

Science

Science

Earth Science

Earth's Resources

by Natalie Rompella

| Genre | Comprehension Skill | Text Features | Science Content |
|------------|-----------------------|--|-------------------|
| Nonfiction | Main Idea and Details | <ul style="list-style-type: none"> • Captions • Charts • Diagrams • Glossary | Natural Resources |

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Vocabulary

acid precipitation

coal

fossil fuel

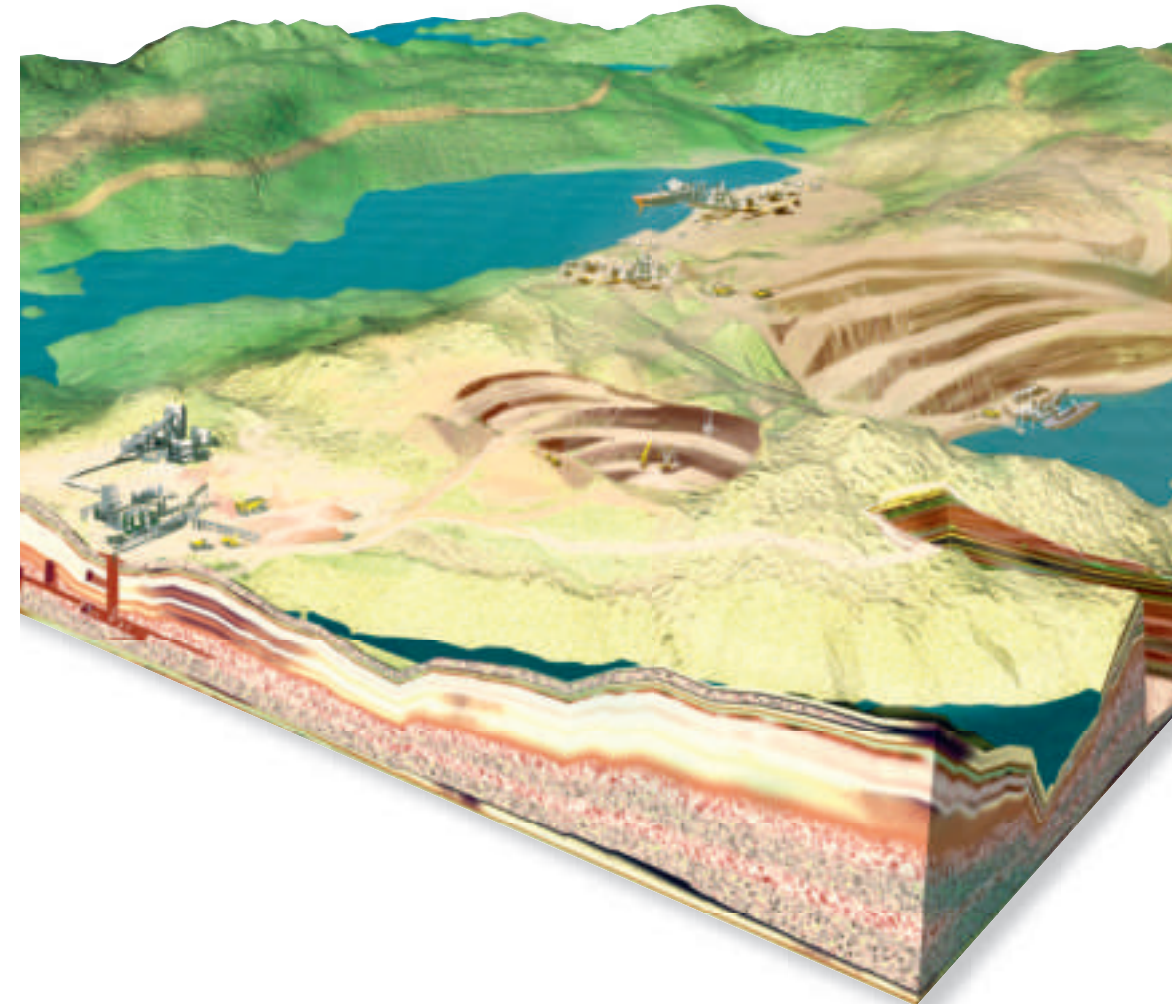
geothermal energy

natural gas

nonrenewable resource

petroleum

renewable resource



Illustrations: Title Page, 12, 19, 23 Peter Bollinger

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What are Earth's natural resources?

Renewable and Nonrenewable Resources

There are many resources on Earth. Three of the most important are air, water, and land. A resource that can be replaced through natural processes almost as quickly as it is used is called a **renewable resource**. Wood and paper come from trees. New trees can be planted in place of the used ones. Cotton also comes from a plant. Trees and cotton are renewable resources because they can be replanted.

A **nonrenewable resource** cannot be replaced as quickly as it is used. Minerals and fossil fuels can be used quickly, but they take millions of years to form.

Before using resources it is important to consider the cost and benefits. When trees are cut down for lumber to build houses, the benefit is that people will have new homes to live in. The cost is that the trees might have been a habitat for plants and animals.

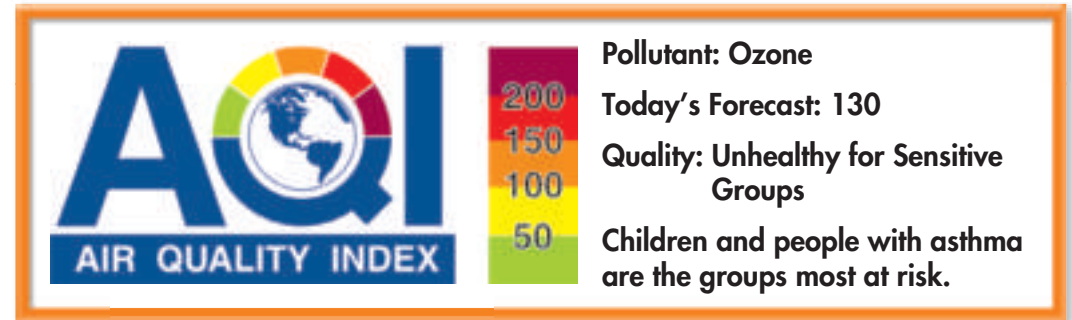


Air Resources

Nitrogen, oxygen, and carbon dioxide are gases in the atmosphere that are essential to life on Earth. Although these gases are renewable, the air can become polluted.

Air pollution is a result of harmful substances being released into the air. This can happen when fuels such as coal, oil, and natural gas are burned. Plants, animals, and humans can be affected by air pollution.

The Environmental Protection Agency (EPA) helps to keep people aware of the quality of their air. An Air Quality Index (AQI) color is used to show the quality of the air. The different colors are indicators of whether the air is clean or polluted.





Land Resources

We depend on land in many ways. Many foods that we eat are grown in the soil. Soil takes hundreds of years to form. Soil erosion can easily happen when wind and water cause soil to blow or wash away. Farmers try to reduce soil erosion by rotating the crops they grow.

We use many minerals from inside Earth. They take thousands of years to form. Automobiles and bicycles are just two of the many things made from the mineral iron. Cement, which is used in buildings and sidewalks, is made from limestone, a rock containing the mineral calcite. Iron and calcite are only two of many minerals we encounter daily. Because they take thousands of years to form, minerals are nonrenewable resources.



Quartz



Forests

Forests provide us with many products we use every day, such as paper, wood, and rubber. Rain forests, in particular, provide us with many medicines, nuts, and fruits.

Many animals use the forest as their home. They rely on it for shelter and food. When forests are cut down, these animals lose their habitats. Some animals may have trouble adjusting to a new environment. Because of this, some species may become extinct.

Forests also help to control the amount of carbon dioxide in the atmosphere. Trees use carbon dioxide and release oxygen into the air in the process of photosynthesis. Carbon dioxide traps heat, causing temperatures to rise. Without trees, more carbon dioxide stays in the atmosphere, causing temperatures to increase. This may be harmful to organisms that cannot adjust to the increased temperature.

Some forests are owned by companies that use trees for lumber and paper. The United States Forest Service helps companies conserve trees by figuring out how often trees can be cut down. This ensures that trees will remain a renewable resource.

Many products come from forests.





Water Resources

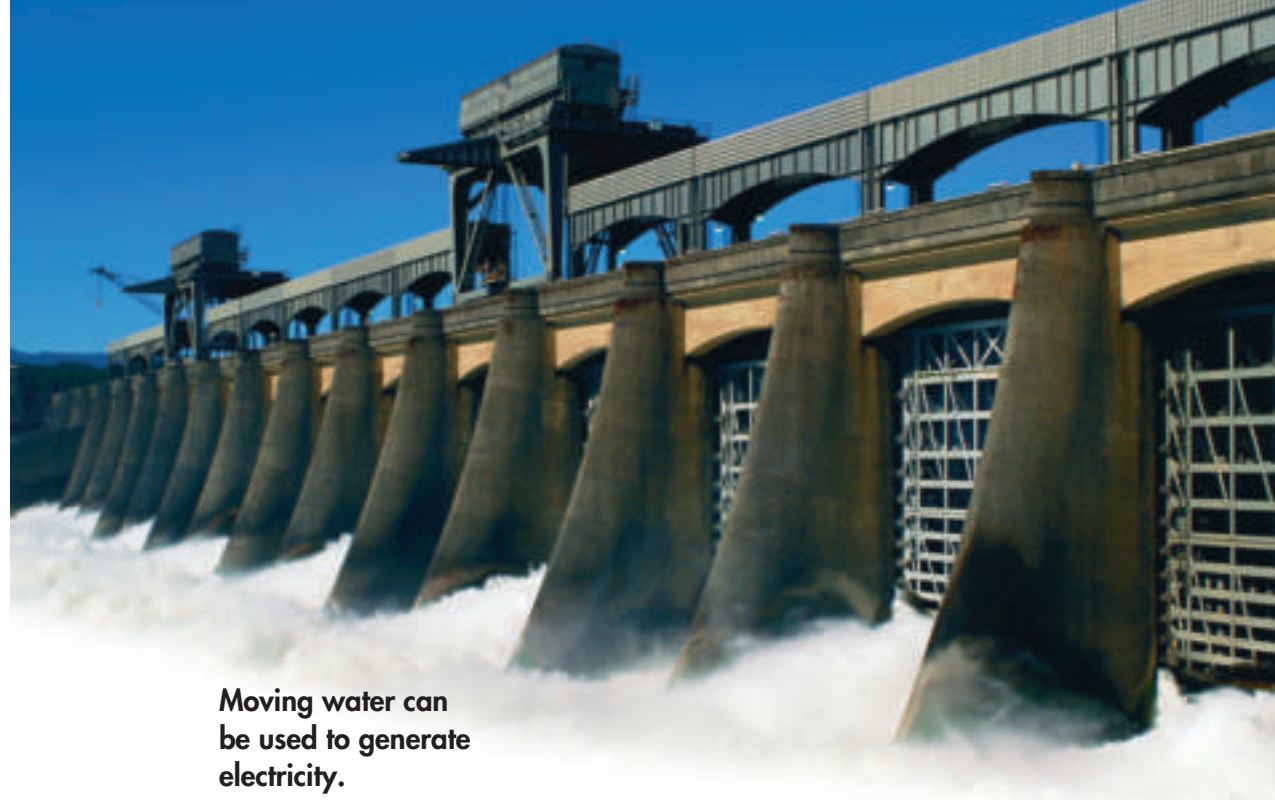
We use water for bathing, drinking, cooking, cleaning, and growing crops. The cells of all living organisms need water to work properly.

Water is reused over and over in a process called the water cycle. As water washes over the land, it can become polluted. It then empties into rivers and lakes. This pollution can end up in our waterways, where various organisms live and rely on the water.

Industries can also pollute the water. Water is often used to cool down machinery. Once the water is no longer needed, it is emptied back into the lakes and rivers, even if it is still warm. A change in water temperature, even a small one, can be harmful to an ecosystem and its organisms. Chemicals from industries can also pollute water.

About 75 percent of Earth's surface is water. Most of it is salt water in the oceans. Only three percent of the water on Earth is fresh water; and this includes water in the form of glaciers. Because there is so little fresh water, some areas in the world have a water shortage. In these areas people get fresh water by removing salt from ocean water or having it brought in from other locations.

Fish are one of the many organisms that live in water.



Moving water can be used to generate electricity.



Ocean Resources

Oceans also provide us with minerals. One of these minerals is salt. Salt can be removed from ocean water by evaporating water.

Other minerals, such as tin, magnesium, iron, and copper, can also be found on the ocean floor. Oil and natural gas can also be found below the ocean floor. To collect these resources, wells are drilled into the bottom of the ocean.

The ocean is a great source of energy. We can generate electricity from moving ocean water. Tidal energy is an excellent renewable resource because it is both inexpensive and does not pollute the environment. It is not a common form of energy because few places on Earth have the coastline and tides needed to build tidal power stations.





Connections Among Resources

Humans can have a negative effect on Earth's resources. People have caused pollution and destruction of habitats, and have used up materials faster than they can be replaced.

A map produced by scientists called The Human Footprint shows humans' effects on Earth's ecosystems. The scale ranges from 0 to 100, 0 representing the least impact. Scientists found that 83 percent of Earth's total land has been affected by humans. This study was done to inform people how the choices they make affect the environment.

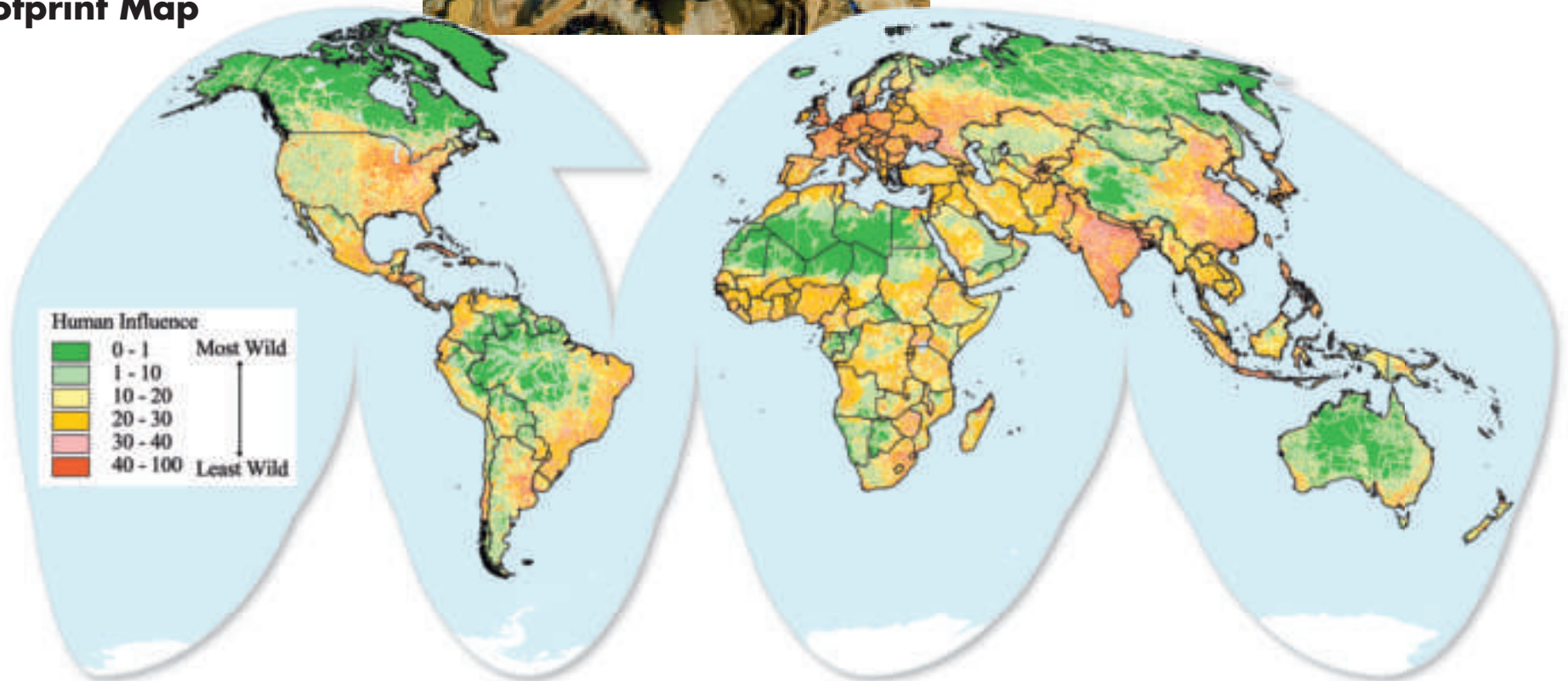


Reducing the Impact

Earth's land, water, air, and living creatures are all interconnected. Changes that affect one of these things can affect the others. A forest might be cut down for timber. Without the trees, the soil may begin to erode and wash away. Other plants and trees may not be able to grow without that soil. Organisms that rely on trees and soil may not survive.

Many resources we use daily are nonrenewable. Minerals, coal, oil, and natural gas need to be conserved so they do not run out. This means we need to use them only when necessary. One way to remind yourself of this is the three Rs: Reduce, Recycle, and Reuse.

Human Footprint Map





Where do we get energy?

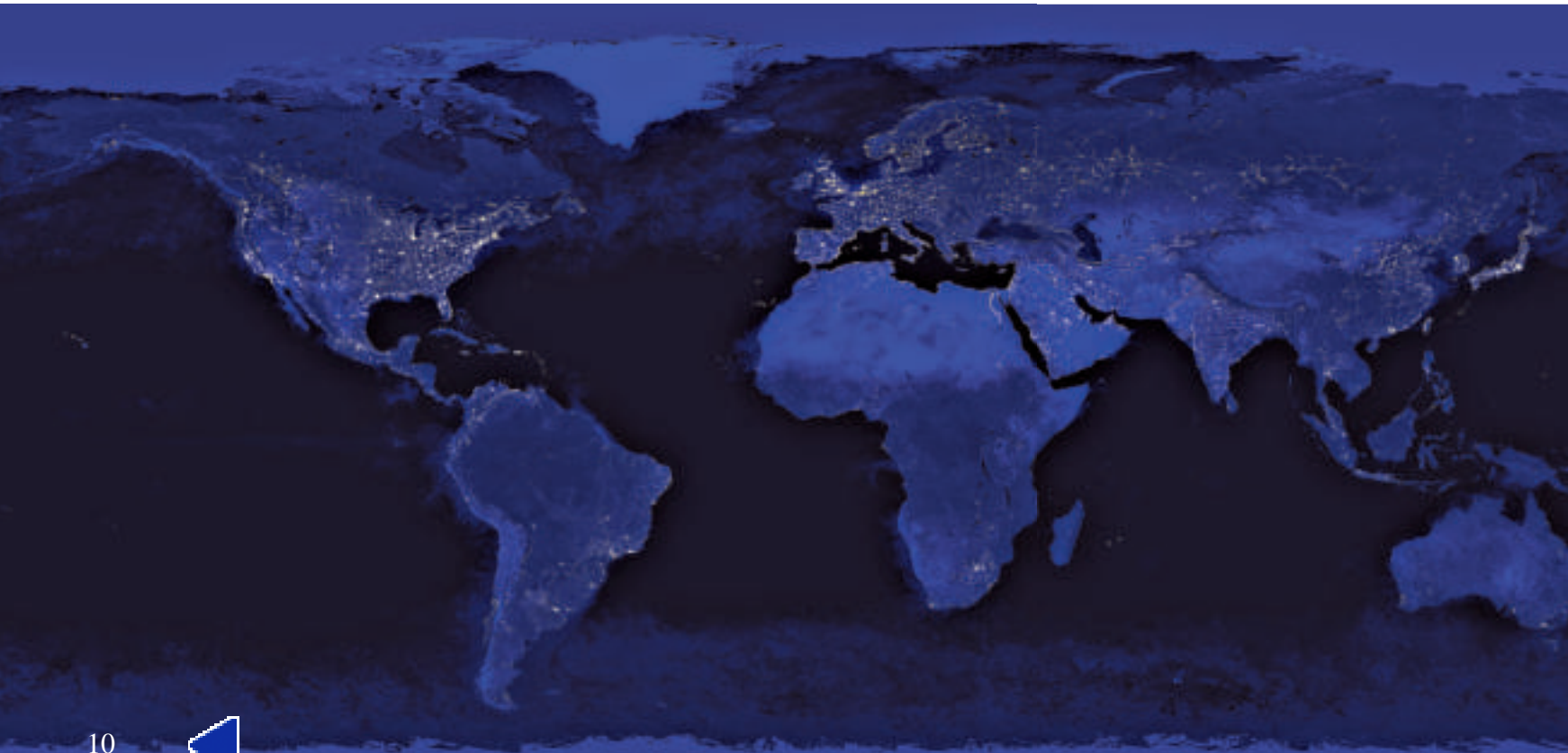
Energy Needs

Energy comes from many different sources: fossil fuels, wind, water, solar energy, nuclear energy, and geothermal energy.

How do we use energy? One of the ways is shown below. To make this picture, hundreds of satellite pictures of Earth at night were put together. It shows human-made lights. These lights use a lot of energy.

Energy has many other uses. Did you ride the bus to school today? Is your house heated or cooled? Do you watch television? These actions all require energy.

Businesses also use energy. Computers, fax machines, phones, and copiers need energy to work. Restaurants use it to cook and keep food cold; theaters use it to show movies; and ships, trucks, and trains use it to transport people and goods around the world.



Energy Needs Over Time

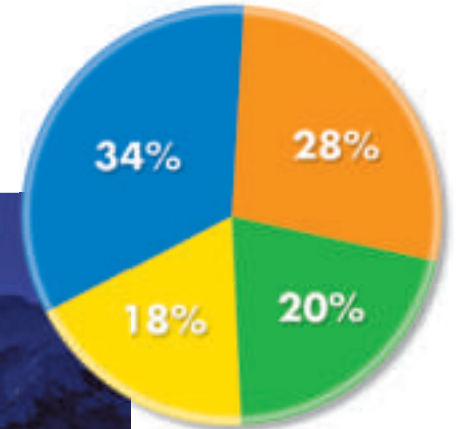
Over the years, energy needs have changed. Early societies used wood for lighting, heating, and cooking. Early farms used animals to pull their plows and other tools.

By the 1700s, machines and factories had been built in the United States that could make clothing, furniture, building materials, and farming equipment quickly.

Today the needs for energy have increased even more. Electricity is a major source of energy. Our society depends on it for light, for heat, and to power many appliances. Unlike other forms of energy that are found naturally on Earth, electricity must be produced.

Earth at night

U.S. Energy Use



- Transportation
- Residential
- Commercial
- Industrial

The graph shows how energy is used for different purposes in the United States. For which purpose is the most energy used?





Sources of Energy

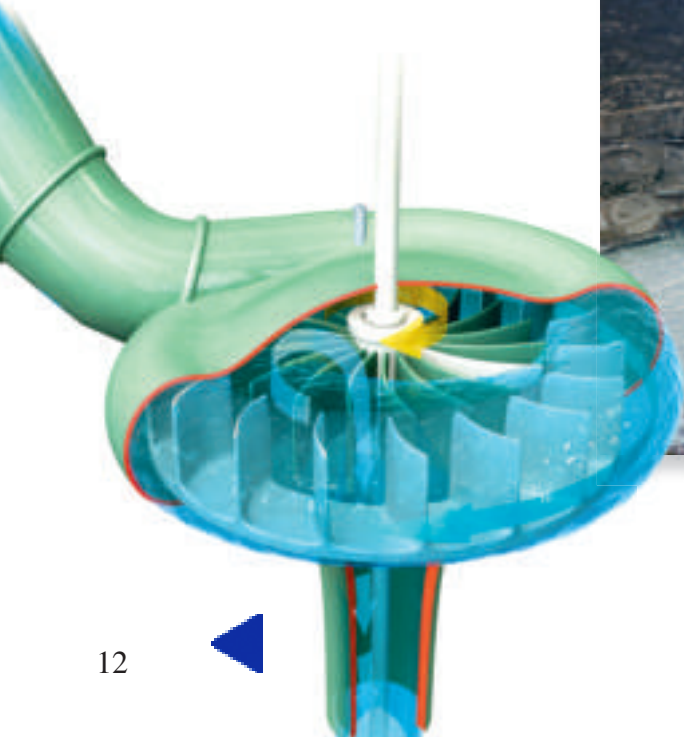
There are many sources of energy on Earth. Fossil fuels are one of the most common. A **fossil fuel** is an energy source made from the remains of living organisms. Coal, oil, and natural gas are fossil fuels.

Energy from Moving Water

Moving water is a source of energy. Electricity can be produced from the movement of ocean tides or from the movement of water in rivers.

Dams built across waterways can use moving water to generate electricity. The water moves through the dam and over turbines that turn blades. The energy of the turning blades is converted into electrical energy inside of a generator. This is known as hydroelectric power, or hydropower. This source of energy does not pollute and is renewable. Unfortunately, water floods the land behind dams, often destroying habitats. In 2002 about three percent of the energy in the United States was generated from hydropower.

Electricity is generated when water flows down through turbines at the base of a dam.



Energy from Atoms and Earth's Heat

Nuclear energy is a source of energy from the heat produced when atoms are split apart. Nuclear energy is a nonrenewable resource. Although nuclear energy does not pollute, the waste produced must be disposed of properly. It can be harmful to organisms, including humans. In 2002 only 8 percent of the energy in the United States came from nuclear energy.

The heat from inside Earth can also be used as an energy source. This is called **geothermal energy**. Scientists drill into Earth's crust, releasing hot steam. This steam can turn turbines and run generators to make electricity. Geothermal energy is a renewable resource, but it can produce pollution from gases being released into the atmosphere.

Clouds of water droplets are forming from the cooling towers of this nuclear power plant.





Energy from Sunlight and Wind

Solar energy, or energy from the Sun, requires no turbines. It is a renewable resource and does not pollute. With our current technology, however, solar energy can't be used everywhere. In 2002 solar energy represented less than one percent of the energy used in the United States.



Solar collectors gather heat from the Sun. The panels heat water that runs through pipes throughout homes and buildings, providing both heat and hot water.



Have you ever seen a windmill? The wind causes its blades to spin. Energy from the wind can be transformed into electricity. Like hydropower, wind can turn turbine blades and generate power. Even though wind power is a non-polluting renewable resource, a steady wind is necessary in order to produce electricity consistently. Many states use wind energy as a source of electricity.



A large number of wind turbines can be placed together to form a wind farm.





How are fossil fuels formed and used?

Types of Fossil Fuels

Fossil fuels are a nonrenewable resource because they take millions of years to form. Fossil fuels formed from organisms that lived long ago. Some were plants that got their energy from the Sun. Some were animals that got their energy by eating plants. Others were animals that got their energy by eating animals that ate plants. When the organisms died, this energy was stored in their bodies. When we burn fossil fuels, we release energy from the Sun that was stored millions of years ago.



Coal is used in power plants to produce electricity.



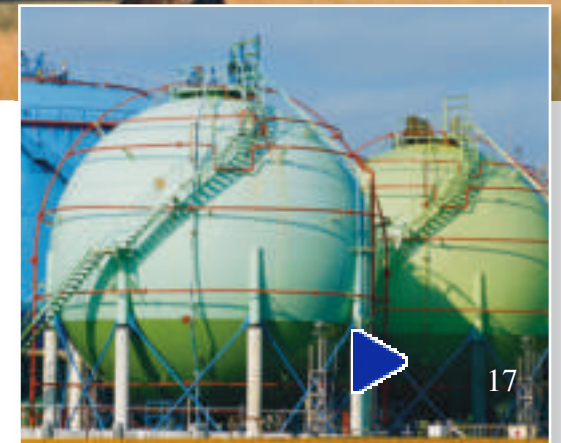
Coal is a solid fossil fuel. It was once commonly used to heat homes and to power trains. Today it is still used in power plants for electricity.

Petroleum, often called crude oil or oil, is a liquid fossil fuel. Ancient Egyptians used it as medicine for wounds and for fuel in lamps. Today we use it for gasoline, jet fuel, home heating, and kerosene.

Natural gas is a mixture of gases. The Chinese used it long ago to heat seawater to separate out the salt. Today it is used for heating homes and for generating electricity. You might use it in your home if you have a gas stove, a gas clothes dryer, or an outdoor gas grill.



Oil is transported through pipelines from where it is found to where it is processed.



Natural gas is stored in tanks and then piped to houses and businesses.



Using Fossil Fuels

When fossil fuels are burned, they produce gases. These gases can trap heat in the atmosphere, which can make Earth warmer. This warming of Earth is called the greenhouse effect. Scientists are concerned that as Earth gets warmer, organisms that cannot adjust to the changes of the temperature in their environment may not survive.

In addition, when fossil fuels are burned, other gases are released into the air and can combine with water vapor, resulting in **acid precipitation**. This rain or snow that contains acid can harm living organisms and can damage buildings and statues. The burning of fossil fuels can also cause a haze called smog, which is harmful to living organisms.

Reducing Fossil Fuel Problems

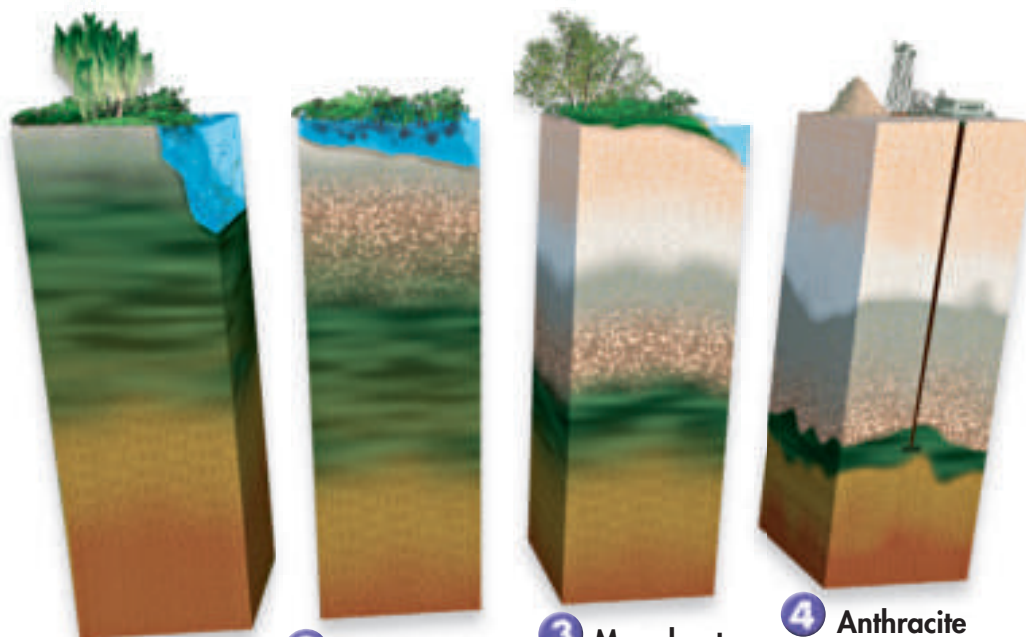
You can make a difference in reducing the amount of fossil fuels used. Carpooling, riding a bike, taking a bus or train, or walking cuts down on the amount of gasoline burned in automobiles. Turning off appliances when they are not being used reduces the amount of electricity needed. As an adult you will be able to make more informed decisions about energy sources. Learn more about other sources of energy, such as the Sun, wind, and water.



How Coal Forms

Millions of years ago, organisms died and became buried in the ground. Swamp plants that were buried under mud and water formed a substance called peat. Through the years, other sediments, including sand and mud, built up on top of it. Pressure and heat changed the peat and sediments to lignite, a soft form of coal.

Coal has many stages. The more carbon coal has, the harder it is and the cleaner it burns. Anthracite is the hardest and cleanest-burning form of coal.



- 1 Dead plants sink to the bottom of the swamp water and form peat.
- 2 Heat and pressure from sediment layers above the peat slowly change it to lignite. Lignite is a brownish-black coal with a lot of water.
- 3 More heat and pressure change lignite to bituminous coal, the most common form of coal used in the United States.
- 4 Anthracite is the last stage of coal formation. It is the hardest form of coal.





Oil and Natural Gas

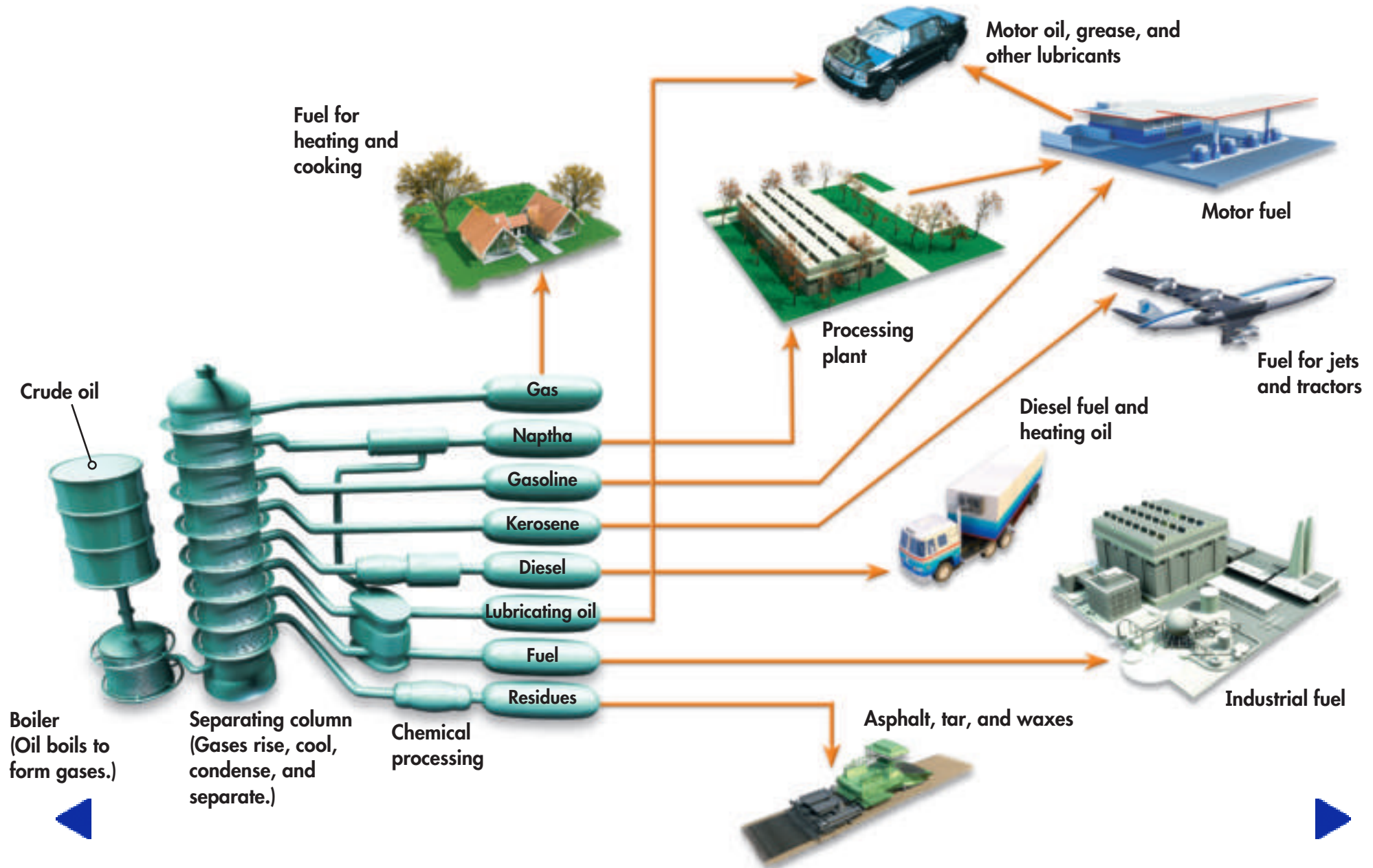
Oil and natural gas formed in processes similar to those that produced coal, but they formed from the remains of tiny organisms that lived in ocean water. Because natural gas is lighter than oil, it is often found on top of oil deposits. Drilling into Earth collects both.



Processing and Delivering Petroleum

Petroleum is a combination of many different products. These are separated at a refinery plant. The crude oil is heated; then, different parts of the oil can be removed at different temperatures.

To make the various substances pure, the water, salts, and oxygen they contain must be removed. Products are then kept at refineries until they are sent to gas stations, airports, and factories. Below is a diagram of how petroleum is processed.





Coal Mining and Reclamation

Coal is removed from the ground differently than petroleum and natural gas. Since it is solid, coal that is buried deep below Earth's surface is dug out making underground tunnels. If the coal is within thirty meters of Earth's surface, it is usually removed in a process called strip mining. Unfortunately, these methods for removing coal can be harmful to the environment and living organisms. It can cause soil erosion, loss of habitat, and water pollution.

Federal and state laws require that land that has been mined through strip mining or underground tunnels be reclaimed, or put to productive use.



During Mining



G Mining Laws
Miners must restore the land either to its original state or to a suitable, agreed-upon land use.

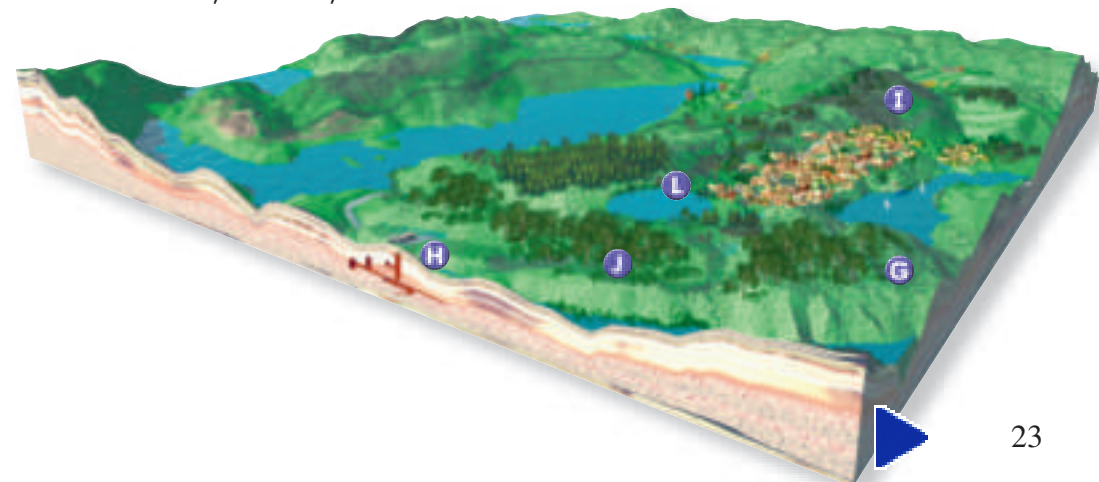
H Closing Mine Shafts
Mine shafts are filled back in with the rocks removed, and sealed.

I Sculpting the Land
Topsoil is replaced to prevent erosion.

J Planting the Land
Species of plants are selected and planted to cover the reclaimed area.

L New Land Uses
Reclaimed mining sites serve new purposes. Stone quarries become lakes. Other areas are converted into wetlands, farms, ranches, and recreational sites.

Reclaimed Land



A Water Management
Mine operators develop methods to ensure that water flows naturally and without pollution through mining areas.

B Water Treatment
Facilities at the mining site treat water before it is reintroduced to streams.

C Waste Storage
Some waste can be buried underground.

D Chemical Recovery
Chemicals used to remove minerals are collected and disposed of properly.

E Protecting Air Quality
Federal and state laws and regulations include strict guidelines for maintaining air quality.

F Ecosystem Protection
Care ensures that wildlife populations are not permanently affected.



Glossary

| | |
|------------------------------|--|
| acid precipitation | rain or snow that has a large amount of acid in it |
| coal | a solid fossil fuel formed from swamp plants |
| fossil fuel | an energy source made from the remains of living organisms |
| geothermal energy | heat energy from deep inside Earth |
| natural gas | a fossil fuel that is a mixture of gases |
| nonrenewable resource | a resource that cannot be replaced as fast as it is used |
| petroleum | a liquid fossil fuel, also called oil or crude oil |
| renewable resource | a resource that is replaced through natural processes almost as fast as it is used |

What did you learn?

1. Describe three ways that forests supply resources for organisms that live on Earth.
2. How can water get polluted?
3. How can you help reduce the negative impact that humans can have on the environment?
4. **Writing in Science** Nonrenewable resources cannot be replaced as fast as they are used. Give an example, and write to explain the benefit and cost of using these resources. Include examples from the book to support your answer.
5. **Main Idea and Details** Which source of energy do you think has the most benefits? Support your answer with details from the book.

