SOLAR ENERGY

WHY SOLAR ENERGY?

The sun is our most powerful energy resource. It heats our planet and nourishes the plants we eat. Without the sun, we could not exist. The energy from the sun is there for the taking. It is not only free, it never runs out. If we could harness all of the sun's energy that falls on one square meter of the Earth's surface for one hour, we could light up a whole city for one year. Also, the energy from the sun poses no environmental hazards.

THE CHALLENGE OF TAPPING THE SUN'S ENERGY

With these many advantages, why are we not using solar energy to meet all of our energy needs? The answer is that tapping the sun's energy is not a straightforward process. To effectively use the sun, it must be constantly available. Yet, even under ideal weather conditions, the sun does not shine 24 hours a day, 365 days a year. To be useful, sunlight must be collected, moved to where it is needed, and stored. This is no easy challenge.

People have been using the sun's energy for thousands of years for space and water heating purposes. With the beginning of the space age, scientists were able to develop a system that converts sunlight into electricity. This is called a photovoltaic system. Utilizing the sun's energy is categorized into three main systems. These are:

- **Passive Systems**;
- **Active Systems**; and
- **Hybrid Systems**.

The last, a hybrid system is some combination of the other systems. In all of the systems, they must face the sun in order to work. We know that the sun moves across the sky during the day from the east to the west. This creates the problem of where to face the system to get the maximum amount of energy from the sun. The answer is to position the system so that it faces due south, or only slightly east or west of south. There also is solar technology available that will allow solar panels to move or "track" the sun as it moves across the sky. This helps increase the efficiency of these solar panels. For more information about these systems, visit **www.eesi.org/topics/solar/description**.

PASSIVE SOLAR SYSTEMS

Passive solar systems do not use any mechanical equipment to move the energy. In these systems, the actual building components become part of the system. These components, or thermal storage materials, are used to store heat during the day for use at night. Among the most commonly used thermal storage materials are tile, concrete, brick, and water. All of these materials are very good at absorbing and holding heat. As with all systems that utilize solar energy, location is a most important consideration in designing a passive solar house. To be most effective, the windows in a passive solar house must face south. In this position, they will be exposed to maximum sunlight. In addition, insulation should be placed around the glass to reduce heat loss. Windows, doors, and walls need to be free of leaks so that trapped heat stays trapped.

Outside landscaping is another important part of passive solar systems. For example, evergreen trees that won't lose their leaves in winter can be planted on the north side of a home to provide winter wind protection. Trees that lose their leaves in winter can likewise be planted on the south side of a home to give it access to winter sunlight and to protect it from hot, summer sunshine.

Learn more about passive solar home design at **www.energy.gov/energysaver/energy-efficient-home-design/passive-solar-home-design**.

ACTIVE SOLAR SYSTEMS

Active solar systems use mechanical and electrical equipment such as pumps, photovoltaic panels and fans to move energy around. Four types of active systems are discussed in this section. Space heating, water heating, photovoltaic systems, and concentrated solar power. A house using active space heating will have to face south, with most of its windows on the south wall. This allows winter sunlight to enter the house, thereby heating the air inside. This heated air is then circulated throughout the house by fans.

When sunlight passes through glass into an enclosed space, the wavelength of the light changes. This new wavelength can not pass back through the glass, thereby entrapping it in the house. This is known as the greenhouse effect. Think of it just like getting into the car on a cold winter day and finding the inside of the car warm.

More equipment needs to be added to the system if night time heating is necessary. The air is heated in collectors and circulated through a rock bed storage compartment. This is an insulated box which contains small rocks. These rocks are heated during the day, and at night, the air inside the home is circulated through the rock bed. As it passes through the rocks, it extracts the stored heat, and heated air is circulated back through the house.

Water heating systems are more complicated than space systems and can be used year-round. A collector panel is mounted on the roof (facing south). This consists of an insulated box with a clear glass or plastic cover. Inside this panel are many copper pipes and fins. These pipes are painted black to absorb and conduct the sun's heat to the water that is pumped through them. This collector panel is attached to the water heater tank which is located inside the house.

The water is circulated between the collector and the water tank by electric pumps. Cold water is pumped from the water tank to the collector, and hot water is pumped back from the collector to the water tank. Thermosensors, which recognize changes in temperature, tell the pump when to cut on and off.

Concentrated solar power (CSP) is an active system distinguished from other solar energy systems by its ability to function as a utility-scale power plant. CSP uses fields of mirrors to concentrate solar energy into channels holding heat-responsive fluid. The high temperatures excite the fluid to a point where it powers a turbine or engine, which in turn runs an electric generator. More information on concentrated solar projects is available at the U.S. Department of Energy's website – **www.energy.gov/lpo/concentrating-solar-power-projects**.

Photovoltaic systems are a type of active system. They convert radiant energy from the sun into electricity. While photovoltaic technology has been around for more than 150 years, its actual development did not occur until 1954. It was first used in 1958 to provide electric power for U.S. spacecraft and satellites.

The cost of producing electricity through photovoltaic technology has dropped significantly in the past few years. Prices have gone from more than $12 per watt to less than $4 per watt. Lawrence Berkeley National Lab tracks this information each year. For more information, visit **https://emp.lbl.gov/tracking-the-sun**.

Photovoltaic systems, while once seen as too expensive, are becoming more commonplace. Photovoltaic systems are often used in remote areas, where it is too expensive for power companies to bring in electric power lines. Also, they are being used to light road signs and bus shelters. Researchers developing electric cars are making use of photovoltaic technology as well.

***SOURCE:** **www.eesi.org/topics/solar/description**