3.5 BASIC PRINCIPAL OF SPV CONVERSION:

3.5.1 PHOTOVOLTAIC EFFECT

- Photovoltaic effect is a process in which two dissimilar materials in close contactproduce an electrical charge when struck by light or any other radiant energy.
- When light strikes crystals such as silicon or germanium (p-n junction) in which electrons are usually not free to move from n-region to p-region due to the potential barrier, the light provides the energy (e.m.f.) needed to free some electrons from the bound condition depending on the absorption of solar energy(Figure 3.23).

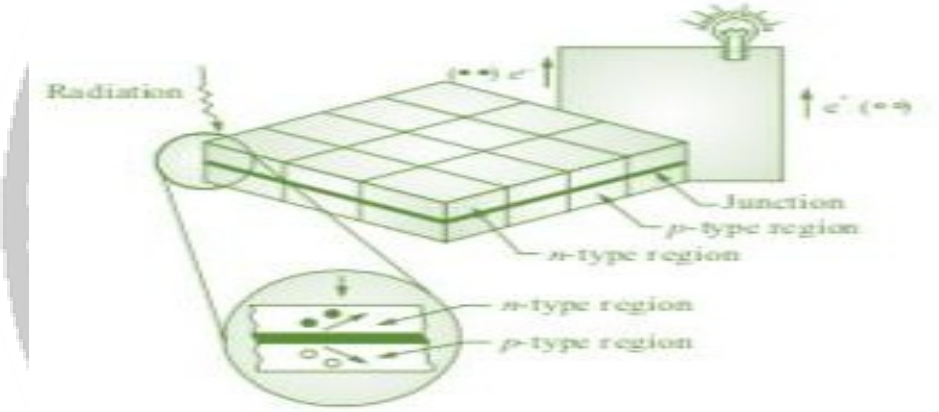

Figure 3.5.1 Generation of emf across junction to move the charge carriers.
[Source: "Solar Photovoltaics: Fundamentals,Technologies andApplications" by ChetanSingh Solanki, Page: 222]

- Free electrons cross the junction between two dissimilar crystals more easily in one direction than in the other, giving one side of the junction a negative charge, and this results in a negative voltage with respect to the other side, as in the caseof a battery in which one electrode has negative voltage with respect to the other.
- The photovoltaic effect can continue to provide voltage and current as long as light falls on the junction of two materials.

3.5.2 BASIC PRINCIPAL OF SPV CONVERSION

- Solar power is the production of electricity directly from sunlight. The solar photovoltaic (PV) power is produced using photovoltaic effect so that when sunlight

strikes a solar voltaic cell, it releases electrons from the p-n junction ofthe cell and pushes these electrons across a potential barrier or electric field atthe junction.

- These electrons then travel through an external circuit to return to their usual state and in this process create electric power.
- The photovoltaic effect is the basic physical process through which a PV or solar cell converts sunlight into electricity. Sunlight is composed of energy packets called photons.
- These photons contain different amounts of energy that correspond to different wavelengths of the solar spectrum. When photons strike a PV cell, they may be reflected, absorbed or can pass through the p-n junction. The absorbed photonsin the p-n junction generate electricity

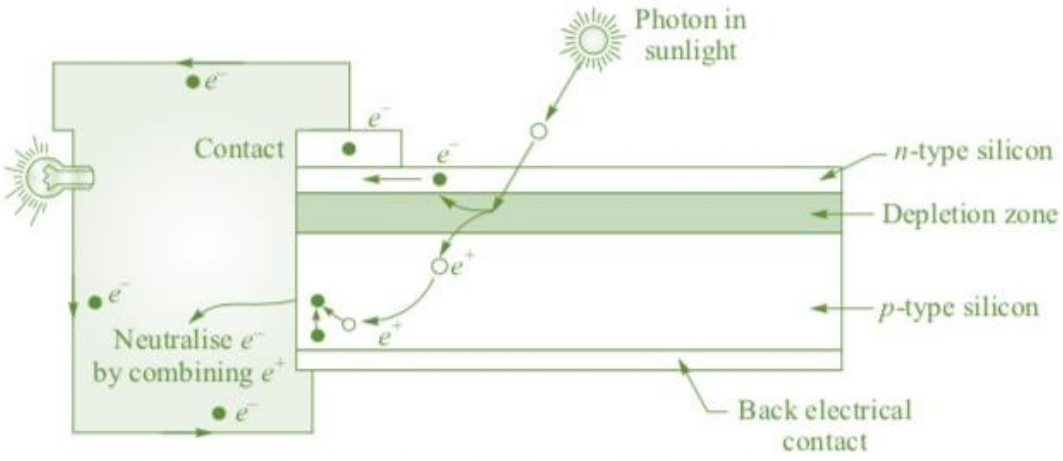

Figure.3.5.2 Photon generating pairs of electron and hole to move electric current inthe external circuit

[Source: "Solar Photovoltaics: Fundamentals,Technologies andApplications" by ChetanSingh Solanki, Page: 227]

- A solar cell is essentially a p-n junction with a large surface area. The n-type material is kept thin to allow light to pass through it and strike the p-n junction. The light travels in packets of energy called photons. The generation of electric current takes place inside the depletion zone of the p-n junction.
- The depletion zone as explained previously is the area around the p-n junction where

the electrons from the n-region diffuse into the holes of the p-region. When a photon of light is absorbed by one of these atoms in n-region of silicon, it will dislodge an electron from any atom, thereby creating a free electron and hole pair.

- The free electron and hole pair has sufficient energy to jump out of the depletion zone. If a wire is connected from the cathode at n-type silicon to an anode of p- type silicon, electrons flow through the wire.
- The electron is attracted to the positive charge of p-type material and travels through the external load (bulb or resistance), thereby creating a flow of electric current. The hole created by the dislodged electron is attracted to the negative charge of the n-type material and travels to back electrical contact. As the electron reaches the p-type silicon from the back electrical contact, it combines with the hole, thereby restoring the electrical neutrality (Figure 3.23).