

# Energy From the Sun

## What is Solar Energy?

Every day, the sun radiates (sends out) an enormous amount of energy. It radiates more energy each day than the world uses in one year. Solar energy is a **renewable** energy source.

The sun's energy comes from within the sun itself. Like most stars, the sun is made up mostly of hydrogen and helium atoms in a plasma state. The sun generates energy from a process called **nuclear fusion**.

During nuclear fusion, the high pressure and temperature in the sun's core cause **nuclei** to separate from their electrons. Hydrogen nuclei fuse to form one helium atom. During the fusion process, **radiant energy** is released. It can take 150,000 years for energy in the sun's core to make its way to the solar surface, and then just a little over eight minutes to travel the 93 million miles to Earth. The radiant energy travels to the Earth at a speed of 186,000 miles per second, the speed of light.

Only a small portion of the energy radiated by the sun into space strikes the Earth, one part in two billion. Yet this amount of energy is enormous. The sun provides more energy in an hour than the United States can use in a year! About 30 percent of the radiant energy that reaches the Earth is reflected back into space. About half of the radiant energy is absorbed by land and oceans. The rest is absorbed by the atmosphere and clouds in the **greenhouse effect**.

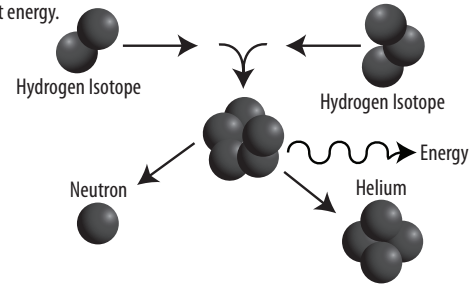
In addition to supplying a large amount of energy directly, the sun is also the source for many different forms of energy. Solar energy powers the water cycle, allowing us to harness the energy of moving water. Solar energy drives wind formation, allowing us to use wind turbines to transform kinetic energy into electricity. Plants use solar energy in the process of photosynthesis. Biomass can trace its energy source back to the sun. Even fossil fuels originally received their energy from the sun.

## How We Use Solar Energy

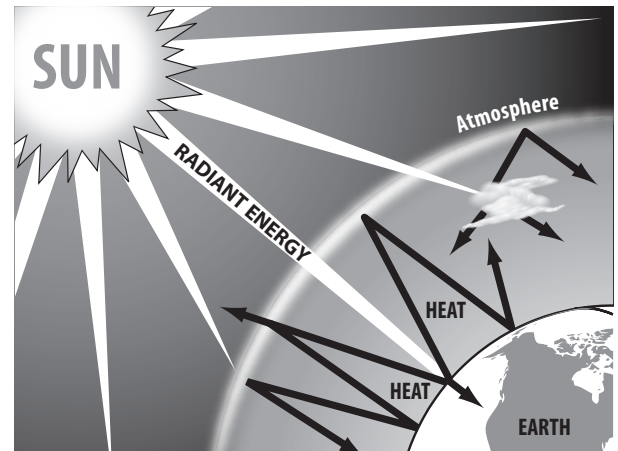
People have harnessed solar energy for centuries. As early as the seventh century BCE, people used basic magnifying glasses to focus light from the sun to make fire. Over a century ago, a scientist in France used a solar collector to make steam to power an engine. Solar water heaters gained popularity in the early 1900's in the southwest United States. Today, people use solar energy to heat buildings and water and to generate electricity. In 2015, solar energy accounted for just over 0.4 percent of U.S. energy consumption – less than one percent! The top producing solar energy states include many of the sunny, warm states in the western United States.

### Fusion

The process of fusion most commonly involves hydrogen isotopes combining to form a helium atom with a transformation of matter. This matter is emitted as radiant energy.



### The Greenhouse Effect



Radiant energy (light rays) shines on the Earth. Some radiant energy reaches the atmosphere and is reflected back into space. Some radiant energy is absorbed by the atmosphere and is transformed into heat (dark arrows).

Half of the radiant energy that is directed at Earth passes through the atmosphere and reaches the Earth, where it is transformed into heat.

The Earth absorbs some of this heat, but most of the heat flows back into the air. The atmosphere traps the heat. Very little of the heat escapes back into space. The trapped heat flows back to the Earth. This is called the greenhouse effect. The greenhouse effect keeps the Earth at a temperature that supports life.

### Top Solar States (Net Generation), 2015



Data: Energy Information Administration