Energy Sources

Heat is very important in our daily lives. We heat our homes and wear insulating clothes to keep warm in the winter. We heat water for showering and for cooking. Each of these processes involves the transfer of thermal energy. What are the sources of thermal energy?

**Solar Energy and Geothermal Energy**

The most obvious direct source of energy on Earth is the Sun (Figure 1). The Sun provides over 90% of the energy that warms Earth’s surface and atmosphere. The Sun’s energy comes from deep within its core. This is where nuclear reactions release huge amounts of energy. Most of this energy, called solar energy or radiant energy, moves away from the Sun in all directions as visible light and infrared radiation.

A tiny fraction of solar energy eventually reaches Earth. Here, some of it is absorbed and converted into thermal energy. It is this energy that heats the land and air, evaporates water, and produces winds, clouds, and precipitation. Earth would quickly become a lifeless deep freezer without the continuous supply of energy from the Sun!

Earth also possesses a large store of geothermal energy. Recall that geothermal energy is the thermal energy contained in the hot core and mantle of Earth. Engineers have developed ways of harnessing this thermal energy for our use.

Solar energy and geothermal energy are large continuous sources of thermal energy. However, they are not the only sources.

---

**Solar energy**: radiant energy (mostly visible light and infrared radiation) produced at the Sun’s outer surface and radiated out into space

**Figure 1** The Sun is the source of most of our energy, even though Earth only captures a tiny portion of the energy emitted by the Sun.

A tiny fraction of solar energy eventually reaches Earth. Here, some of it is absorbed and converted into thermal energy. It is this energy that heats the land and air, evaporates water, and produces winds, clouds, and precipitation. Earth would quickly become a lifeless deep freezer without the continuous supply of energy from the Sun!

Earth also possesses a large store of geothermal energy. Recall that geothermal energy is the thermal energy contained in the hot core and mantle of Earth. Engineers have developed ways of harnessing this thermal energy for our use.

Solar energy and geothermal energy are large continuous sources of thermal energy. However, they are not the only sources.
Energy Transformations
Many forms of energy, such as chemical energy, can be transformed into thermal energy. Wood and other fuels, such as oil and natural gas, contain large quantities of chemical energy. The chemical energy in wood is transformed into thermal energy when wood is burned (Figure 2). Natural fires, such as forest fires, can be harmful for wildlife. Controlled fires, such as the burning of fuels in furnaces, car engines, and thermal-electric power stations, are useful for humans (Figure 3).

Figure 2  The chemical energy stored in wood is sometimes released in forest fires. Huge quantities of thermal energy are released to the atmosphere, along with gases and ash.

When you rub your hands, you produce friction, the force produced when objects rub against each other. Just rubbing your hands together produces thermal energy. The motion of your hands (mechanical energy) increases the kinetic energy of the particles in your skin. This results in warmer skin. Friction can convert mechanical energy into thermal energy and radiant energy (light). This occurs when a hard, rough, fast-moving surface rubs against another surface (Figure 4).

Thermal energy is extremely useful for heating. However, we also need energy for cooling, lighting, communication, transportation, and manufacturing. Our modern lifestyle and high standard of living depend on having energy available to meet our wants and needs.

Figure 3  In home furnaces, the chemical energy stored in natural gas is released in a very controlled fashion. This energy is then used to warm your home.

friction: a force produced when objects rub against each other

Figure 4  The sparks tell us that both radiant energy and thermal energy are released when metal is being cut.
Many everyday technological devices use electricity as their direct energy source. The devices convert the electricity into other forms of energy. Where does the electricity come from in the first place?

**Sources of Electrical Energy**

There is no ready-made usable source of electricity anywhere in the world. Electricity is produced naturally—by lightning in thunderstorms—but not in a form that we can use (Figure 5).

So far, scientists and engineers have not developed an effective method for harnessing the energy in lightning. We need to generate electrical energy from other sources. Scientists and engineers have invented devices that transform almost all other forms of energy into electricity. For example, hydro-electric generating stations transform the mechanical energy of falling water into electrical energy. Nuclear power plants (nuclear reactors) convert nuclear energy into electricity. Thermal-electric power stations convert the chemical energy in certain fuels into electricity. Other forms of energy that can be transformed into electrical energy include radiant energy from the Sun (solar energy), mechanical energy of wind (wind energy), and geothermal energy.

The production and consumption of useful energy has significantly improved our standard of living. This use of energy, however, is also responsible for many serious impacts on the environment, including air and water pollution, and climate change. In the remainder of this chapter, we will examine the different ways in which useful energy is produced. We will also consider the advantages and disadvantages of energy production and use, and environmental impacts of energy use and production. We will suggest some ways to minimize the negative impacts.

![Figure 5](image)

**Figure 5** Lightning contains a lot of electrical energy that scientists have not yet been able to harness effectively.

<|endoftext|>