How Do Solar Cells Work?

By Sharon Fabian

[1] Solar energy is the most renewable form of energy of all. There is more solar energy coming at us than we will ever need. The problem, of course, is finding ways to capture and use that energy.

[2] Scientists have been making solar cells to do just that since the 1800s. The first solar cell was created in 1883. It was about one percent efficient - no good for anything but experimenting in the lab.

[3] It wasn't until the energy crisis of the 1970s that scientists began to think seriously about using solar energy to produce power for our everyday needs. Today, solar cells are much more efficient than the original ones. Small solar cells power devices like watches and calculators. Solar cells can be combined in large groups called modules. Modules can be combined into even larger formations called arrays. In this way, solar energy can be used to provide power for everything from lights to home heating systems to satellites.

[4] Whether in a small calculator or on the wing of a satellite, solar cells all work in about the same way. Solar cells are made of chemicals known as semiconductors, the same chemicals used in computer chips. Silicon is the chemical most commonly used in solar cells.

[5] These chemicals have special properties. They are useful in solar cells because they absorb sunlight. This is due to the arrangement of their electrons. Like all atoms, silicon has electrons arranged in shells. In the case of silicon, the first two shells are filled, but the third shell is only half full. Since they have empty spaces, silicon atoms are always searching for electrons from other atoms to fill up those spaces. This movement of atoms begins to generate a current.

[6] To make the process efficient, chemicals such as phosphorus and boron are added to the silicon. This part of the process is called doping. It helps to set up a constant flow of electrons.

[7] In the solar cell, there are negative atoms with free electrons and positive atoms with extra spaces in their electron shell. The boundary between the two types of atoms is where the current will be generated, turning sunlight into electricity.

[8] Solar cells have metal contacts that draw off the current for use as electricity. Anti-reflective coatings on the solar cells reduce loss of electricity due to reflection. With cells combined into modules and arrays, large amounts of electricity can be produced.

[9] Depending on their intended use, more steps are needed to get the solar cells ready. One example is the solar panels that are put on house roofs. These must be placed carefully to make full use of the available sunlight. They must be pointed in the right direction and angled just right. On houses in the northern hemisphere, solar cells should be aimed at the South Pole. They must also be placed where they will not be shaded by trees.

[10] Arrangements must be made to store some of the energy collected by the solar cells during the day for nighttime use. There are two ways to do this. One is by using a battery. A charge controller helps the battery last longer. Even so, batteries do not last indefinitely, and they will eventually need to be replaced. Another way to store solar energy for nighttime use is by tying the solar cells into the utility company's power grid. In this way it is possible to sell excess solar energy to the power company during the day and buy it back as needed during the night.

[11] Some uses of solar power are efficient and save money. Others are less practical and still expensive. In the future, scientists hope to make solar cells more efficient. They hope to find ways to use different chemicals and new ways of manufacturing solar cells. Then everyone will be able to use solar power, the most renewable form of energy on the planet.

Name _____ Science Pd. _____

How Do Solar Cells Work?

1. Scientists began trying to find ways to use solar power to provide energy for everyday use in _____.
   - (A) The 1800s
   - (B) 1790
   - (C) The 1970s
   - (D) 1883

2. Solar power is used to power satellites in space.
   - (A) False
   - (B) True

3. The chemicals used in solar cells are also used in _____.
   - (A) Printers
   - (B) Spaceship frames
   - (C) Computer chips
   - (D) Spaceship engines

4. All of the following chemicals are often used in solar cells except _____.
   - (A) Boron
   - (B) Phosphorus
   - (C) Iron
   - (D) Silicon

5. Solar roof panels need the protection of shade trees.
   - (A) False
   - (B) True

6. Energy from solar cells can be stored for use when the sun is not shining by _____.
   - (A) Neither
   - (B) Tying into the utility grid
   - (C) Using a battery
   - (D) Both

7. One of the most effective uses of solar power so far has been on satellites and other space vehicles. Why do you think this is so?

   _____

   _____

8. Name two uses of solar power.

   _____

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