INTRODUCTION TO SOLAR

Information from NEED Project 2008 (Energy Infobook) & NASA (Website)

WHAT IS SOLAR ENERGY?

Every day, the sun radiates (sends out) an enormous amount of energy—called **solar energy.** It radiates more energy in one second than the world has used since time began. This energy comes from within the sun itself.

Like most stars, the sun is a big gas ball made up mostly of hydrogen and helium gas. The sun makes energy in its inner core in a process called **nuclear fusion.**

Only a small part of the solar energy that the sun radiates into space ever reaches the earth, but that is more than enough to supply all our energy needs. Every day enough solar energy reaches the earth to supply our nation's energy needs for a year!

It takes the sun's energy just a little over eight minutes to travel the 93 million miles to earth. Solar energy travels at a speed of 186,000 miles per second, the speed of light.

Today, people use solar energy to heat buildings and water and to generate electricity.

SOLAR COLLECTORS

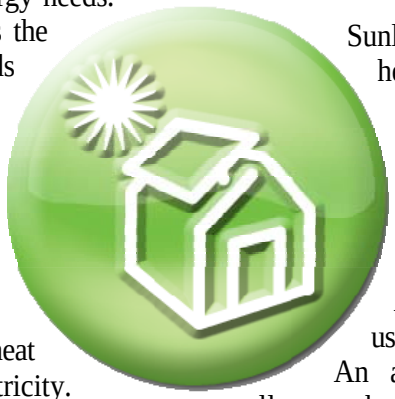
Heating with solar energy is not as easy as you might think. Capturing sunlight and putting it to work is difficult because the solar energy that reaches the earth is spread out over a large area. The sun does not deliver that much energy to any one place at any onetime.

The amount of solar energy an area receives depends on the time of day, the season of the year, the cloudiness of the sky, and how close you are to the earth's equator.

A solar collector is one way to capture sunlight and change it into usable heat energy. A closed car on a sunny day is like a solar collector. As sunlight passes through the car's windows, it is absorbed by the seat covers, walls, and floor of the car. The absorbed light changes into heat. The car's windows let light in, but they don't let all the heat out. A closed car can get very hot!

SOLAR SPACE HEATING

Space heating means heating the space inside a building. Today, many homes use solar energy for space heating. A **passive solar home** is designed to let in as much sunlight as possible. It is like a big solar collector.



Sunlight passes through the windows and heats the walls and floor inside the house. The light can get in, but the heat is trapped inside. A passive solar home does not depend on mechanical equipment, such as pumps and blowers, to heat the house.

An **active solar home,** on the other hand, uses special equipment to collect sunlight. An active solar house may use special collectors that look like boxes covered with glass.

These collectors are mounted on the rooftop facing south to take advantage of the winter sun. Dark-colored metal plates inside the boxes absorb sunlight and change it into heat. (Black absorbs sunlight better than any other color.) Air or water flows through the collectors and is warmed by the heat. The warm air or water is distributed to the house, just as it would be with an ordinary furnace system.

SOLAR HOT WATER HEATING

Solar energy can be used to heat water. Heating

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water for bathing, dishwashing, and clothes washing is the second biggest home energy cost.

A solar water heater works a lot like solar space heating. In our hemisphere, a solar collector is mounted on the south side of a roof where it can capture sunlight. The sunlight heats water in a tank. The hot water is piped to faucets throughout a house, just as it would be with an ordinary water heater. Today, more than one million homes and 200,000 businesses in the U.S. use solar water heaters.

SOLAR ELECTRICITY

Solar energy can also be used to produce electricity. Two ways to make electricity from solar energy are photovoltaics and solar thermal systems.

Photovoltaic Electricity

Photovoltaic comes from the words *photo* meaning *light* and *volt*, a measurement of electricity. Sometimes photovoltaic cells are called PV cells or solar cells for short. You are probably familiar with photovoltaic cells. Solar-powered toys, calculators, and roadside telephone call boxes all use solar cells to convert sunlight into electricity.

Solar cells are made up of silicon, the same substance that makes up sand. Silicon is the second most common substance on earth. Solar cells can supply energy to anything that is powered by batteries or electrical power.

Electricity is produced when sunlight strikes the solar cell, causing the electrons to move around. The action of the electrons starts an electric current. The conversion of sunlight into electricity takes place silently and instantly. There are no mechanical parts to wear out.

You won't see many photovoltaic power plants today. Compared to other ways of making electricity, photovoltaic systems are expensive.

It costs 10-20 cents a kilowatt-hour to produce electricity from solar cells. Most people pay their electric companies about nine cents a kilowatt-hour for the electricity they use, large industrial consumers pay less. Today, solar systems are mainly used to generate electricity in remote areas that are a long way from electric power lines.

Solar Thermal Electricity

Like solar cells, **solar thermal systems** use solar energy to produce electricity, but in a different way. Most solar thermal systems use a solar collector with a mirrored surface to focus sunlight onto a receiver that heats a liquid. The super-heated liquid is used to make steam to produce electricity in the same way that coal plants do.

Until recently, the most successful thermal power plant was the LUZ plant in the Mojave Desert of California. LUZ made electricity as cheaply as most coal plants. In 1992, LUZ shut down because of financial problems.

Solar energy has great potential for the future. Solar energy is free, and its supplies are unlimited. It does not pollute or otherwise damage the environment. It cannot be controlled by any one nation or industry. If we can improve the technology to harness the sun's enormous power, we may never face energy shortages again.

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Sun Facts

- The sun is a star. This makes it extremely important for life on Earth. The sun provides us with energy, which brings life on our planet. It defines the seasons, the harvests, and even the sleep patterns of all living creatures on Earth.

- The sun is the closest star to our planet. Imagine two cars on the road during the night with their headlights on. One car is closer to you and the other one is far away. Which headlights would seem brighter and bigger? That explains why we see the sun so big and bright. It is simply the nearest star to Earth.

- Remember! The Earth orbits around the sun.

- The sun is way bigger than the Earth. In fact its radius is 109 times bigger than the radius of the Earth. For those of you who are curious, the sun's Radius is 696,000km and the Earth's radius is 6, 376km.

- DON'T TOUCH THE SUN! IT'S HOT! The sun's average surface temperature is 5700 C. Compare that to the Earth's average temperature, which is 20 C.

- The sun is 150 million km (93 million miles) away from the Earth.

- How old is the sun? Can you imagine 4.5 billion years?

- We know that the Earth's structure consists of different layers. The sun also has layers but unlike the Earth, the sun is entirely gaseous; there is no solid surface.

- The sun rotates on its axis approximately once every 26 days. The sun is made of gas, which is why its different parts rotate at different speeds. The fastest rotation is around the equator and the slowest rotation is at the sun's polar regions (more than 30 days).

- The sun changes. No matter when or where we look at the sun, we will always see something interesting. Scientists observe these changes by watching the sunspots. They increase and decrease on a regular cycle of about 10.8 years.