

## Importance of Solar Energy for Sustainable Development

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### Abstract

This paper highlights the significance of sustainable energy development. Solar energy would help steady energy prices and give numerous social, environmental and economic benefits. This has been indicated by solar energy's contribution to achieving sustainable development through meeting energy demands, creating jobs and protecting the environment. Hence, a paramount critical component of long-term sustainability should be investigated. Based on the current condition of fossil-fuel resources, which are deemed to be depleting energy sources, finding an innovative technique to deploy clean-energy technology is both essential and expected.

**Keywords:** Solar energy, clean-energy, non-polluting, sustainable development, environment, economy.

### Introduction

Solar energy is a sustainable energy and is inherently more sustainable than fossil fuel energy sources. As a way of converting the Sun's energy into electrical energy, solar panels make use of the single most sustainable resource on the planet - the light of the Sun. According to the [United Nations](#), sustainability means "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Solar energy embodies this widely accepted definition of sustainability because the sun's energy can be used indefinitely without diminishing its future availability. Most experts agree that the sun is the [most important source](#) of renewable energy. Solar energy is considered a renewable resource, as opposed to [non-renewable energy sources](#), such as fossil fuels, which are finite. There is more than enough solar power to provide for all the energy needs of the planet, even if the Earth's population continues to grow and consume more energy, making it an important component of effort to combat climate change. A study published in [Scientific American](#) found that in 40 minutes the amount of energy contained in the light of the Sun that reaches the Earth is equivalent to the amount of electrical energy used on the planet in a year's time.

Fossil fuels cause [pollution](#) as they are consumed, while solar energy does not, which is another way that it embodies the principles of sustainability. Solar panels sit idly on rooftops or in large solar arrays, creating no waste products, noise or any other outputs - just clean electrical energy.

A major reason why solar energy has not become more widespread is that it is not yet economically sustainable. The up front cost of installing solar panels eventually pays for itself because they

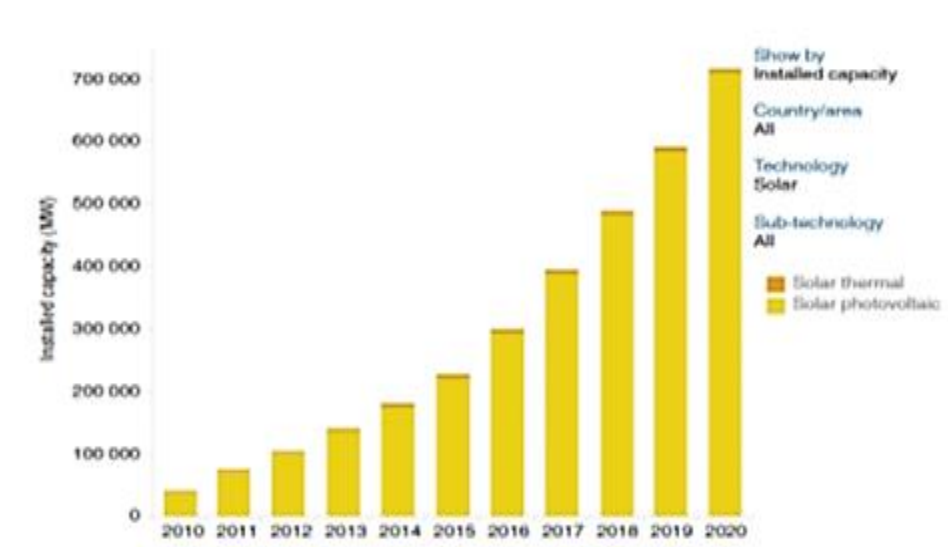
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produce energy for free once they are up and running, but the ratio of costs to energy produced has remained [too high](#) for the average homeowner to afford panels, as well as for large scale applications.

Solar technology continues to advance, however, so it is expected that at some point solar energy will become more cost effective than non-renewable energy sources that, by nature, become more expensive as their availability declines.



Source: Irena Solar Energy- International Renewable Energy Agency, [www.irena.org/solar](http://www.irena.org/solar), 2022.

Fig. 1: Installation capacity of solar energy worldwide

In recent years, it has become increasingly obvious that the world must decrease greenhouse gas emissions by 2050, ideally towards net zero, if we are to fulfil the Paris Agreement's goal to reduce global temperature increases. The net-zero emissions complement the scenario of sustainable development assessment by 2050. According to the agreed scenario of sustainable development, many industrialized economies must achieve net-zero emissions by 2050. However, the net-zero emissions 2050 brought the first detailed International Energy Agency (IEA) modelling of what strategy will be required over the next 10 years to achieve net-zero carbon emissions worldwide by 2050.

### Literature Review

Mark. Z. Jacobson *et.al.* (2010) in their study, "Providing all global energy with wind, water and solar power, Part-I: technologies, energy resources, quantities and areas of infrastructure and materials" analyse the feasibility of providing worldwide energy for purposes from wind, water and sunlight. In Part-I, they discuss WWS energy system characteristics, current and future energy demand,

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availability of WWS resources, number of WWS devices and area and material requirements. In Part-II, they address variability, economics and policy of WWS energy. Finally, they have suggested to produce all new energy with WWS by 2030 and replacing the pre-existing energy by 2050.

Damon Turney et.al, (2011) in their study titled “Environmental impacts from the installation and operation of large-scale solar power plants” developed an improved understanding of the environmental impacts of the installation and operation phases of solar power. They identified and appraise 31 impacts related to issues of land use, human health and well-being, wild life and habitat, geohydrological resources, and climate their analysis accomplishes the following: (1) identifies impacts, (2) assesses each impact relative to traditional power generation, (3) classifies each impact as beneficial or detrimental, (4) appraises the priority of each impact. The results form a comprehensive description of the impacts of installation and operation of solar power, in a variety of climates and afford a first picture of the impacts of solar power in forested regions.

James Hamilton (2012) in his article “careers in solar power” provides information on the process of generating solar power and details various occupations in the solar industry. The first section details a brief history of solar power in the United States, followed by an overview of how solar power is generated, which entities use it and the technology involved in supplying solar power. The second section provides occupational information highlighting a brief job description of several noteworthy occupations that are related to solar power; the credentials needed to work in the occupation, such as education, training, certification or licensure and wage data. Finally, he concluded lean energy such as solar power is expected to be a key piece of the growing “green economy”, and jobs in solar power show great potential for new employment opportunities.

T.V. Ramachandra *et.al.* (2015): “Hotspots of solar potential in India”. This paper evaluates the progress made in solar power generation in the country especially with the inception of an ambitious National Solar Mission also termed as ‘solar India’. Organizational aspects of solar power generation with focus on existing policy elements are also addressed so as to probe the actual potential of the identified solar hotspots in meeting the NSM targets and beyond. Authors identified the solar hotspots in India using high resolution satellite data. They observed that nearly 58% of the country receives annual average global insolation of 5kWh/m<sup>2</sup>/day. The solar power technologies like SPV and CSP have been discussed with focus on their techno-economic constraints of implementation. Finally, authors concluded solar hotspots in India have the potential to offset a huge volume of GHG emissions as demonstrated and help realize a low carbon economy at a faster rate. It will create numerous employment opportunities especially in the village level.

Naveen Kumar Sharma (2017) in his study titled “Solar energy in India: Strategies, policies, perspectives and future potential”, made efforts to summarize the availability, current status, strategies, perspectives, promotion policies, major achievements and future potential of solar energy options in India. Thus, he concluded India has a severe electricity shortage. It needs massive additions in capacity to meet the demand of its rapidly growing economy. Development of solar energy, which is indigenous distributed and has low marginal cost of generation, can increase energy security by diversifying supply, reducing import dependence and mitigating fuel price volatility. So

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photovoltaic power systems will have an important share in the electricity of the future not only in India, but all over world.

Gagari Deb *et.al.* (2019) in his study "Use of solar tracking system for extracting solar energy" deal with the design and execution of a solar tracker system dedicated to the PV conversion panels. In this paper mechanism of building an efficient solar tracking system with the help of lab view software is discussed and also discussed about the control strategy of the stepper motor. Finally, they concluded by using this circuit the solar array can be rotated in required direction following the sun path to get maximum energy from the sun with the help of this lab view program the efficiency of the solar panel would be increased. Again, use of this technique can capture large amount of solar energy. For this reason, the use of the non-conventional energy will increase which is very fruitful incident of our future power sector.

Ganesh Hegde *et.al.* (2022): "Scope for solar energy in Kerala and Karnataka". Karnataka and Kerala states are dependent mainly on conventional energy source such as diesel, coal, gas and hydro energy. Only 4% of total installed plant capacity is based on renewable energy sources in Kerala and 24% in Karnataka. However, both the states get very good solar insolation solar energy utilization is not remarkable. Subsequently, both states facing the electricity defect problem. Solar energy harvesting could lead to the solution. In this paper authors discusses the electrical energy harvesting from solar energy in the available wastelands in the states. And they concluded harvesting of solar energy in waste land could meet the present as well as future demand in both the states. Since solar energy is cleaner and renewable source pollution and energy deficiency problem can be eliminated.

### **The Essence of Sustainability**

Since the sun is expected to continue shining for several billion years, calling solar energy a sustainable power supply is a pretty safe bet. The challenge now is to figure out how to drive down the cost of solar panels to the point where it is also economically sustainable using more renewable materials.

**Solar energy** is that produced by the Sun's **light – photovoltaic energy** – and its **warmth – solar thermal** – for the **generation of electricity or the production of heat**. Inexhaustible and renewable, since it comes from the Sun, solar energy is harnessed using **panels and mirrors**.

**Photovoltaic solar** cells convert sunlight directly into electricity by the so-called photovoltaic effect, by which certain materials are able to absorb photons (light particles) and liberate electrons, generating an electric current. On the other hand, solar thermal collectors use panels or mirrors to absorb and concentrate the Sun's heat, transferring it to a fluid and conducting it through pipes to use it in buildings and installations, and also for electricity production (solar thermoelectric).

It provides **heat** tapped by mirrors that focus sunlight on a receiver that contains a fluid which reaches temperatures up to 1,000°C. The heat transforms the fluid in steam which moves a turbine and finally produces electricity.

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It provides **light** that is converted into electricity through photovoltaic solar panels. Photovoltaic panels are formed by groups of cells or solar cells that convert light (photons) into electrical energy (electrons).

**Renewables do not emit greenhouse gases** in energy generation processes, making them the cleanest, most viable solution to prevent environmental degradation.

Compared to conventional energy sources such as coal, gas, oil and nuclear - reserves of which are finite - **clean energies** are just as available as the sun from which they originate and adapt to natural cycles, hence their name “renewables”. This makes them an essential element in a **sustainable energy system** that allows development today without risking that of future generations

**Solar energy does not emit toxic substances or contaminants** into the air, which can be very damaging to the environment and to human beings. Toxic substances can acidify land and water ecosystems, and corrode buildings. Air contaminants can trigger heart disease, cancer and respiratory diseases like asthma.

**Solar energy does not generate waste or contaminate water**—an extremely important factor given the scarcity of water. Unlike fossil fuels and nuclear power plants, wind energy has one of the lowest water-consumption footprints, which makes it a key for conserving hydrological resources.

#### **Increasingly competitive**

Nowadays renewables, specifically [wind](#) and photovoltaic, are cheaper than conventional energies in much of the world. The main renewable technologies – such as wind and solar photovoltaic – are drastically reducing their costs, such that they are fully competitive with conventional sources in a growing number of locations. Economies of scale and innovation are already resulting in renewable energies becoming the most sustainable solution, not only environmentally but also economically, for powering the world.

#### **Creates Wealth and Jobs**

In addition, **solar energy is a “native” energy**, because it is available practically everywhere on the planet, which contributes to reducing energy imports and to creating wealth and local employment.

For these reasons, producing electricity through **solar energy** and its efficient use **contributes to sustainable development**.

#### **Curiosities about Solar Energy**

**“Use of solar energy is near a solution”**. This was the headline in the *New York Times* on 4 April 1931. It turned out to be a premonition, since, 80 years later and electricity is being supplied to **millions of human beings in the world from renewable energies such as solar**. Humanity has now declared its readiness to accelerate the transition to a low-carbon economy, conscious of the finite nature of fossil fuels and their prejudicial effects on the environment as the main cause of global warming.

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Solar energy, on the other hand, will never die of shining, since the Sun still has 6.5 billion years of life according to NASA. Indeed, in rather less time, **solar technology in some countries has evolved to compete with conventional sources of electricity generation**. In just a few decades' time, it will become the major part of a sustainable energy system for the world.

Additionally, the conditions for the development of solar energy could not be more perfect: **the Sun bathes the Earth hourly with enough light and heat to fulfill global needs for a whole year**; in other words, solar radiation can satisfy our energy needs 4,000 times over.

As the publication Renewable Energies Info estimates, the Earth's surface receives 120,000 Terawatts of solar irradiation, "which represents 20,000 times more power than the whole planet needs.

### Conclusion

Solar energy is an environmentally friendly technology, a great energy supply and one of the most significant renewable and green energy sources. It plays a substantial role in achieving sustainable development with energy solution of the globe for centuries to come. The massive amount of solar energy attainable daily makes it a very attractive resource for generating electricity. Both technologies, applications of concentrated solar power or solar photovoltaics, are always under continuous development to fulfil our energy needs. Hence, a large installed capacity of solar energy applications worldwide, in the same context, supports the energy sector and meets the employment market to gain sufficient development. This study highlights solar energy applications and their role in sustainable development and considers renewable energy's overall employment potential. Thus, it provides insights and analysis on solar energy sustainability, including environmental and economic development. Furthermore, it has identified the contributions of solar energy applications in sustainable development by providing energy needs, creating jobs opportunities and enhancing environmental protection. Finally, the perspective of solar energy technology is drawn up in the application of the energy sector and affords a vision of future development in this domain.

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### References

1. Anik Deb (2018): "Prospects of solar energy in Bangladesh", IOSR-JEEE, Vol.4, Issue-5, 46-57.
2. Bouckaert S., Pales A.F., McGlade C., et al. Net Zero by 2050: A Roadmap for the Global Energy Sector. Paris: International Energy Agency, 2021.
3. Elias Sanz, Lucia Lascurian, Antonio Eleazar, Birger Laesen (2014): "The production, consumption and research on solar energy: The Spanish and German case, Renewable Energy: International Journey, 733-744.

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4. Jaymin Gajjar (2015): "Solar PV energy generation map of Karnataka India", Smart Grid Renewable Energy, No-6, 333-342.
5. Kashmir J., Solar Energy for Sustainable Development. 2018. <https://www.dailyexcelsior.com/solar-energy-sustainable-development>.
6. Nagalakshmi P. and Veda Chary M. (2019): "Effective energy management system with solar energy", IJMER, Vol-3, Issue-5, Sep-Oct 2019, 2836-2839.
7. Ramachandra T.V., et.al. (2015): "Hotspot of solar potential in India", Journal of Renewable and Sustainable Energy Resources, 15, 3178-3186.
8. Shubojit Dawn, Prashant Tiwari, Arup Kumar Goswamy and Manash Mishra (2016): "Recent development of solar energy in India: Perspectives, Strategies and Goals", Renewable and Sustainable Energy Review, 215-235.
9. Sims R.E., Renewable Energy: A response to Climate Change. Solar Energy, 2004, 76:9-17.
10. Sorensen B., Renewable Energy: Physics, Engineering, Environmental Impacts, Economics and Planning. 4th edn. London: Academic Press, 2010.

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