

# A Brief Review of Solar Energy

Dr. SujitKumar, Dr. Ezhilarasan G

Department of Electrical and Electronics Engineering, Faculty of Engineering and Technology, Jain (Deemed-to-be University), Bengaluru, India

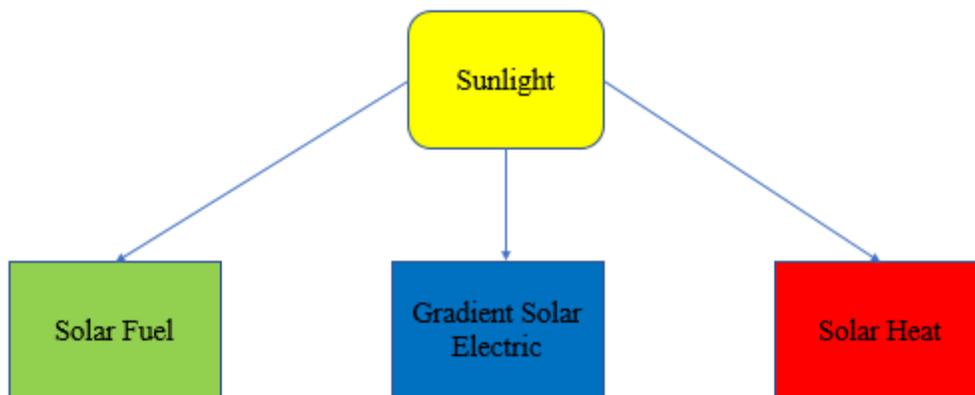
Email Id- k.sujith@jainuniversity.ac.in

**ABSTRACT:** Solar energy, radiations from Sun able of the producing heats, causing the chemical reaction, or producing electricity. The entire amounts of the solar-energy incidents on the Earth is massively in the surplus of world's anticipated and current energy requirement. This review paper focuses on the solar energy and provide all the information about the solar energy such as what is solar energy why it is important for use in different sector. This review also provided the various data of different countries and their production as well as use of solar energy for different years. A comparison between different types of renewable energy as well as conversion, advantages and disadvantages of solar energy also provided on this review paper. Solar energies storage is critical to success of the future energies systems since it allows excessive electricity generated during day to be used at future time when the sunlight is less abundant (for example in night). Solar energies plants will store surplus energy and sell it later for a number of uses, such as emergency preparedness, grid stabilization, and load leveling.

**KEYWORDS:** Energy, Electricity, Power, Renewable, Solar.

## INTRODUCTION

Solar energy is define as heat and radiant light from Sun i.e. harnessed by using range of the ever evolving technology like solar heating's, photovoltaic, molten salt solar thermals energy, solar architectures, and power plant photosynthesis [1]. In the 1.6 day, sun produces  $1.8 \times 10^{22}$  J of the energy. That energy is equivalent to the all of energy which is three trillions barrel of the entire oil supply on the Earth will provide. Humans consume  $4.6 \times 10^{20}$  J of gross yearly energy in a year. The sun provides this energy in 1 hour. As a result, the sun's energy is more than capable of meeting all of humanity's needs on its own. The sun's incredible amount of energy is matched by its versatility. The sun's energy will primarily be used in three ways, as seen in Figure 1.



**Figure 1: Three Way of the Adapting Solar-Energy into the another Form of Energy Creating Chemical Fuels by Artificial Photosynthesis, Producing Electricity Via Exciting Electron in Solar-Cell, and Intent Sunlight for Produces Heat.**

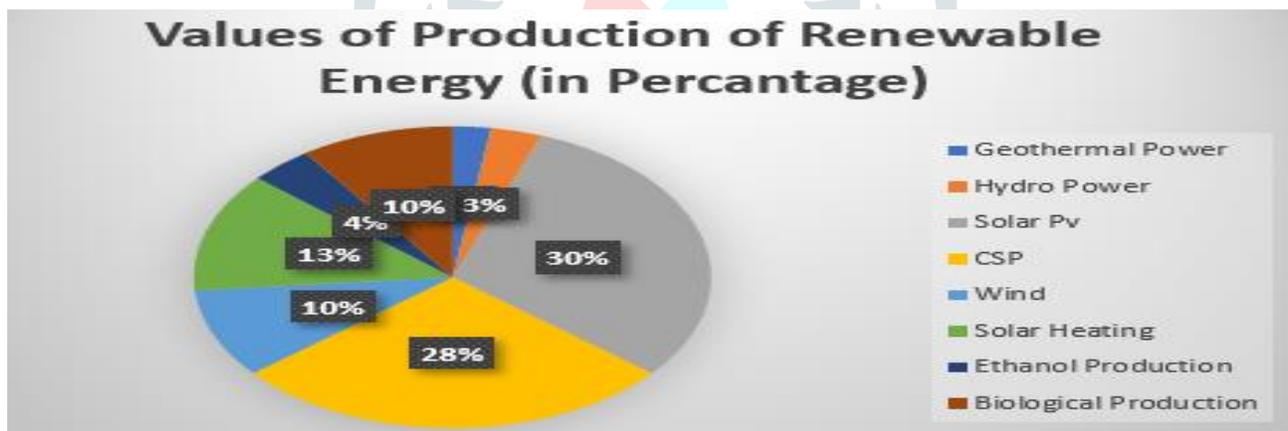
Heat, power, and solar fuels can all be made from solar energy. Solar oil, such as, can be transformed into the solar fuels spontaneously by the mechanism of photosynthesis. Photosynthesis is chemical mechanism in which plant stores solar energy as carbohydrates, which are a sort of food. Additionally, the electrons and protons produce during photosynthesis can be metabolized to create  $CH_4$  and  $H_2$ . Natural photosynthesis of biomass uses about 11.01 percent of the solar-energy, making it the most efficient usage of the solar energy. Just 100 TW of energy is transformed into the photosynthesis, which is insufficient for human consumption. Although energy

efficacy is insufficient, there are established methods for increasing efficiency of solar fuel generation. The Table 1 shows the annual growth rate of renewable energy in percentage (Geothermal Power, Hydro Power, Solar PV(Photovoltaic), CSP(Concentrating Solar Power), Wind, Solar Heating, Ethanol Production and Biological Production) capacity in 2013.

**Table 1: Yearly Growth Percentage of the Renewable-Energy Capacity in year 2013.**

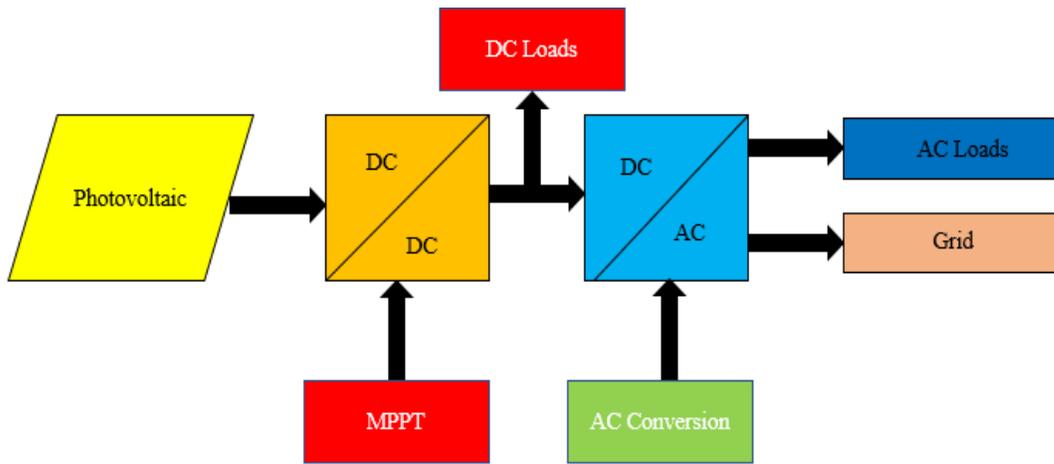
Types of Renewable Power	Values of Production of Renewable Energy (in Percentage)
Hydro Power	4
Geothermal Power	3
CSP(Concentrating Solar Power)	35
Solar PV	38
Solar Heating	16
Wind	12
Biological Production	12
Ethanol Production	5

Figure 2 shows the values of production of renewable energy(in percentage)in 2013 and by this it is clearly seen that the highest value of production is provided by solar photovoltaic which contribute 38 percentage of energy and minimum value of production is provided by hydro power which contribute 4 percentage of energy.



**Figure 2: Graphical Representation of Value of the Productions of the Renewable-Energy (In Percentage) in 2013.**

The simple Photovoltaic systems which comprise Photovoltaic modules, DC-DC (Direct Current-Direct Current) inverter, loads and converter is shown in the Figure 3. This is designs to provide maximum power transfer to load or loads in any circumstance. This structure have 2 power conversions stage so it's called 2 stage systems. DC-DC converters tracks MPP as well as regulates DC loads voltage. In case of Alternating current power demands or the grid connections, power produce by photovoltaic modules are convert into the Alternating current powers by the using DC or AC (Direct Current or Alternating Current) inverter. On other hands, both MPPT(Maximum Power Point Tracker) and AC or DC conversion can performed by the use only 1 AC or DC inverter which called single stages systems[2] .



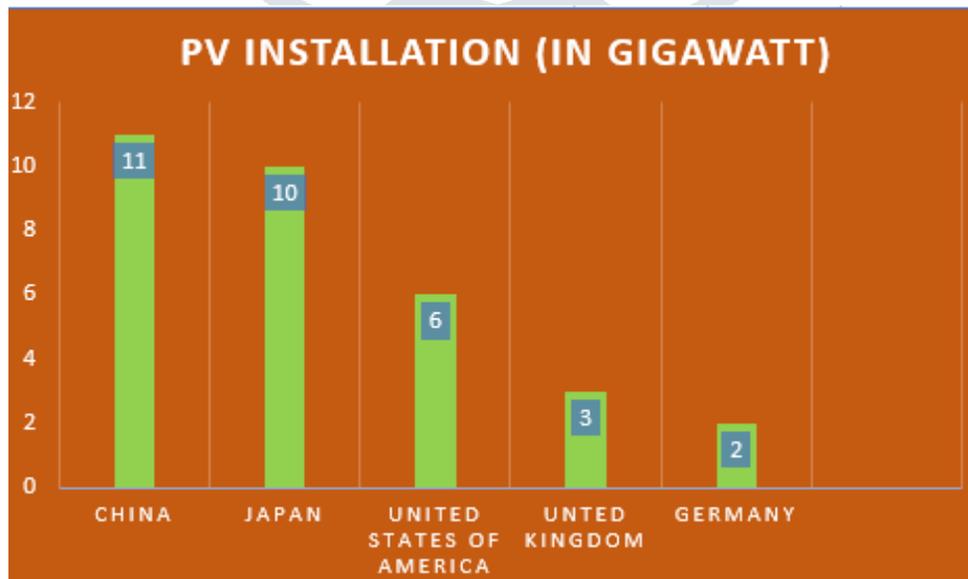
**Figure 3: Block-Diagram of the Solar-Energy Translation System.**

Table 2 shows the photovoltaic installations in the year 2014 for leading countries (China, Japan, United States of America, United Kingdom and Germany). These are the countries who use solar energy as renewable energy and they did the installations of photovoltaic for the production of various purposes such as electricity, vehicle etc.

**Table 2: Photovoltaic Installation in Year 2014 for the Top Countries.**

Countries	Photovoltaic installation (in Gigawatt)
China	11
Japan	10
United States of America	6
United Kingdom	3
Germany	2

Figure 4 shows the installations in the year 2014 for leading countries (China, Japan, United States of America, United Kingdom and Germany). It is clearly seen that China did more installation of photovoltaic which are 11 in Gigawatt and Germany did minimum installations of photovoltaic which is just 2 in Gigawatt.



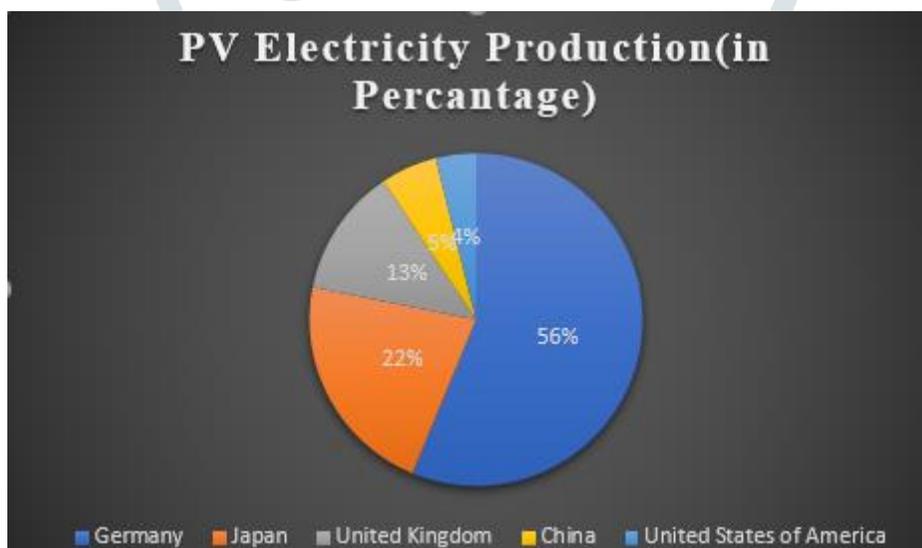
**Figure 4: Graphical Representation of the Photovoltaic Installation in the Year 2014 for Top Countries.**

Table 3 show percentage of photovoltaic electricity production in 2014 of five leading countries (China, Japan, United State of America, United Kingdom and the Germany). These are the top 5 countries of the photovoltaic electricity production in 2014. By use of this the countries takes lots of advantages from solar energy.

**Table 3: Theoretical Percentages of the Photovoltaic Electricity Productions in year 2014 of the 5 Top Countries.**

Countries	Photovoltaic electricity production(in Percentage)
Germany	7.2
Japan	2.8
United Kingdom	1.6
China	0.7
United States of America	0.5

Figure 5 shows the graphical presentation of the theoretical percentage share of photovoltaic electricity production in 2014 of five leading countries (such as China, Japan, United States of America, United Kingdom and Germany). This graphs shows the Germany has highest value of production of photovoltaic electricity 7.2 percent and united states of America has lowest value of production of photovoltaic electricity 0.5 percent in 2014.



**Figure 5: Graphical Representation of Theoretical Percentages of the Photovoltaic Electricity Productions in year 2014 of the 5 Top Countries.**

### DISADVANTAGES AND ADVANTAGES OF THE SOLAR ENERGY

Solar energy is heat and radiant light from Sun i.e. harnessed by using ranges of the ever evolving technology like heating's, photovoltaic, molten salt solar thermals energy, solar architectures, as well as power plant photosynthesis.

#### 1. Advantages:

##### 1.1.Reduce Electricity Cost:

By producing own powers through the solar panel, easily may cut the yearly electricity-bill by the up-to 40,758.35 Indian Rupee. Plus, if generate greater powers than use, may earn the money by the sell it backs to grid by Guarantee. Therefore the use of solar energy is important for the reduction of electricity cost.

### *1.2.Reduce Carbon Footprints:*

Solar powers are renewable energy option, but using it to power home will help the UK achieve their carbon emissions objectives, and is an essential step in fighting climate change. Reduce carbon emissions to help protect industries, ecosystems, and wildlife environments, which are endangered by climate change.

### *1.3.Renewable Sources of the Energy:*

Renewable energy sources like solar not only aim to fight climate change, but they also help to minimize air emissions, which is the 1 of world's greatest problems. So by the usage of the use of solar energy environment is save from the different types of pollutions and diseases which is good for the environment.

### *1.4.Easy for Installation:*

Rooftop solar panels are simple to mount. It normally just takes day or two for home to be powered by solar energy. However, keep in mind that the angle and orientation of the roof will affect the amount of energy produced by the panels. With variety of system to choose from, can tailor the solar system to meet specific needs.

### *1.5.Technologies Development:*

The solar powers industry's technology is the continuously educating, as well as this trends will continues in the future and the Nanotechnology advancement as well as quantum physics have potential to the improve efficiency of the solar panel and doubles, if not triple, electrical inputs of the solar powers system[3].

## *2. Disadvantages:*

### *2.1.No Electrics if Grid Go Downs:*

When have battery storage facility, solar systems will the shut downs if power grid go down. Although a solar panel will produce energy from grid, it cannot supply power in the case of a power failure unless a battery backup is bought. Grid tied Solar's systems must be equipped with accelerated shut-down modules to prevent energy from flowing back into grid, according to safety legislation. That means that if electric grid is offline for some reason, the machine will shut down before the grid is restored. This is mandated by statute in order to protect people who operate on power lines[4].

### *2.2.Initial Cost may be the Intimidating:*

Solar is large expenditure that needs cash up front or accesses for funding in the order for save money over time. Solar installation prices, on the other hand, have dropped dramatically. The average cost in one watt of solar energy installation has decrease by 64 percent for the residential project as well as the 67 percent for the commercial project between 2010 and 2018. Solar has the never been more competitive, thanks to several cost-cutting incentive at the regional and national levels.

### *2.3.Land Usage:*

Another issue is the solar energy may consume a large amount of soil, resulting in land destruction or wildlife habitat losses. Although solar photovoltaic system may be attached to existing infrastructure, larger utility scale photovoltaic system can need up to 11 acres in one megawatt, while CSP facilities can need up to 17 acres per megawatt. However, by locating facilities in low-quality areas or along established transmissions and transportation corridors, the effect can be minimized[4].

### *2.4.Geographic Limitation:*

Companies in the solar industry are expanding, but they typically cover very small regional areas. If live in outside of a solar company coverage area, will have a difficult time locating one that'll comes to house. When live in a

remote state, this is a challenge because may have problems calling customer service to get something solved if anything go wrong.

## USAGE OF SOLAR ENERGY

### 1. *Solar Electricity's:*

The solar electricity is 1 of the solar energies technologies that's gained lots of the momentums in current years. If solar panels costs decrease and the peoples becomes conscious of environmental and financial advantages of the solar energy, solar power is the becomes increasingly available. Solar power, though only a small percentages of total electricity produced in the United States (1.9 percent in year 2017), is rising steadily (almost triple in three years and add up to 40 percent), according's to US Energies Information's Administration.

### 2. *Solar Waters Heating:*

Solar energies can also be used in water heating's systems. The majority of Solar's water heating systems provide warm water which is used inside the home. Solar's water heater capture the sun heat and send to water tank through rooftops cell. According to the US Departments of the Energy, Solar's water heater have 5 to 10 years payback period (DOE).

### 3. *Solar Heating:*

Solar spaces heating system is often used to fuel radiant floor or to heat a home in conjunction with a Force Hot Airs (FHA) systems. When considering the arrangement of the windows and the materials used in the construction, inactive solar homes architecture will also heats businesses and homes in winter.

### 4. *Solar Ventilations:*

Solar cooling systems, like solar attics fan can help to cool house during the summer, reducing the cost of heating, ventilation, and air conditioning. If user unable to mount a solar photovoltaic device that will cover entire home energy consumption, this could be a viable solution and the Sol tube solar attic fan is a unique device.

### 5. *Solar Lighting:*

Solar lamps have become commonplace, with applications ranging from the surveillance lighting and home landscaping to road sign and street light. From nearest hardware store to online retail portals like Amazon.com, that solar lightings technologies for the homes are affordable as well as readily accessible in simple for high ends style. Sol tubes skylight, which was featured on Mash able as an innovative use of indoor solar lighting, adds natural illumination while reducing energies consumption.

## LITERATURE REVIEW

The various researcher and their researches on the topic solar energy are given below: N. Kannan et al. studies the world energy demands are rapidly growing as results of the demographic technological and growth advance. For the future energies demand, it's therefore dangerous to select a stable, cost effective, and eternal renewable energies source. Solar energies, like additional alternative energies source, is readily and viable existing sources of the energies for the addressing longs term problem in energies crisis. Since of strong demands for the electricity, solar industries rapidly growing all overs world, considering facts that main energies supply, fossil fuels, is rare as well as others option is costly. It became a catalyst for successful developing countries' economics sustaining and status lives of many underprivileged citizens because it is now cost effective as results of the year of the intensive study to the speed ups its growth. In contrast to other green energy sources, the solar industries will certainly be best choices for potential energies demands because it's superior in terms of cost competitiveness, availability, quality capability, and accessibility. As a result, their paper addresses the importance of the solar industries, as well as its basic principles, the global energies situation, highlight of the research undertaken for upgrade the solar industry, it's possible uses, and threats to a better solar industries in future in orders to address the energy crisis's[5].

Muhammad Badar Hayat et al. studies the renewable energy systems as a whole, as well as a detailed analysis of the indirect and direct approaches for producing power from the solar-energy, as well as the direct applications of solar- energy. A review of the state of the art procedures for photovoltaic description and output rating has been published. Furthermore, the fiscal, technological, storage, and environmental issues are addressed, as well as potential solutions. A detailed list of possible research direction in field of indirect and direct solar-energy production is also presented.

Mehreen Gul et al. Studies Solar-photovoltaic technologies is the one of green technologies that has the potential to form a future energy grid that is efficient, flexible, inexpensive, and clean. Their article includes a thorough examination of solar-photovoltaic technologies in terms of photovoltaic material performance and leading countries around the world. The major 5 leading countries identified based on previous years' reviews and photovoltaic installation in year 2014 are Japan, Germany, France, and the United Kingdom. America, the United States of China, the United Kingdom, and South Africa are three of the most populous nations in the world. In 2014, these 5 countries account for 80.01 percent of the all photovoltaic installations. Their report also addresses the guiding policies, funding, and R&D programs in order to determine the reasons for the leading countries' progress. Finally, with the aid of 99 worldwide deployed projects, their article discusses photovoltaic costs investigation in terms of photovoltaic module cost, balance of the device cost, and project costs[6].

Ashok Upadhyay et al. studies Solar energies solutions have exploded in popularity in current years. The understanding of technical advancements, rising public knowledge of the environmental issue, the current economic situation, and the availability of a variety of policy instrument has both contributed to and maintained this intense curiosity in that developments. Due to the high cost of solar-generated energy and the fact that powers from the renewable energies, including solar, is insecure, large-scale production of renewable resources has not occurred, and distribution providers have shown no interest in purchasing power from the renewable source. . Their paper gives a summary of solar energy production from a policy economic, technological, and standpoint. They examine the current state of solar-energy in term of the resources potential, current capability, historical patterns, and futures growths prospects. The economic, scientific, and structural obstacles to production and usage of solar-energy technologies are also discussed in their paper. Their paper examines current regulatory and fiscal policy tools to promote solar energy production and assesses how effective they are at achieving their objectives. Finally, their review of the potential prospects of the solar-energy supply below various set-ups in India's efficient power market is presented, based on current studies[7].

## DISCUSSION

After analysis and studies on the topic solar energy from above literature review there are some points are missing in their paper which is given in this paper. This review paper emphasizes on the topic solar energy and provide all the information about the solar energy such as what is solar energy why it is important for use in different sector. This review also provided the various data of different countries and their production as well as use of solar energy for different years. A comparison between different types of renewable energy(Geothermal Power, Hydro Power, Solar PV(Photovoltaic), CSP, Wind, Solar Heating, Ethanol Production and Biological Production conversion,)advantages, and disadvantages of solar energy also provided on this review paper.

## CONCLUSION

In this review we did study on the subject of solar energy and provides all relevant facts, such as what is solar energy and why it is essential for use in various industries. This study also included information on different countries, their development, and their use of solar energy for various years. This study paper also provides a comparison of various forms of green energy, as well as conversion, benefits, and drawbacks of solar energy. Solar energies storage is critical to success of the future energies systems since it allows excessive electricity generated during day to be used at future time when the sunlight is less abundant (for example in night). Solar energies plants will store surplus energy and sell it later for a number of uses, such as emergency preparedness, grid stabilization, and load leveling. Although these solar batteries storage system seem to be no brainer, there's still a lot of works to done to reduce the cost of that systems, which are mostly made up of costly lithium ion

batteries. Battery storages installation should become additional widespread in future as costs and reliability both decrease.

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