperity of companies, societies, states, and nations. Nevertheless, solar power is now being adopted as a natural and substantial part of electricity generation in many developed and developing countries to fulfill energy needs. However, there are a number of limitations as well as benefits associated with its use.

3.1 Drawback Of Solar Energy Technologies

High initial installation cost is one of the most significant flaws of the solar energy system; for example, the average price per watt for solar energy was $3.70 in the USA in early 2016 [39]. Based on an average solar energy system of 5 kW per household, the system would cost $13,000 when the Federal solar tax credit is put into consideration(there by reducing costs by 30%). However, lengthy payback periods and small revenue streams also reduce the value of credits for such systems [32]. Furthermore, the efficiencies of most domestic solar panels are around 10–20% which is another shortcoming of solar technology[17].

However, more efficient (ca.>20%) solar panels are also available at higher prices. The performance limitations of other components such as batteries, inverters, etc. are other areas with considerable room for improvement. Short battery lifetimes and the safe disposal of spent batteries are another concern with regard to solar energy systems. Moreover, batteries are often large and heavy, thereby requiring large storage space. Additionally, as solar panels are made from rare or precious metals such as silver, tellurium, or indium, insufficient facilities exist with which to recycle spent panels. Factors associated with the maintenance of systems such as a shortage of skilled manpower to meet growing demands for installation, maintenance ,inspection, repair, and evaluation of solar power systems are another constraint as well. Furthermore, a lack of basic technical knowhow on the user's behalf (especially in rural areas of the developing world) with regard to solar power systems can result in irregular usage, over charging the battery, polarity reversal, by-passing the charge controller, etc. which can all lead to system damage[40].

3.2 Advantages Of Solar Energy Technologies

It is well known that nothing can compare with the energy potential of the sun. As solar power is theoretically abundant enough, it is more than capable of fulfilling the world's electricity demands. Because solar energy is not only sustainable but also renewable, it is not necessary to consider the notion that solar energy may eventually be depleted [41].Global warming is characterized by cataclysmic potential, thus portending its harmful impact on the climate, environment (including animals and plants), and human health [42]. Power plants (especially coal-fired) are a significant source of greenhouse gases (GHG), which are responsible for approximately 25% of all anthropogenic emissions[43]. Hence, GHG emissions associated with the generation of solar power (including manufacturing, installation, operation, and maintenance)are minimal [44]. The range of CO2 emission per kilowatt-h generated from coal, natural gas, and solar are estimated as 0.64 1.63,0.27 0.91, and 0.03 0.09 kg (emission ratio of 18:9.5:1), respectively. As such, this comparison again confirms the superior environmental friendliness of solar power among others [45]. Hence, solar power has become one of the most feasible solutions to the current global warming crisis, which if left unabated, could be extremely expensive with its potential ramifications. Thus, mitigating global warming through the substitution of coal and gas-based power sources with solar power will eventually be environmentally, economically, and socially beneficial toward achieving sustainable development.

Solar energy is considered to be a non-polluting, reliable, and clean source of energy. Unlike other energy sources, its use is not accompanied by the release of harmful gases (e.g., oxides of C/N/S and/or volatile organic compounds (VOCs)) and particles (e.g., soot, carbon black, metals, and particulate matter (PM)). Such fossil fuel emissions from gas-fired power plants have been indicted with regard to causing neurological damage, heart attacks, breathing problems, cancer, etc.[46,47]. Machol [48] reported that the replacement of fossil fuels with renewable energy could minimize premature mortality rates, lost workdays, and reduce the overall costs for healthcare. A limited accessibility to water during droughts and heat waves has hindered the generation of electricity by limiting its generation from power plants. On the other hand, electricity generated from solar installations does not require water to operate; additionally, the existence of fuel by-products or the requirement for radioactive waste storage is nonexistent.

4. Future Scope In Solar Technology

Solar energy is one of the best options to meet future energy demand since it is superior in terms of availability, cost effectiveness, accessibility, capacity, and efficiency compared to other renewable energy sources [49,50]. For the first time, researchers have successfully measured in detail the flow of solar energy, in and between different parts of a photosynthetic organism [51]. The result is a first step in research that could ultimately contribute to the development of technologies that use solar energy far more efficiently than what is currently possible. Researchers from the Graphene Flagship showed that the life time of perovskite solar cells can significantly enhanced by using few-layer MoS2 flakes as an active buffer interface layer [52]. Furthermore, scientists in Hong Kong reported that they have successfully developed perovskite-silicon tandem solar cells with the world's highest power conversion efficiency of 25.5% [53]. It is worth mentioning here that the efficiency of perovskite solar cells was only 3.8% when first appeared in 2009 [54]. Hence, semi-transparent perovskite solar cell shave been created that demonstrate high-power conversion efficiency and transmit visible light while blocking infrared light, making themgreat candidates for solar windows [55]. It was demonstrated that the polymer poly (3,4-ethylenedioxythiophene) should have great potential for cost-effective and highly efficient perovskite solar cells as a hole transporting material [56].

5. Conclusions

Solar energy technologies have become well-established and popular technologies throughout the world. To achieve this, billions of US dollars have been invested and much more are expected to be invested in the near future to overcome the current limitations in the solar industry. Presently, a number of new large scale solar power (for example CSP) projects are coming online or are under development in both developed and developing countries. CSP has been found to be suitable for regions without frequent clouds or haze, although the system is more expensive than PV technology. PV technologies for the time being may continue to be the primary source of solar power generation .Moreover, the potential market for off-grid solar systems remains largely untapped given the limited evolution of supporting policies and institutions.

In this review, we investigated the global potential of solar energy technologies, their Drawback and advantages, and their future scope. Accordingly, we concluded that despite a few drawbacks solar energy technology is one of the most promising renewable energy sources to meet the future global energy demand.

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