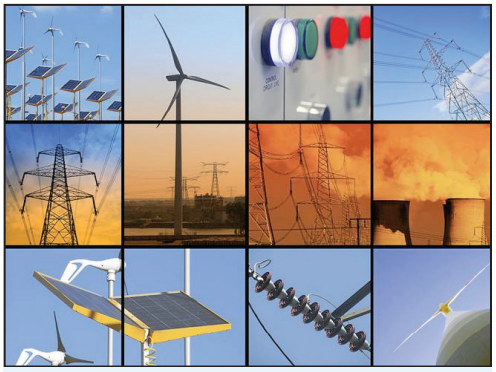
## reflect

Millions of years ago, certain plants and animals living on Earth died. Over time their bodies decayed and became part of the soil. The energy held in their bodies did not disappear, however. Over time, additional layers of soil and rocks piled up on the ancient **matter**. Buried deep inside Earth, these organic materials were exposed to extremely high pressures and temperatures. They were transformed into new substances such as coal, oil, and natural gas.

**matter**: the stuff that makes up all things



Earth contains many different sources of energy in addition to fossil fuels.

Today we tap into these "fossil fuels." We use their energy to drive our cars, heat our homes, and run our factories. But the amount of coal, oil, and natural gas on Earth is limited, and it takes millions of years to create more. We are starting to run out of these fuels. What will happen when we completely run out? What are some alternatives to using these sources of energy?

**Why are certain energy resources called "alternative" resources?**
Most of the energy used to power our lifestyles at work, home, and school comes from fossil fuels. *Fossil fuels* are substances formed from decayed plant and animal matter over millions of years. They include some of the most common sources of energy such as gas, coal, and oil.

Although we use them in many ways, using fossil fuels has certain disadvantages. Removing them from the ground causes pollution. So does burning them. They are also *nonrenewable*, meaning we can't make more. Once the supply is used up on Earth, it cannot be replaced. Soon these natural resources will run out entirely. How will we power our lives without fossil fuels?

People are turning to alternative sources for energy. *Alternative energy resources* rely on processes that occur in nature to generate energy. There is energy in the wind, in running water, and in sunlight. Capturing this energy can provide the world with replacements to fossil fuels. Because these actions happen naturally and pretty regularly, alternative energy is a lot cleaner for the environment. Compared to fossil fuels, most alternative energy resources pollute air or water much less than burning fossil fuels. Using them doesn't damage the land like mining for coal or drilling for oil. Most alternative energy sources are also renewable. The Sun continues to shine, rivers continue to flow, and the wind continues to blow. This helps conserve Earth's natural resources. It also helps us rely more on renewable energy resources.

# ALTERNATIVE ENERGY

## what do you think?

Look at these pictures of wood, oil, and wind. Decide whether each picture shows a renewable or nonrenewable resource. Ask yourself, “Will the supply of this energy source run out? Can it easily be replaced?”


**What are some examples of alternative energy resources? How are they used?**
There is energy all around us in nature. Living things hold energy in their cells. Water and air hold energy in their movements. The Sun shines its energy onto Earth every day. Let’s examine a few alternative energy resources in more detail.

**Wind:** Wind energy comes from the movement of air. If you’ve ever been outside on a windy day, you know how much energy the wind can have. It can push you around and flip your umbrella inside out. In towns struck by tornadoes or hurricanes, the extremely strong winds can blow roofs off buildings and uproot trees.

To use wind as an alternative energy resource, its power must be captured and changed into electricity. Huge machines called wind turbines can do this. The blowing wind turns a propeller on the turbine. That energy spins a device that creates electricity. Wind turbines are usually placed at least 30 meters (100 feet) in the air so that they can capture the fastest winds. Some of them even turn in different directions to face the wind most efficiently!

## try now

Take a few minutes to explore the power of wind energy. For this activity, you will need a sheet of paper, a ruler, and masking tape. You will also need a small fan with at least two settings.

1. Find an area on the floor or outdoors where you have some space.
2. On one part of the floor, place a strip of masking tape that will be the starting line.
3. Wad the piece of paper up into a ball and place it on the starting line.
4. Using just your breath, blow the paper ball away from the starting line.
5. Use the ruler to measure the distance your breath could move the paper ball.
6. Now, ask two other people to use their breaths to move the paper ball. Then use the fan—first on the low setting, then on the high setting—to move the ball.
7. Look at the results from the measured distances. What was the farthest the paper ball moved? How did you increase the energy affecting the paper ball?

**Sun:** The Sun is the original source for all the energy on Earth. You can even trace the energy in fossil fuels to the Sun. The plants get their energy from sunlight. The animals then get their energy by eating the plants (or by eating animals that ate the plants). But the Sun's power can be used directly as well. Energy from the Sun is called *solar energy*.

When sunlight shines on an object, it changes to heat and the object warms up. If you've sat in the sunlight for a period of time, you have experienced this. Certain materials, though, change sunlight into electricity instead of heat. These materials are used to make things like solar panels that people install on the roofs of buildings. The energy captured by solar panels can be used to power the whole building, from heating the water to powering the computers.

**Water:** Moving water has been used for centuries as a power source. Ancient Greeks and Romans used water wheels to provide energy for grinding wheat into flour. Today, water flows through turbines placed inside **dams**. Like wind turbines, these water turbines spin and produce electricity that is sent to nearby homes. Hoover Dam, located on the border of Arizona and Nevada, holds water from the Colorado River. When the water moves through the turbines, it generates electricity that is used by people living in Arizona, Nevada, and California.

**dam:** a wall or barrier built to hold back water

**Plants:** Imagine your parents fueling up the car with vegetable oil or heating your home with cow manure. Sounds far-fetched, but there is energy in those substances! Similar to fossil fuels, living plants contain energy that can be used as an energy source. Fuel that is made from plants is called *biofuel*. When plant matter is burned, the energy in the plants is released. The energy is converted to power that people can use. As fossil fuels are used up, more people are turning to biofuels to drive their cars, run machinery, and heat their homes.

**Earth:** Underneath the surface of Earth, there are hot water and rock than can be used as alternative energy sources. Many states in the western United States tap into this natural resource. Engineers drill into Earth, creating

wells to release the heat. Sometimes the heat is used directly to heat buildings, water, and greenhouses for plants. Other times, hot steam is released from Earth. The steam spins a turbine, generating electricity. Sometimes the hot water shoots out from the surface naturally. This powerful force is called a geyser.

## what do you think?

Alternative energy resources have many advantages over fossil fuels. However, they can't all be used everywhere. It would be difficult to rely on solar power in a city where it is often cloudy, for example. Review the different sources of alternative energy. Describe the kinds of places where it might be good to use each energy resource. Which resources would be good to use where you live?

**Looking to the Future: Advantages of Alternative Energy Resources**

There are several advantages to using alternative energy resources over fossil fuels. First, alternative energy is renewable. There is no shortage of wind, Sun, or flowing water. Scientists predict that the oil we use to make gasoline might be used up as soon as the year 2050. Unlike fossil fuels, there is no need to worry about running out of alternative resources because nature replenishes them every day.

One of the most famous geysers is Old Faithful in Yellowstone National Park.

This building produces ethanol, a biofuel made from corn. Corn is a renewable energy resource. However, making and using ethanol creates pollution.

Another advantage to alternative energy resources is that they are better for the environment. Fossil fuels pollute in two main ways: they have to be dug out of the ground by mining or drilling (which pollutes the air), and they also pollute the air when they are burned. These processes damage the land and water—sometimes permanently. A major oil spill can kill aquatic animals and pollute beaches.

Fossil fuels pollute when they are used (or burned). They must be burned in order to get energy out of them. The chemicals released by burning fossil fuels pollute the air, water, land, and living things, including our bodies. Because we do not have to burn most alternative resources to release their energy, they do not pollute the air or water. The exception is biofuels, which are burned. However, they generally produce fewer harmful gases than fossil fuels.

## look out!

Alternative energy resources have lots of advantages, so why do we still use fossil fuels? The answer is that alternative energy resources also have some important disadvantages. Capturing energy from alternative resources is still more expensive than using fossil fuels. Using alternative energy is rather new. Most machines and processes—including driving most vehicles—still rely on fossil fuels. Replacing these machines, developing new technologies, and changing processes are costly. However, the world is moving in the direction to use more alternative energy. Perhaps by the time you're grown up, you'll be living in a solar house and driving a sugar-powered car!

**What do you know?**
Fossil fuels are the most common source of energy in the world. As we noted, however, there are many disadvantages to using them. Besides the pollution they cause, they are nonrenewable. Alternative energy resources provide benefits that fossil fuels cannot. They are renewable and provide cleaner energy. In the table below, identify the type of alternative energy resource that powers each object (Earth, plants, the Sun, flowing water, or wind). Then, list one advantage or one disadvantage of each resource. Some answers have been completed for you.

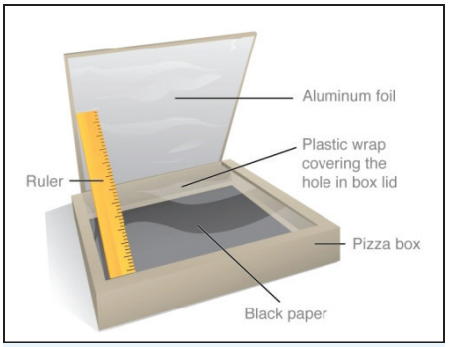
| Source of Energy | | | | | |
|---|---|---|---|---|---|
| **Use** | A bus that runs on corn oil | A public garbage can that compacts the trash on cloudless days | A waterfall that spins a turbine and makes electricity | A bathtub that fills with hot water from an underground spring | A propeller on top of a house that charges a generator used for electricity |
| **Advantage** | | Solar power is abundant and renewable. | | It can be used directly to heat homes. | |
| **Disadvantage** | Using crops for fuel can take away from food supplies. | | It is expensive to build large dams. | | The amount of power is not steady as the force of the air changes. |

# ALTERNATIVE ENERGY

## connecting with your child

**Alternative Energy at Home**

To help students learn more about alternative energy sources, set up experiments where they can demonstrate how these resources provide power for doing work. Building a solar cooker is one possible project that allows students to experience how alternative resources provide energy. This design focuses on solar energy, but encourage students to find other experiments that test the use of wind, hydroelectric, geothermal, and biomass alternative energy. A good place to find ideas is at the U.S. Department of Energy's website.




Your solar cooker should look like this when you are finished.

Help students build a solar cooker to cook food. Encourage students to think about how using the Sun instead of natural gas for cooking would be beneficial because natural gas is a fossil fuel.

For this activity, collect:

- Pizza box
- 2 sheets of black construction paper
- Newspaper
- Aluminum foil
- Plastic wrap
- A pat of butter or piece of chocolate
- Scissors
- Tape

1. Place the newspaper in the bottom of the pizza box. Cover the newspaper with the black construction paper.
2. Cut three sides of a square out of the top of the pizza box to make a flap. Leave about 2 inches on each side and at the front of the box. The flap should remain attached at the back.
3. Bend the flap back and cover it with aluminum foil.
4. Tape a sheet of plastic wrap across the opening you made on the top of the pizza box.
5. Take your solar cooker outdoors and place it in direct sunlight. Prop the flap open with a ruler or pencil so sunlight shines on the aluminum foil.
6. Place a pat of butter or a piece of chocolate inside the solar cooker under the plastic wrap. Also place a pat of butter or piece of chocolate outside the solar cooker, but still in sunlight. This is the control.
7. Set a timer and check the solar cooker and control every 5 minutes until the foods are melted. If the Sun moves, change your solar cooker so that it is always in the sunlight.

Here are some questions to discuss with students:

- What energy source does a solar cooker use to "cook" the food?
- Did the solar cooker or direct sunlight cook the food faster? Why do you think this happened?
- How do you think solar energy can be used to provide power at your home?