



Research Article

Solar Cells – Importance in Creating Sustainable Environment

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Abstract

Science and technology have always been useful in making human life easy and comfortable in multiple ways. However, the increased use of machines for different purposes from industries to domestic have become threat to depleting sources of energy such as coal, petroleum, etc. besides creating polluted environment for society. The need for adopting practices which can help in creating sustainable environment has gained importance in the recent years. Several initiatives and schemes are being promoted by the Government to enhance use of renewable sources of energy so as to build sustainable environment for future generation. Among the various sources of renewable energy, the use of solar energy can be considered as most abundant and reliable sources of power. The present study has been conducted to demonstrate the application of Solar cells in generation of solar energy and its increasing use for different purposes as a substitute for traditional sources of energy. Appropriate statistical techniques have been used to draw meaningful interpretations and suggestions have been made based on the findings of the study.

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INTRODUCTION

Sustainability is about meeting present needs without compromising the ability of future generations to meet theirs. It reflects ethical responsibility and long-term thinking. The need for a sustainable environment is not just an option but a necessity. It ensures the preservation of natural resources, protection of ecosystems, and a healthier planet. By adopting sustainable practices today, humanity can secure a balanced and prosperous future for generations to come.

Need for Sustainable Environment

The need of a sustainable environment arises from the urgent need to balance human development with the protection of natural resources and ecosystems. Without sustainability, the survival and well-being of life on Earth are at risk.

1. Preservation of Natural Resources

Natural resources like water, forests, and fossil fuels are finite. A sustainable environment ensures their careful use so they remain available for future generations.

2. Maintaining Ecological Balance

Ecosystems depend on a delicate balance between living organisms and their surroundings. Sustainability helps protect biodiversity and prevents disruptions caused by human activities.

3. Prevention of Environmental Degradation

Uncontrolled industrialization and urbanization lead to pollution, deforestation, and land degradation. Sustainable practices reduce these harmful effects and promote environmental health.

4. Combating Climate Change

Rising global temperatures, melting glaciers, and extreme weather conditions are consequences of climate change.

Sustainability encourages the use of renewable energy and reduces greenhouse gas emissions.

5. Ensuring Human Health and Well-being

A polluted environment leads to diseases and poor living conditions. Sustainable practices ensure clean air, safe drinking water, and a healthier lifestyle.

6. Supporting Economic Growth

Sustainability promotes long-term economic stability by encouraging efficient resource use, green technologies, and sustainable industries.

7. Responsibility Towards Future Generations

We have a moral duty to preserve the environment so that future generations can meet their needs and enjoy a healthy planet.

Among the various areas which have drawn attention of the society towards environment protection and creation of sustainable environment, use of energy sources for day-to-day functioning. Traditionally, the power plants were making use of coal for generation of electricity. Increasing need of energy and dependence on nonrenewable sources of energy is a major threat to the environment. Keeping in view this fact, several initiatives have been taken to make use of renewable sources of energy for meeting demand and consumption needs of Industry, domestic as well as for commercial purposes. Several steps have been taken by the Government to promote the usage of solar energy for domestic purposes as well as manufacturing and agricultural purposes. It has been observed that over the last one decade, the usage of Solar Power has increased sharply as against Wind Power. The year wise statistics of installation of Solar Energy and Wind Power for the period 2014-15 to 2024-25 as per the information shared by the Ministry of New and Renewable energy is given below in table 1.

Table 1: Year-wise statistics of Installed Renewable energy (in MW)

Year	Wind Power	Solar Power
2014-15	2311.77	1171.62
2015-16	3423.05	3130.36
2016-17	5502.37	5658.63
2017-18	1865.23	9563.69
2018-19	1480.97	6750.97
2019-20	2117.79	6510.06
2020-21	1503.3	5628.8
2021-22	1110.53	12760.5
2022-23	2275.55	12783.8
2023-24	3253.38	15033.24
2024-25	4151.31	23832.87

Source: <https://mnre.gov.in/en/year-wise-achievement/>

The comparison in the installation of Wind Power and Solar Power is more visible in the figure shown below:

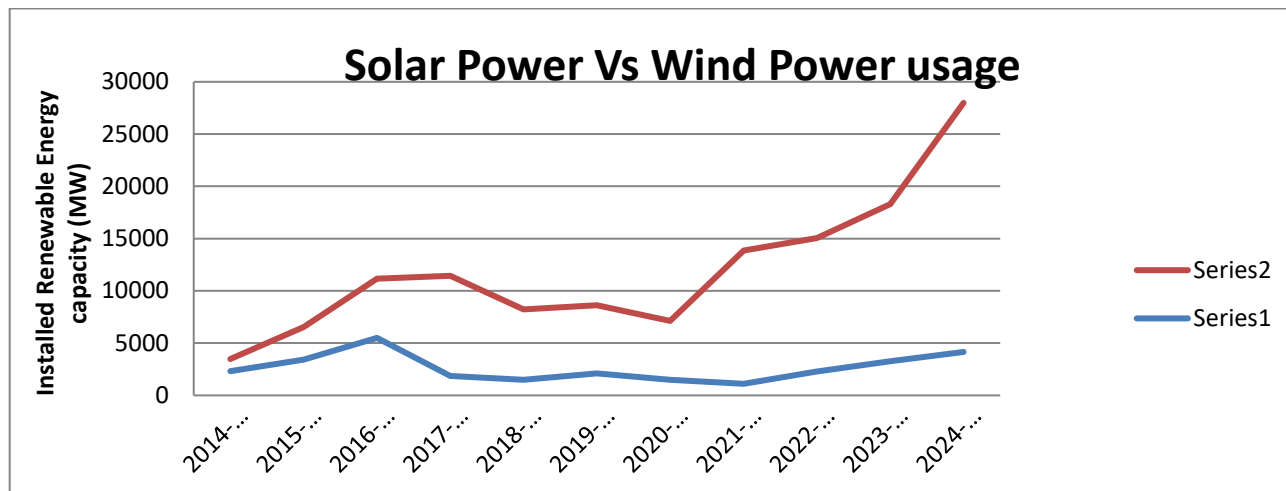


Figure 1: Graph showing comparison of Solar Power Vs Wind Power (Series 1 represents Wind Power, Series 2 represents Solar Power)

It can be observed that during the period 2014-15 to 2024-25, the use of solar energy has consistently increased as an important source of renewable energy and has appeared as an alternative to traditional source of energy in various ways from small devices to large-scale power generation. Solar energy is created using solar cells. Solar cells, also known as photovoltaic (PV) cells, are devices that convert sunlight directly into electrical energy. Their primary function is based on the photovoltaic effect. When sunlight falls on the solar cell, it generates electric power without using any fuel. Solar cells are made of semiconductor materials like silicon. When sunlight hits the surface:

- Photons (light particles) transfer energy to electrons in the semiconductor.
- Electrons get excited and start moving freely.
- This movement of electrons creates an electric current.

Solar cells produce electricity in the form of direct current (DC). This DC power can be used directly or converted into alternating current (AC) using an inverter for household and industrial use. Some of the important Government schemes promoting usage of solar energy are mentioned below:

1. PM Surya Ghar: Muft Bijli Yojana: Aims to install rooftop solar on 1 crore households, providing subsidies and 300 units of free electricity monthly.
2. Pradhan Mantri Kisan Urja Suraksha evam Utthan Mahabhiyan (PM-KUSUM) Scheme for de-dieselisation of farm sector and enhancing the income of farmers. Under the Scheme, central government subsidy upto 30% or 50% of the total cost is given for the installation of standalone solar pumps and also for the solarization of existing grid-connected agricultural pumps.

Various purposes for which solar energy is useful are described below:

1. Electricity Generation

- Used in solar power plants to generate large-scale electricity.
- Installed on rooftops of homes, offices, and factories to supply power and reduce electricity bills.

2. Rural and Remote Area Electrification

- Provide electricity in remote villages where grid supply is unavailable.
- Used for lighting, charging devices, and running small appliances.

3. Space Applications

- Widely used in satellites and spacecraft as a reliable power source.
- Essential for long-term missions since sunlight is abundant in space.

4. Portable Devices

- Used in calculators, watches, and small gadgets.
- Provide continuous power without needing battery replacement.

5. Street Lighting and Traffic Systems

- Solar-powered street lights, traffic signals, and signboards reduce dependence on conventional electricity.

6. Water Pumping Systems

- Used in agriculture for solar water pumps to irrigate fields.
- Helps farmers in areas with limited electricity supply.

7. Battery Charging

- Used in solar chargers and power banks to charge mobile phones, laptops, and other devices.

8. Heating Applications (Indirect Use)

- Though mainly for electricity, solar cells can power systems used for water heating and space heating.

9. Transportation

- Used in solar-powered vehicles (cars, boats, and experimental aircraft).
- Helps reduce fuel consumption and pollution.

10. Environmental Protection

- Provide clean and renewable energy, reducing reliance on fossil fuels and lowering pollution.

CONCLUSION

It can be inferred from the above details; solar cells represent a powerful and practical solution to the growing environmental challenges faced by the world today. As the demand for energy continues to rise, reliance on fossil fuels has led to severe pollution, climate change, and depletion of natural resources. Solar energy, being clean, renewable, and abundant, offers a sustainable alternative that can significantly reduce carbon emissions and promote environmental balance. The widespread adoption of solar cells not only ensures energy security but also supports economic development and improves the quality of life, especially in remote and underserved regions. Therefore, embracing solar technology is not just an option but a necessity for building a greener, cleaner, and more sustainable future for generations to come.

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