

SOLAR PHOTOVOLTAICS

Photovoltaics (PV) comprise the technology to convert sunlight directly into electricity. A photovoltaic (PV) cell, also known as "solar cell," is a semiconductor device that generates electricity when light falls on it. When sunlight strikes a PV cell, the photons of the absorbed sunlight dislodge the electrons from the atoms of the cell. The free electrons then move through the cell, creating and filling in holes in the cell. It is this movement of electrons and holes that generates electricity. The physical process in which a PV cell converts sunlight into electricity is known as the photovoltaic effect.

One single PV cell produces up to 2 watts of power, too small even for powering pocket calculators or wristwatches. To increase power output, many PV cells are connected together to form modules, which are further assembled into larger units called arrays.

TWO TYPES OF PV SYSTEM:

- 1) **Flat plate :** Flat plate systems build the PV modules on a rigid and flat surface to capture sunlight, flat plate systems are typically less complicated but employ a larger number of cells.
- 2) **Concentrator systems :** Concentrator systems use lenses to concentrate sunlight on the PV cells and increase the cell power output, concentrator systems use smaller areas of cells but require more sophisticated and expensive tracking systems.

Types of PV cell materials :

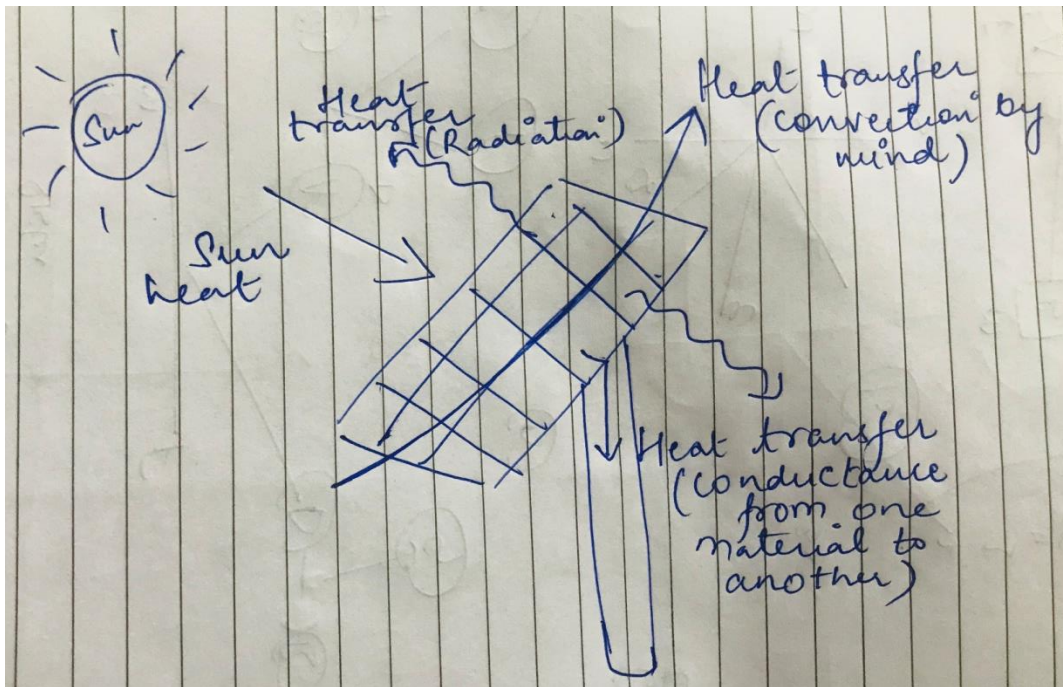
The major types of materials are semiconductor materials, crystalline and thin films (thickness less than 1 μm), which vary from each other in terms of light absorption efficiency, energy conversion efficiency, manufacturing technology and cost of production. The solar cells in calculators and satellites are photovoltaic cells or modules (modules are simply a group of cells electrically connected and packaged in one frame).

Heat Transfer of Solar PV Panels :

1) **Conduction:** It refers to the heat transfer that occurs across the medium, medium can be solid or a fluid

2) **Convection:** It refers to the heat transfer that will occur between a surface and a moving fluid when they are at different temperatures.

3) **Radiation:** In absence of medium there is net heat transfer between two surfaces at different temperatures in the form of electromagnetic waves.



Solar PV systems :

Solar photovoltaic systems are energy conversion systems which convert solar energy into electrical energy. The solar photovoltaic system comprises of three main sub-systems, viz., solar panel, control unit and battery. The solar panel contains solar cells which produce electricity when exposed to sunlight. The electricity generated charges the battery / batteries and the power stored can be used at a later time. The control unit regulates the charging and discharging of the battery. The application has to be optimized according to the load profile and the geographic location in which it is used.

Solar lantern :

The solar lantern is a portable solar photovoltaic lighting system which provides about 2-3 hours of light per night based on the days charge. The system consists of 5 watt tube which is driven at a specially designed frequency choke / inverter operating at a frequency above 30 KHz.



Solar water pumping system:

A solar photovoltaic water pumping system, essentially consists of a SPV panel directly powering a water pump. The water pumped during the day can be stored in storage tanks for use during night. The generated electricity from the panel is fed to the pump through a switch. Normally, no storage batteries are provided as the water can be stored in storage tanks, if required.

Features :

- 1) Noise and pollution free operation*
- 2) Does not require any fuel*
- 3) Uses the abundantly available sunlight*
- 4) Designed to give optimum output even during low sunshine period*

Applications:

- 1) Minor irrigation*
- 2) Drinking water for unelectrified villages and remote locations*
- 3) Horticulture, poultry farming, silviculture and pisciculture*

