# PHOTOVOLTAICS

BY ROGER BARKER

# WHAT IS ELECTRICITY?

- When electrons move, they carry electrical energy from one place to another. This is called current electricity or an electric current. A current of electricity is a steady flow of electrons.
- Each electron carries a tiny amount of electric charge. When electrons move from one place to another they carry electrical energy from place to place. When you have millions and trillions of electrons moving together you get an electric current.

# WHAT ENERGY CAN BE USED TO CREATE ELECTRICITY?

- The source of all energy in our solar system is the Sun.
- In full sun, you can safely assume that the Earth receives about 100 watts of solar energy per square foot. If you assume we receive 12 hours of sun per day, for 365 days a year, this equates to 438,000 watt-hours per square foot per year. Based on 27,878,400 square feet per square mile, sunlight bestows 12.2 trillion watt-hours per square mile per year.

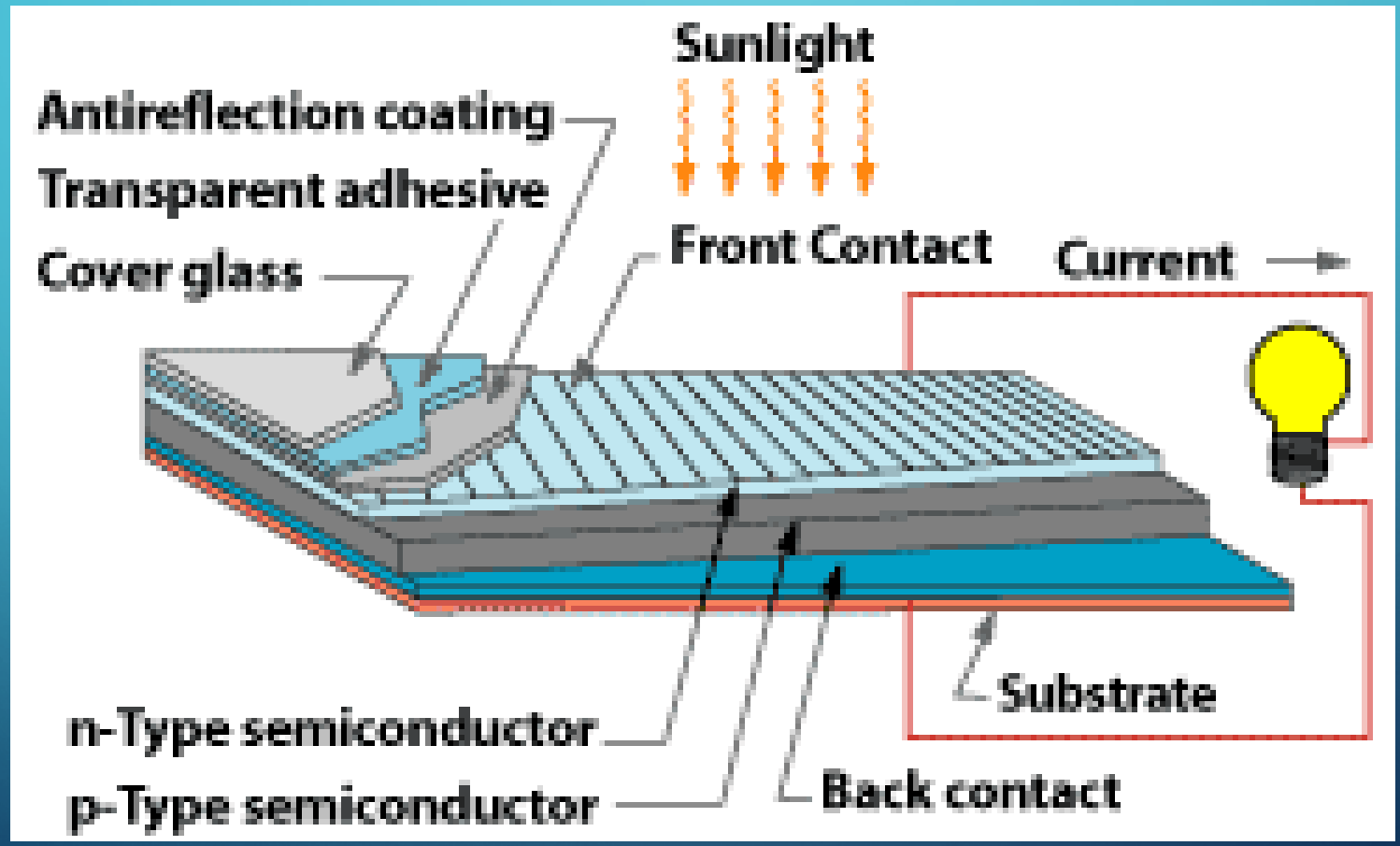
# RULE OF ENERGY

- The Law of Conservation of Energy states:
  - Energy cannot be created or destroyed it can only change forms.

# USING THIS INFORMATION WE CAN CREATE AFFORDABLE ELECTRICITY.

- The Sun's light energy is delivered to the Earth in the form of Photons. We can convert the energy in the Photons into electrical energy through the use of Photovoltaic Cells.

# ANATOMY OF A PHOTOVOLTAIC CELL




http://www.solarpowerbeginner.com/images/247xNxsolar-panel-diagram-3.gif.pagespeed.ic.bbc-pt-1TF.png

# HOW DO PHOTOVOLTAIC CELLS WORK?

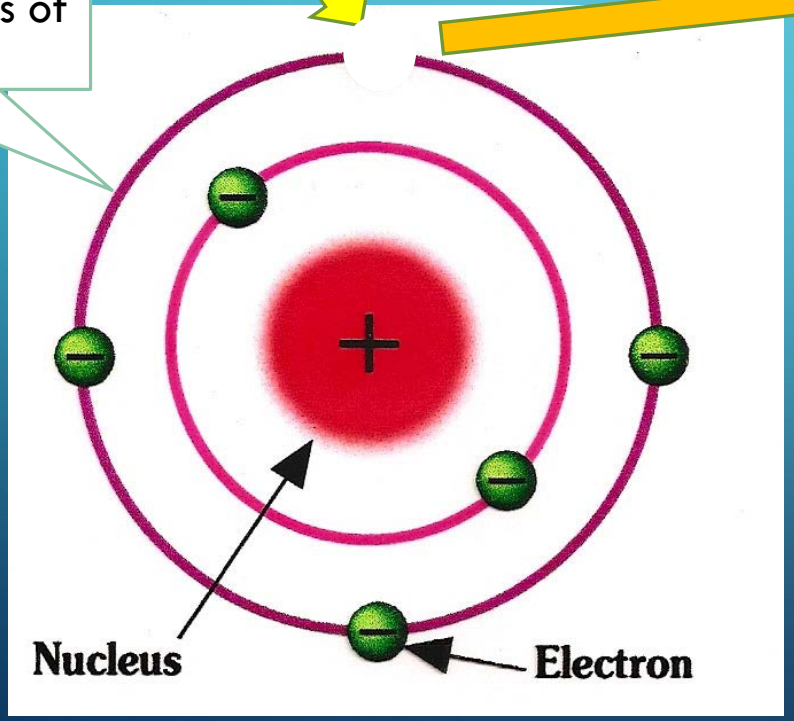
- The basic idea is to extract free electrons from the material that makes up a solar cell and draw the electrons into a circuit for distribution of the electrical energy.

# WHERE DO THE ELECTRONS COME FROM?

- We all know that atoms have a nucleus that is surrounded by electrons. The outer band of electrons is called the valance band. The energy from the photons excites (adds energy to) the electrons on the valance band of the atom. The free electrons are removed from the valance band across the band gap to the conduction band. The photovoltaic cell then draws the free electron in a specified direction to be used in an electric current.

Photons from the sun excite (add energy to) the electrons on the valance band.

Atom of a N-Type material. (has an excess of electrons).




Using the extra energy from the photons, the electron then moves off of the valance band and is free to be used for electricity.

http://winking-falcon.com/engineering%20web/2manufacturing/electronics/atom.jpg

# WHAT ARE THE FACTORS THAT MAKE A SOLAR CELL EFFECTIVE?

- Color of light
  - The sun produces a full spectrum of light.
- Angle of light entering the PV cell.
- Intensity of light.
- Efficiency of PV cell to convert photons into electricity.
- Temperature

# PRACTICE

- We will now complete a lab to determine what factors affect a photovoltaic cell's ability to create electricity?