

UNIT-1

PRINCIPLES OF SOLAR ENERGY

Introduction

What is Solar Energy?

Solar energy is the energy obtained from the Sun.
It is a renewable and inexhaustible source of energy.
Solar energy can be converted into heat and electricity.
It is environmentally friendly and sustainable.

Importance of Solar Energy

- **Why Solar Energy?**
- Reduces dependence on fossil fuels.
- Minimizes environmental pollution.
- Available abundantly in most regions.
- Helps in achieving energy security.
- Supports sustainable development.

Principles of Solar Energy

- **Basic Principle**

- The Sun emits electromagnetic radiation.
- Solar radiation reaches the Earth's surface.
- Solar energy is captured using solar collectors or solar panels.
- The captured energy is converted into useful heat or electricity.

: Solar Radiation

- **Solar Radiation**

- Energy emitted by the Sun in the form of electromagnetic waves.
- Includes visible light, infrared, and ultraviolet radiation.
- The amount of radiation received depends on location, season, and weather conditions.

Solar Energy Conversion

- **Types of Conversion**
- **Thermal Conversion**
 - Converts solar energy into heat.
 - Used in solar water heaters and solar cookers.
- **Photovoltaic Conversion**
 - Converts sunlight directly into electricity.
 - Uses photovoltaic (PV) cells.

Photovoltaic Effect

- **Working Principle of Solar Cells**
- Sunlight falls on a semiconductor material.
- Photons transfer energy to electrons.
- Electrons move and generate electric current.
- This phenomenon is called the Photovoltaic Effect.
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- **Components of a Solar Energy System**
- **Main Components**
- Solar Panels
- Charge Controller
- Battery Storage
- Inverter
- Electrical Load

Advantages of Solar Energy

- **Benefits**
- Renewable and clean energy source.
- No fuel cost.
- Low maintenance requirements.
- Reduces greenhouse gas emissions.
- Suitable for remote areas.

Limitations of Solar Energy

- **Challenges**
- High initial installation cost.
- Depends on sunlight availability.
- Requires energy storage systems.
- Large area needed for large-scale installations.