

If modern technologies that use energy suddenly became unavailable, there would be no television or radio, no ride to school in a bus or car, no heat or air conditioning, and little light in offices and classrooms. Much of the energy used today comes from fossil fuels such as coal and oil. Even though fossil fuels are made naturally on Earth, the process takes millions of years. If people keep depleting these fuel sources at the current rate, fossil fuels will run out before the supply can be replenished. In addition, the refinement and burning of fossil fuels causes air pollution, acid rain, and other environmental dangers.



The process of turning oil into a usable fuel contributes to air pollution.

Fossil fuels are considered nonrenewable. Scientists are researching alternative fuel sources that can be replenished as they are used. As with fossil fuels, however, renewable energy sources have advantages and disadvantages.

## Hydropower

Moving water is a powerful force that can erode mountains and carve canyons. Scientists have learned how to turn the power of moving water, or hydropower, into electricity using large fanlike machines, called turbines, which move when pushed by water. As a turbine turns in a hydroelectric power plant, the motion is converted into electricity. The electricity can be generated as long as there is enough water to move the turbines.



Dams store water that can be used to generate electricity. If more electricity is needed, parts of the dam can open to release more water.

Hydroelectric turbines can be placed at the bottom of dams, behind which a lot of water is stored. If more electricity is needed, more water can be released and moved through the turbines. The hydroelectric power industry

hopes to add more hydroelectric generators at existing dams in the future.

Dams can have a negative impact on the environment. The water stored behind a dam sometimes increases in temperature, changing the aquatic environment and harming the organisms that live there. Also, building hydroelectric plants can be expensive. There are benefits, however. Growth in this industry will create jobs as scientists, engineers, and other workers are needed to design, build, and maintain these power plants. Also, generating hydroelectric power is less damaging to the environment than refining fossil fuels. Today, 7% of all electricity in the United States comes from hydroelectric power.

### **Geothermal Energy**

The magma below Earth's surface has helped shaped our planet. As heat energy moves the magma around below Earth's crust, the magma pushes against the crustal plates. The force of this movement can form mountain ranges and deep ocean trenches. The heat from magma, known as geothermal energy, warms natural hot springs around the world.

The geothermal energy stored in Earth's interior can also be used as a power source. This energy can be used to heat water for nearby areas. The energy can also be used to generate electricity. In a geothermal power plant, heat from below Earth's surface is used to heat water and create steam. The steam is then used to turn the blades of turbines that generate electricity. Scientists have estimated that, if harnessed, geothermal energy could fully meet the needs of today's society.

Of course, there are some disadvantages to this source of energy. Some areas of Earth's crust are thinner than others, and geothermal energy is easier to access in these places. More energy can be accessed from deeper below the surface, but drilling too deep into Earth's crust can contribute to earthquakes. In fact, a geothermal project in Switzerland was



Natural hot springs like those found in Yellowstone National Park are heated from the energy of Earth's interior.

shut down in 2009 because the government realized that the damage caused by potential earthquakes would cost millions of dollars. As with other alternative energy sources, scientists continue to research better, safer, and less expensive ways to access this power source.

## **Biomass**

Another alternative energy source is biomass. Biomass refers to organic waste, or material that was once part of living things. Biomass includes leftover food, forest debris, manure, and leftover lumber scraps.

Biomass has been burned as a fuel for many years, and supplies are good because the organic materials are already being created by ongoing human activities. Organic waste can be mixed with coal or burned in plants that were originally designed to use coal, which makes it unnecessary to build new plants to begin taking advantage of this energy source. However, burning biomass, just like burning any fuel, contributes to air pollution.

There are other ways to harvest the power of biomass without damaging the atmosphere. As waste decomposes, the waste releases methane gas and carbon dioxide. Scientists have developed technology to create an environment that encourages this reaction. The gases can then be used to move turbines that generate electricity. This process releases less air pollution but can initially cost more to set up.

## **Solar Power**

Scientists have been trying to harness the power of the sun's light for many years, and solar technology has come a long way. People can now buy solar panels for their homes, and businesses can set up thousands of solar panels in an area to generate and sell electricity. Solar power can be used to power calculators, street lights, highway signs, and even trash compactors in urban areas.



Leftover woodchips are one source of biomass.



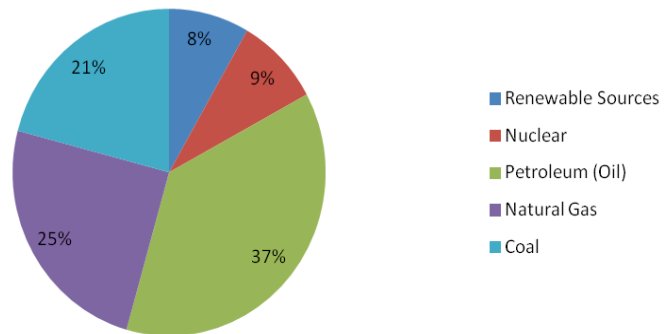
Solar panels are made of materials that can turn the sun's energy into electricity.

On a sunny day, solar power warms some materials, such as asphalt and metals. Other materials, such as silicon, can generate electricity when these materials absorb energy from the Sun. The Sun's energy excites the electrons in the silicon atoms, and the energy that is released can be transformed into electricity.

Solar power is more expensive than fossil fuels. Scientists must continue to develop more inexpensive ways to generate electricity using the sun before this energy source becomes more popular. Solar power is also not as reliable as other sources, since it is most efficient when sunlight is available. Energy needs might increase, but the amount of sunlight available cannot be adjusted on demand.

People use a great deal of energy every day. Scientists have not found a single energy source that can meet everyone's needs. Each source of energy has positive and negative aspects. In general, as the use of alternative energy sources increases and reliance on fossil fuels decreases, more jobs will be created for skilled workers. Ongoing research may lead to discoveries of new energy sources or better ways to use current sources. For now, however, our energy will continue to be harnessed from a variety of sources to meet our needs.

**United States Energy Consumption by Source, 2009**



Energy in the United States comes from a variety of sources.

## QUESTIONS

1. Hydropower, geothermal energy, biomass, and solar power are each alternative energy sources to fossil fuels. What are advantages of all of these alternative energy sources compared to fossil fuels?
  
  
  
  
  
  
  
  
  
  
2. Which alternative energy source do you think would be most useful in your region? Explain your choice.

## RESEARCH PROJECT

Research the advantages of using geothermal resources to provide energy in your region. You may wish to find out if a company provides geothermal energy to heat homes in your community, or if a geothermal power plant provides electricity. Prepare your findings in an oral or written report.