

## Solar Power

### History

Solar energy is the most readily available source of energy on the planet. Every hour the sun sends enough energy to power the entire planet for a year! Capturing the sun's energy to do work for us began in the 7<sup>th</sup> century BCE when magnifying lenses were used to light fires. In the 18<sup>th</sup> and 19<sup>th</sup> century, solar technology really began to heat up with the invention of solar ovens and the discovery of the photovoltaic effect (the creation of electric current in a material upon exposure to light). During the late 1800's and throughout the 1900's, three different solar technologies emerged: solar photovoltaics , concentrating solar power and passive solar (discussed more below).

In the early 1960's satellites in the United States and Soviet space programs were powered by solar cells and in the late 1960's solar power was basically the standard for powering space bound satellites.

The period from the 1970's to the 1990's saw a change in the use of solar cells. Solar cells began powering railroad crossing signals and in remote places to help power homes, Australia used solar cells in their microwave towers to expand their telecommunication capabilities. Desert regions used solar power to assist with irrigation, when other means of power were not available. Today, you may see solar powered cars and solar powered aircraft.

Recently new technology has provided such advances as screen printed solar cells. There is now a solar fabric that can be used to side a house and solar shingles for roofing. International markets have opened up and solar panel manufacturers are now playing a key role in the solar power industry.

Today, many advances in solar technology are propelling it into the forefront of the alternative energy movement.

### Pros and Cons

Solar energy is a renewable resource which we tend to think of as being better than non-renewable types of energy that use fossil fuels. However, like any other resources, hydro-electric power has both pros and cons.

#### **Pros:**

- ❖ Indefinitely renewable: as long as the sun shines we will have access to solar energy.
- ❖ Requires little maintenance after initial set-up.
- ❖ Solar technologies are silent.
- ❖ Solar technologies pay for themselves, and the federal government offers tax incentives to those who use solar power.

#### **Cons:**

- ❖ It is an intermittent energy source. It cannot produce electricity at night and produces limited electricity when it is cloudy.
- ❖ Initial set-up is expensive, and it requires more space than other renewable energy resources.
- ❖ Rare and expensive materials are used to make some types of solar panels.
- ❖ There is some pollution associated with the manufacturing of solar panels, but total emissions from fossil fuels are much greater than solar technologies.

## **How It Becomes Usable Energy**

### *Photovoltaics /Solar Panel*

Most people think of solar photovoltaics (PV), or solar panels, when they think of solar power. Simply put, PV cells are filled with a material that captures the sun's energy and converts it into electrical current. When photons (or energy packets from the sun) hit the semiconductor material inside a PV cell, electrons are knocked loose. These electrons travel through the positively and negatively charged layers of the cell. This creates an electrical current that is harnessed by wires connected to the cell. Check out this [video](#) by the U.S. Department of Energy for more information. PV arrays (a collection of PV cells) are commonly used for residential building, offices, generating electricity in remote areas, small machine such as calculators and in space satellites. However, PV cells are expensive and inefficient compared to other technologies (although they are improving every year). For that reason, a different method, known as concentrating solar power, is used to generate enough electricity to power cities.

### *Concentrating solar power*

Concentrating solar power (CSP) is the process of collecting solar energy on a large scale. One method utilizes parabolic troughs, or curved mirrors that concentrate solar rays, to heat up a liquid that runs through a tube. This liquid is then used to heat water, which creates steam. The steam rotates a turbine that is connected to a generator. The generator creates electricity that is put into the power grid for use by cities. Check out this [video](#) to learn more about this process.

### *Passive Solar*

Just as the name suggests, passive solar refers to the process of collecting solar energy without any ongoing activity. The idea behind solar power is to place objects that we want to heat, like homes or water tanks, in a place where the sun will heat them naturally. Generally, this means placing them in a south-facing orientation so that they will receive sunlight all day. Additionally, you can enhance the natural heat of the sun in homes by installing large windows to let it in, using dark or stone materials to absorb it, and by having good ventilation to move it around.

### *Solar Energy in West Virginia*

West Virginia receives between 4 and 5 kWh/m<sup>2</sup>/Day on average. This would not make West Virginia a smart choice for large-scale solar power. However, small scale and passive solar sources could work in sunny spots. In particular, remote locations and cities could benefit from solar power technologies. According to the U.S. Energy Information Association, the average American home uses 29.6 kWh/day.

That means that in order to power a West Virginia household with solar power you would need approximately 7.4 m<sup>2</sup> in solar paneling. Many people who choose to power their homes with PV cells hook into the power grid, sell the electricity made during the day back to the grid and buy electricity back during cloudy weather or at night time. Currently, solar power creates less than 1% of the electricity in West Virginia ([Energy Efficient West Virginia](#)).

### **Cool Facts**

- ❖ NASA has been working on a series of solar-powered unmanned aircrafts since the 1980s.
- ❖ The world's largest concentrating solar power plant, Ivanpah Solar Power Facility, opened in 2014, in San Bernardino, CA. The second largest CSP plant is also in California, located in the Mojave Desert.
- ❖ In 1921, Albert Einstein won the Nobel Prize for his theories on the photoelectric effect.

### **Activities**

[Ice Cube Meltdown](#)

[Solar Oven](#)

[Melted Bead Suncatchers](#)