

LECTURE 6

What is a Solar Cell ?

- A solar cell is a semiconductor device which converts electromagnetic radiation into electrical signals.
- It is a device which generates electricity directly from Sun's radiation by means of the photovoltaic effect so it is also called Photovoltaic cell.
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- In order to generate useful power, it is necessary to connect a number of cells together to form a solar panel, also known as a photovoltaic module.
- The nominal output voltage of a solar panel is usually 12 Volts, and they may be used singly or wired together into an array.
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- The number and size required is determined by the available light and the amount of energy required.

Construction

- ▶ It consists of p-n junction diode in which electrons & holes are generated by the incident photons.
- ▶ When an external is connected through the p-n junction device a current passes through the circuit & generates power when light is incident on it.
- ▶ Large area p-n junction is used for effective power generation.

Storage of power

- The amount of power generated by solar cells is determined by the amount of photons absorbed by it.
- Several solar cells are mounted on a common panel connected in series or parallel for increasing the voltage or power respectively. This type of device is called Solar Panel.
- In this type of system the usual choice for energy storage is the lead-acid battery.
- The number and type of batteries is dependent on the amount of energy storage needed.

Efficiency of Solar Cell

Efficiency of a Solar cell is the ratio of the electrical power output to the light input.

The Efficiency can be increased by using an anti-reflection coating on the thin heavily doped surface.

The maximum efficiency so far is 18.7%.

Types of Solar Cells

- Two solar cell types are currently in use. They include amorphous solar cells & crystalline solar cells.
- Amorphous solar cells are prepared by attaching a thin silicon film onto a durable material such as steel.
- Amorphous cells have been used for a long time in products like solar powered calculators, and garden lamps. The entire panel consists of one piece, making individual solar cells less identifiable. This has long been the least efficient solar cell type, but they have begun to improve to the point where they may become a viable alternative to crystalline solar cells.
- Crystalline cells use a series of cells combined in a circuit to generate power. A panel of 36 cells typically produces about 20 watts, or enough to charge a 12volt battery.
- Crystalline cells come in two types: Monocrystalline & Multicrystalline.
- For the purposes of Solar Power Industries, multicrystalline solar cells represent the greatest efficiency for manufacturing and the greatest value to the customer.

Theoretically, monocrystalline cells are the most efficient cell type, but in practice poly-crystalline cells produce nearly the same energy output.