

SECTION 4 Energy Resources

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What is an energy resource?
- How do we use nonrenewable energy resources?
- What are renewable energy resources?

National Science Education Standards
PS 3a, 3e, 3f

What Is an Energy Resource?

Energy is used for many things. It is used to light our homes, to make food and clothing, and to move people from place to place. An *energy resource* is a natural product that can be changed into other energy forms to do work. There are many types of energy resources.

STUDY TIP

In your science notebook, make a table that lists nonrenewable and renewable energy resources.

What Are Nonrenewable Energy Resources?

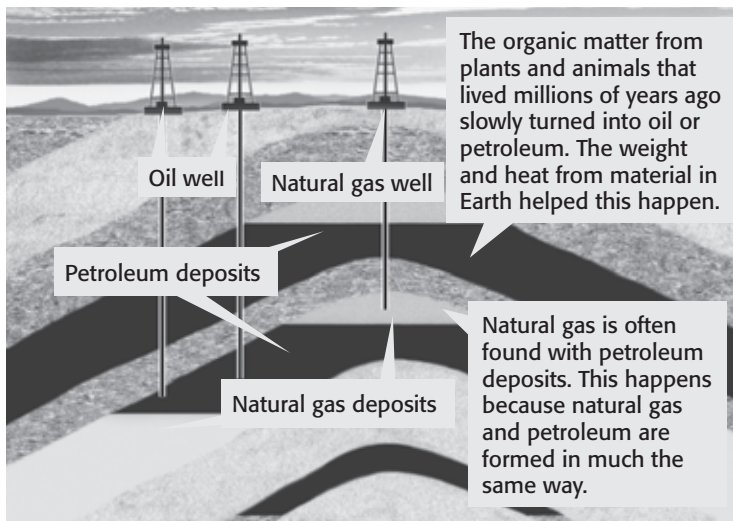
Some energy resources are **nonrenewable resources**. These are resources that can never be replaced or are replaced more slowly than they are used. ✓

Oil, natural gas, and coal are nonrenewable resources called fossil fuels. **Fossil fuels** are energy resources that formed from buried plants and animals that lived a very long time ago. Millions of years ago, the plants stored energy from the sun by photosynthesis. The animals stored and ate the energy from the plants. When we burn fossil fuels today, we are using the sun's energy from millions of years ago. ✓

READING CHECK

1. Identify What are nonrenewable resources?

Formation of Fossil Fuels



READING CHECK

2. Identify Where did the energy contained in fossil fuels come from?

SECTION 4 Energy Resources *continued*

USES OF FOSSIL FUELS

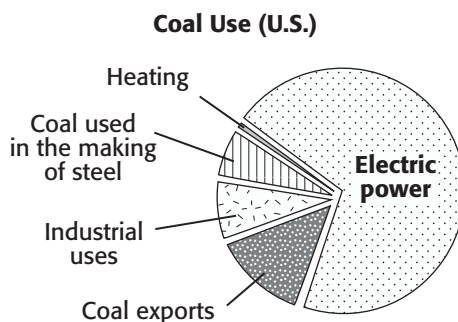
All fossil fuels have stored energy from the sun. This can be changed into other kinds of energy. The figure below shows how we use fossil fuels.

The three most common fossil fuels are coal, natural gas, and oil (petroleum). Burning coal is a way to produce electrical energy. Gasoline, wax, and plastics are made from petroleum. Natural gas is often used to heat homes. ✓

READING CHECK

3. Identify What are the three most common fossil fuels?

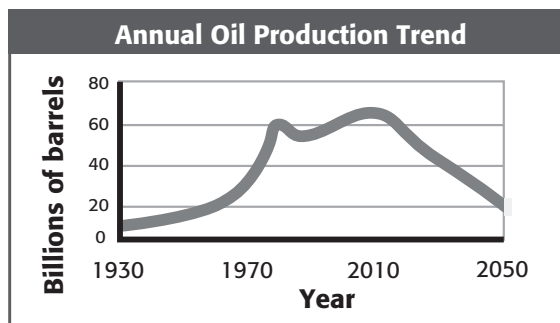
Everyday Uses of Some Fossil Fuels



Most coal used in the United States is burned. This produces steam that runs electrical generators.

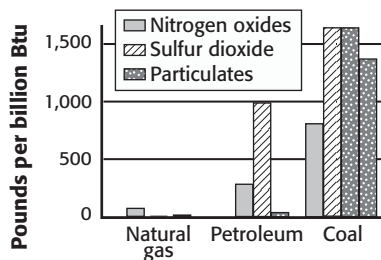
Math Focus

4. Analyze Graph What is the annual oil production trend after the year 2010?



Gasoline, kerosene, wax, and petrochemicals come from petroleum. Scientists continue to look for other energy sources.

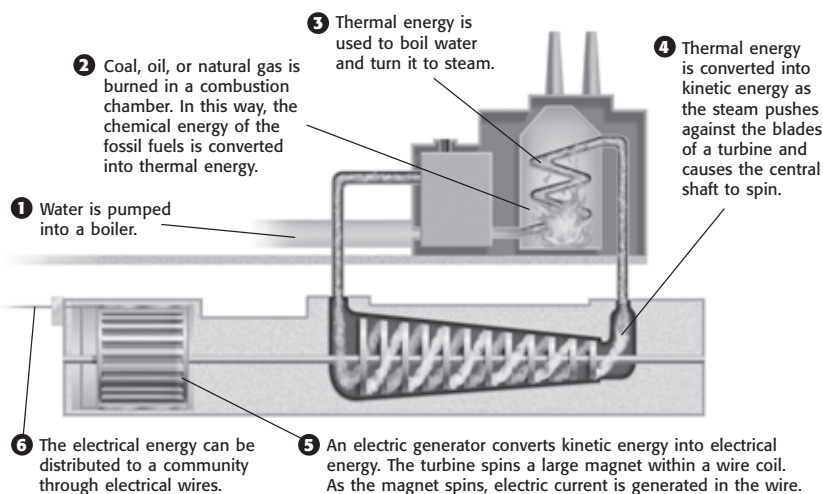
Fossil-Fuel Emissions



Natural gas is used to heat homes, stoves, and ovens, and to power vehicles. Natural gas has lower emissions than other fossil fuels.

SECTION 4 Energy Resources *continued***ELECTRICAL ENERGY FROM FOSSIL FUELS**

Electrical energy can be produced when fossil fuels are burned. Most of the electrical energy produced in the United States is from fossil fuels. *Electric generators* change the chemical energy from the fossil fuels into electrical energy. This is shown in the figure below.

Converting Fossil Fuels into Electrical Energy**NUCLEAR ENERGY**

Electrical energy is also produced from nuclear energy. Nuclear energy comes from radioactive elements like uranium. The nucleus of a uranium atom splits into two smaller nuclei in a process called *nuclear fission*. There is not a large supply of radioactive elements, so nuclear energy is a nonrenewable resource. ✓

A nuclear power plant changes the thermal energy from nuclear fission into electrical energy. Splitting uranium atoms creates thermal energy. This thermal energy is changed to electrical energy in a process similar to how fossil fuel power plants work. The figure above shows how this happens.

STANDARDS CHECK

PS 3e In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.

5. Identify What is most often used to produce electricity in the United States?

READING CHECK

6. Identify What nuclear process is used to produce electricity?

SECTION 4 Energy Resources *continued*

What Are Renewable Energy Resource?

Some energy sources are replaced faster than they are used. These are **renewable resources**. Some of these resources can almost produce an endless supply of energy.

SOLAR ENERGY

The energy from the sun can be changed into electrical energy by solar cells. A *solar cell* is a device that changes solar energy into electrical energy. You may have seen solar cells in calculators or on the roof of a house. ✓

READING CHECK

7. Describe What does a solar cell do?

ENERGY FROM WATER

The potential energy of water can be changed into kinetic energy in a dam. The water falls over the dam and turns turbines. The turbines are connected to a generator that changes kinetic energy into electrical energy.

WIND ENERGY

Because the sun does not heat Earth’s surface the same in all places, wind is created. The kinetic energy of wind can turn the blades of a windmill. Wind turbines change this kinetic energy into electrical energy by turning a generator.

GEOTHERMAL ENERGY

Thermal energy made by the heating of Earth’s crust is called *geothermal energy*. Geothermal power plants pump water under the ground near hot rock. The water turns into steam, which is used to turn the turbines of a generator.

BIOMASS

Biomass is organic matter, like plants, wood, or waste. When biomass is burned, it gives off the energy it got from the sun. This can be used to make electrical energy.

TAKE A LOOK

8. Identify The table lists many renewable resources. Complete the missing boxes in the table.

Renewable energy source	Direct source of energy	Original source of energy
Solar energy	sun	_____
Energy from water	_____	sun
Wind energy	_____	sun
Geothermal energy	heat of earth’s crust	_____
Biomass	organic matter	_____

SECTION 4 Energy Resources *continued*

How Do You Decide What Energy Source to Use?

All energy resources have advantages and disadvantages. The table below compares many energy resources. The energy source you choose often depends on where you live, what you need it for, and how much you need. To decide which source to use, advantages and disadvantages must be thought about.

One disadvantage of using fossil fuels you have often heard is that fossil fuels pollute the air. Another disadvantage is that we can run out of fossil fuels if we use them all up.

Some renewable resources have disadvantages, too. It is hard to produce a lot of energy from solar energy. Many renewable resources are limited to places where that resource is available. For example, you need a lot of wind to get power from wind energy. ✓

Energy planning around the world is important. Energy planning means determining your energy needs and your available energy resources, and then using this energy responsibly.

**READING CHECK**

9. Describe What is a disadvantage of solar energy?

Advantages and Disadvantages of Energy Resources		
Resource	Advantages	Disadvantages
Fossil Fuels	<ul style="list-style-type: none"> • produces large amounts of energy • easy to get • makes electricity • makes products like plastic 	<ul style="list-style-type: none"> • nonrenewable • produces smog • produces acid precipitation • risk of oil spills
Nuclear	<ul style="list-style-type: none"> • concentrated energy form • no air pollution 	<ul style="list-style-type: none"> • produces radioactive waste • nonrenewable
Solar	<ul style="list-style-type: none"> • almost endless source • no pollution 	<ul style="list-style-type: none"> • expensive • works best in sunny areas
Water	<ul style="list-style-type: none"> • renewable • inexpensive • no pollution 	<ul style="list-style-type: none"> • needs dams, which hurt water ecosystem • needs rivers
Wind	<ul style="list-style-type: none"> • renewable • inexpensive • no pollution 	<ul style="list-style-type: none"> • needs a lot of wind
Geothermal	<ul style="list-style-type: none"> • almost endless source • little land needed 	<ul style="list-style-type: none"> • needs a ground hot spot • produces wastewater
Biomass	<ul style="list-style-type: none"> • renewable • inexpensive 	<ul style="list-style-type: none"> • needs a lot of farmland • produces smoke

TAKE A LOOK

10. Identify What are some advantages to using wind power?

Section 4 Review

NSES PS 3a, 3e, 3f

SECTION VOCABULARY

fossil fuel a nonrenewable energy resource formed from the remains of organisms that lived long ago

nonrenewable resource a resource that forms at a rate that is much slower than the rate at which the resource is consumed

renewable resource a natural resource that can be replaced at the same rate at which the resource is consumed

1. Compare What is the difference between a nonrenewable energy resource and a renewable energy resource?

2. Analyze Why can it be said that the energy from burning fossil fuels ultimately comes from the sun?

3. Explain How is nuclear energy used to make electrical energy?

4. Identify What is a renewable energy resource that does not depend on the sun?

5. Analyze What are some possible reasons that solar power is not used for all of our energy needs?
