Where Do We Get Our Energy?

Fossil Fuels

For a moment, think about burning wood in a fireplace. The burning wood is converted into light and heat. Light and heat are forms of energy, and the fire is a chemical reaction that releases the energy from the wood. But how did that energy get into the wood? Where did the energy come from?

Well, the wood used to be a tree, and before the tree was chopped down, it was a living plant. It got its energy from the sun, converting sunlight and water into food to grow. It stored that energy in its trunk, leaves and roots. And when the tree died, that energy didn't just go away—it remained stored in the wood. When we burn something that used to be alive—like wood, paper or straw—we convert its stored energy into heat and light. A fuel is a substance that provides a form of energy (heat, light, electricity or motion) as a result of a chemical change. And when we burn a fuel to release its energy, that is called combustion.

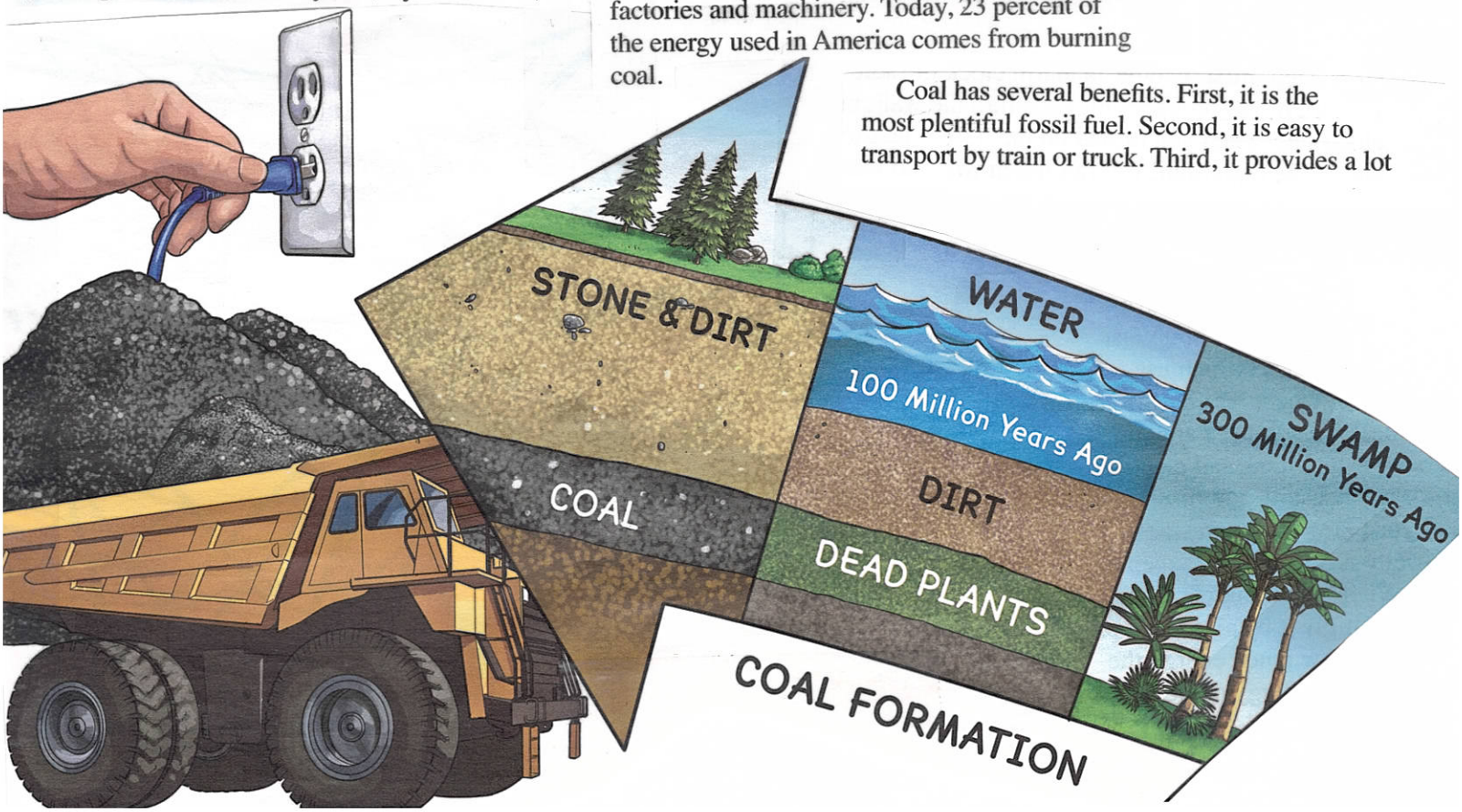
Now, a campfire or a fire in a fireplace may be pretty, but you know that it's not what we use for most of our energy. There are other fuels that have far more energy packed into them than wood does. These fuels are called fossil fuels. Like wood, fossil fuels used to be alive. But they weren't alive just a few years ago. They are formed from organisms that lived hundreds of millions of years ago. As these plants, animals and other living organisms died, their remains piled up. Over millions of years, layers of sand, rock and mud piled on top of these remains. Heat and pressure slowly changed those substances into new substances—fossil fuels. So, fossil fuels are the energy-rich substances formed from the remains of organisms that were once alive.

Whenever we talk about energy resources in America, we think of fossil fuels. That's because 85 percent of energy used in America is from burning fossil fuels. Obviously, fossil fuels are very important to us. There are some benefits (good things) about using fossil fuels, but there are also some costs (bad things). Whenever we look at energy resources, we need to think about the benefits and costs of using them. One of the biggest problems with fossil fuels is that they are nonrenewable. Because they were formed so long ago, we cannot make any more. Once we use them up, they will be gone. So it is very important to conserve (use wisely) fossil fuels. There are three fossil fuels—coal, oil and natural gas.

Coal

Coal is a solid fossil fuel, formed from ancient plant remains. Until about 1800, humans mostly used wood for fuel. But then the Industrial Revolution began, and people couldn't chop down enough wood to power the new machines. They began to dig deep into the Earth for coal, which they burned to power the new factories and machinery. Today, 23 percent of the energy used in America comes from burning coal.

Coal has several benefits. First, it is the most plentiful fossil fuel. Second, it is easy to transport by train or truck. Third, it provides a lot



of energy when it is burned. But coal also has some costs. For one thing, when it burns, it pollutes the air. Coal mining is dangerous for miners and can cause erosion and damage to the environment. Like all fossil fuels, coal is nonrenewable, so if we aren't careful, we could eventually use it all up.

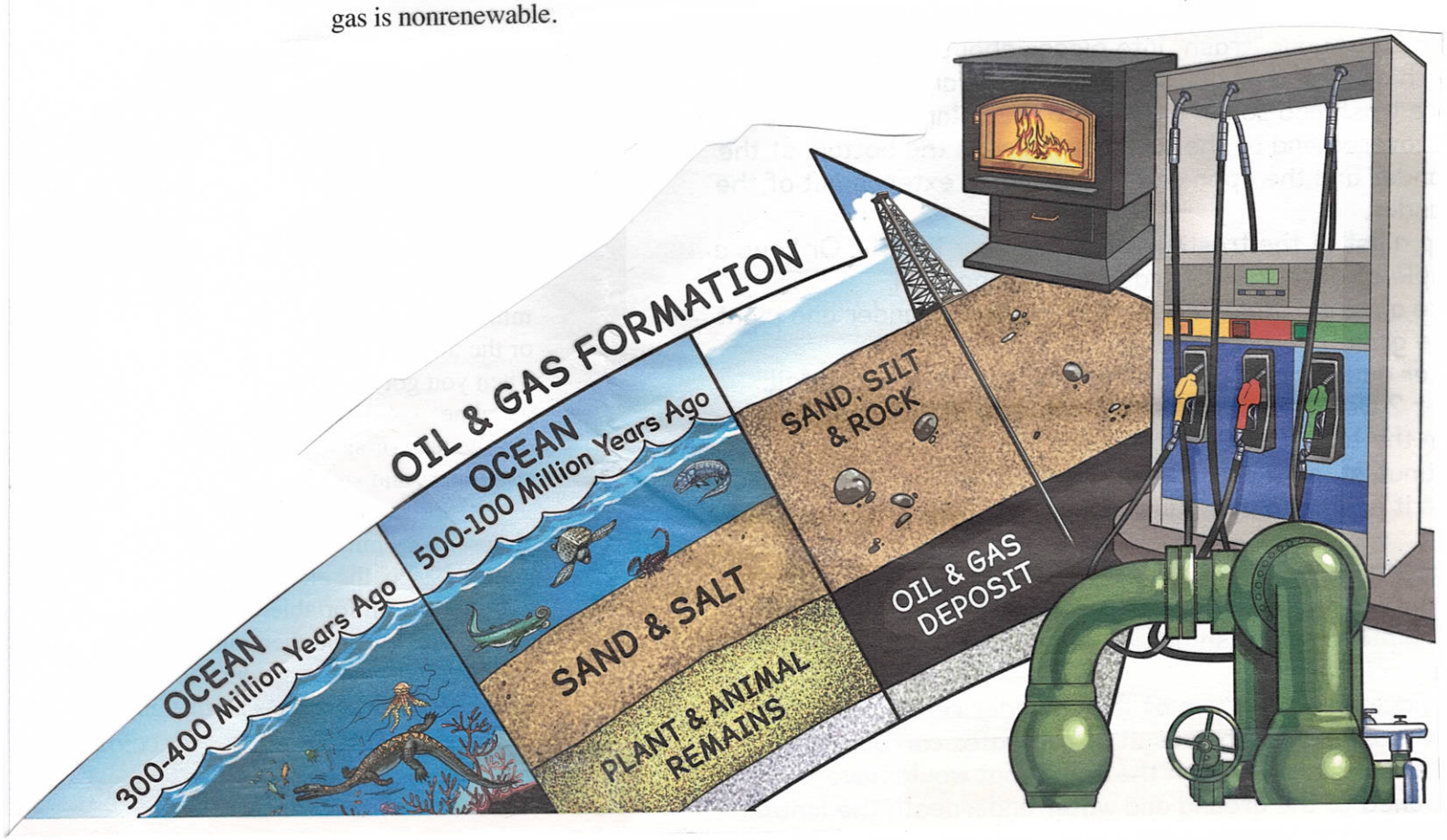
Oil

Oil is a thick, black, liquid fossil fuel. It was formed from the remains of tiny ocean plants and animals. Petroleum is another word for oil. Petroleum cannot be used right from the ground. Instead, it must be refined, or separated into fuels and other products. Gasoline, jet fuel, home heating oil, diesel fuel and kerosene are all refined oil products. Oil is also used in many other products, like plastics, medicines, cosmetics and paints.

Some of the benefits of oil are that it doesn't cause as much air pollution as coal and that it can be refined into so many different products. But oil has costs. First, it is difficult to find because it is located deep beneath Earth's surface. Second, it is very expensive to pump out of the ground. Third, the refining process takes time and adds to the cost. Fourth, the United States uses much more oil than it produces, so we have to buy most of our oil from other countries. And of course, oil is nonrenewable, so it will eventually run out.

Natural Gas

Natural gas forms from the same organisms that form petroleum. It is usually found floating above oil deposits. It is transported by pipelines and is often used to heat homes. Natural gas has several benefits. First, it doesn't need to be refined as much as oil does. Second, it is easy to transport in pipelines. Natural gas is very flammable, so gas companies must be very careful to avoid leaks or explosions. Like coal and oil, natural gas is nonrenewable.



Alternative Energy

Nonrenewable energy resources (coal, oil and natural gas) will someday run out. Fortunately, there are alternative energy sources. Alternative means "another choice." Alternative energy resources are energy resources that can be used in place of fossil fuels. Most alternative energy resources are renewable, meaning they are naturally replaced in a short period of time. Power companies are working to develop alternative energy resources because they have many benefits.

Solar energy, or energy from the sun, is in constant supply. In one day, the sun sends enough energy to Earth to power the entire world for 40 years! Solar energy does not cause pollution, and it will last for billions

of years. Solar energy does have a few drawbacks, however. First, it is only available when the sun is shining, so a backup system is needed on cloudy days and during the night. Second, solar energy is spread out over all the Earth. To use it effectively, the energy needs to be collected and concentrated into a small area. Third, while houses can be fitted with solar power panels, the process is too expensive for many people.

Most electric plants burn coal to boil water and create steam. Pressure of that steam turns the turbine, which generates electricity. Wind and water can be used to turn turbines without having to burn a fossil fuel. This is what happens with windmills and hydroelectric plants.

Wind power does not cause pollution, but it needs a constant flow of wind in order to work. As a result, wind farms are only built in areas that are nearly always windy. Hydroelectric power uses flowing water to power turbines. Hydroelectric plants use a river that has been dammed. It is inexpensive (once the dam is built), and it doesn't cause pollution. But dams cause changes in the local environment, which some people say are too damaging.

Geothermal energy uses steam trapped below Earth's surface to heat homes. It is an unlimited energy resource, and and it doesn't cause pollution. Unfortunately, only certain places on Earth have access to this type of energy, because a geothermal plant can only be built in areas where magma has collected near Earth's surface.

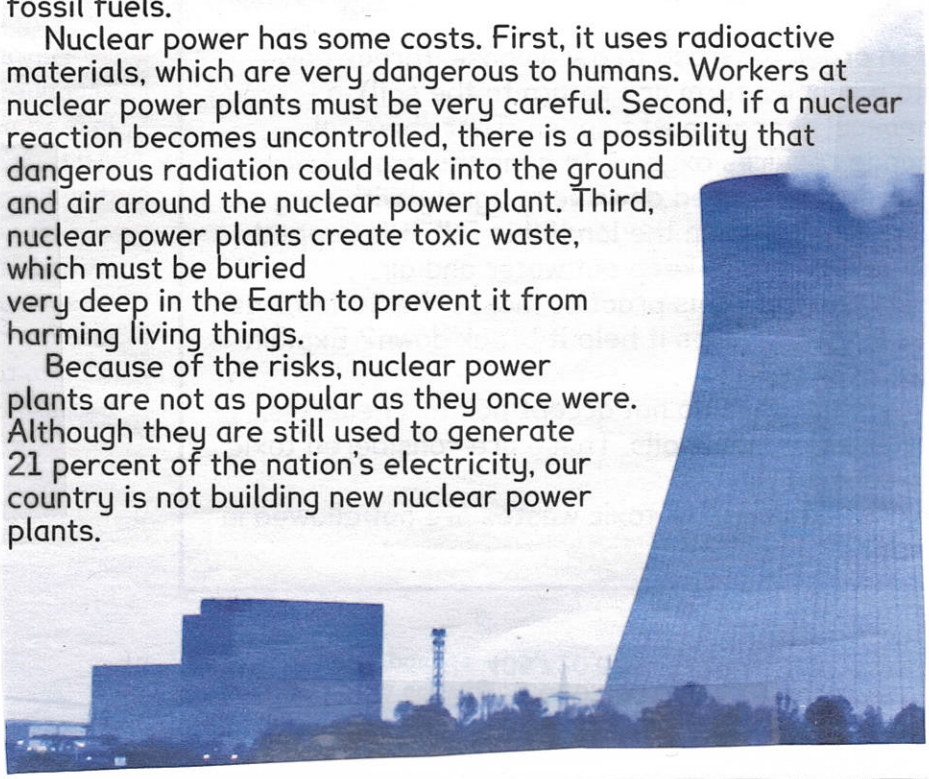
Biomass fuels are matter that were recently alive, like wood, leaves and cornstalks. Scientists are developing ways to convert these waste products into alcohol, which can be mixed with gasoline to make gasohol. This would reduce our reliance on gasoline for our cars. Scientists are also working to develop hydrogen power, which would burn without pollution and give off pure water as a byproduct. For now, though, producing electricity with hydrogen costs too much money to be worthwhile.

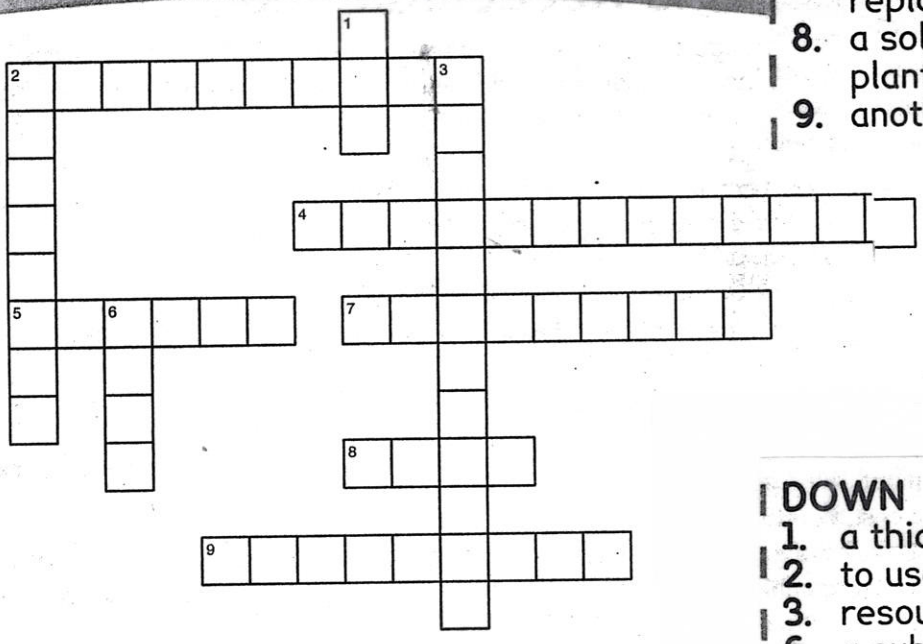
What is nuclear energy?

Nuclear energy is an alternative energy resource that uses the energy stored in the nucleus of an atom. That energy is released in a process called nuclear fission. Nuclear power doesn't use fossil fuels.

Nuclear power has some costs. First, it uses radioactive materials, which are very dangerous to humans. Workers at nuclear power plants must be very careful. Second, if a nuclear reaction becomes uncontrolled, there is a possibility that dangerous radiation could leak into the ground and air around the nuclear power plant. Third, nuclear power plants create toxic waste, which must be buried very deep in the Earth to prevent it from harming living things.

Because of the risks, nuclear power plants are not as popular as they once were. Although they are still used to generate 21 percent of the nation's electricity, our country is not building new nuclear power plants.





ACROSS

2. the process of burning a fuel to release its energy
4. power formed by flowing water
5. to separate oil into fuels and other products
7. resources that can be naturally replaced in a short period of time
8. a solid fossil fuel formed from ancient plant remains
9. another word for oil

DOWN

1. a thick, black, liquid fossil fuel
2. to use resources wisely
3. resources that will run out
6. a substance that provides a form of energy

Name _____ Core _____

1. Why can geothermal energy only be used in certain places on Earth?

_____

_____

2. How much of the energy used in the United States comes from burning fossil fuels?

_____

_____

3. How can biomass fuels be converted to use in vehicles?

_____

_____

4. Which of the following is considered a natural resource?

Ⓐ hot dog
Ⓑ MP3 player
Ⓒ textbook
Ⓓ corn on the cob

5. Which of the following resources would be considered nonrenewable?

Ⓐ steam
Ⓑ natural gas
Ⓒ ethanol fuel made from corn
Ⓓ wind

6. Which of the following is NOT a way to conserve and/or protect natural resources?

Ⓐ throwing away plastic water bottles
Ⓑ replanting trees that have been cut down
Ⓒ taking shorter showers
Ⓓ turning the heat down at bedtime

7. What is one reason scientists are looking at alternatives to nuclear energy?

Ⓐ Nuclear energy relies on use of fossil fuels.
Ⓑ Materials to produce nuclear energy can harm people and the environment.
Ⓒ Nuclear energy does not pollute the air.
Ⓓ Scientists are unsure how nuclear power can be created.

8. Which of the following would decompose relatively quickly in a landfill?

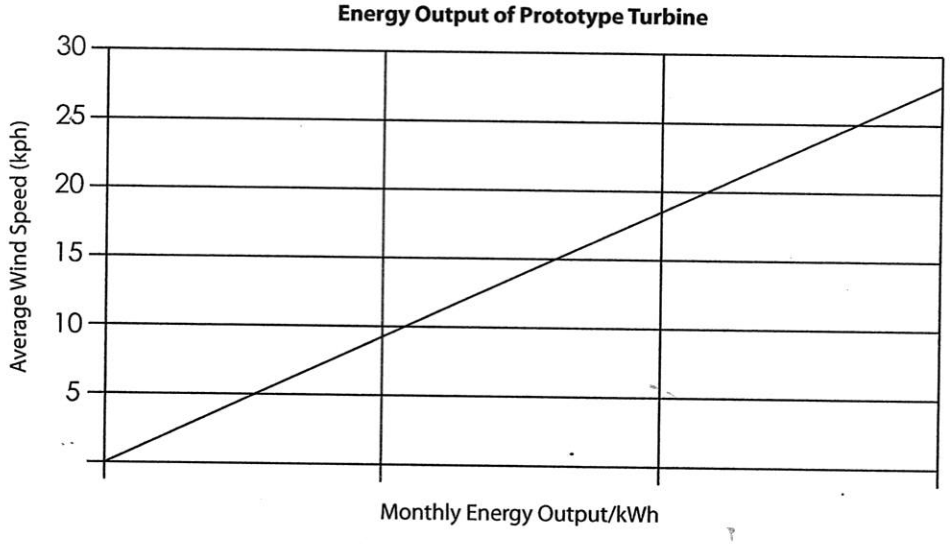
Ⓐ a cloth coat
Ⓑ a screwdriver
Ⓒ a pair of sandals
Ⓓ a fish

9. Which idea is not in the correct position on the chart below?

Alternative Energy Sources	Fossil Fuels
Solar	Oil
Biomass fuels	Natural gas
Hydroelectric power	Coal
Geothermal energy	Wind

Ⓐ Biomass fuels
Ⓑ Natural gas
Ⓒ Wind
Ⓓ Geothermal energy

10. A wind engineer measured the amount of kinetic energy a prototype turbine produced when placed in locations with different average wind speeds around the United States. A graph of the results is found above. What inference can be made about operating this type of turbine at a location with an average wind speed of >20 kph?



Ⓐ The stronger the wind blows, the greater amount of energy that can be produced.
Ⓑ The average speed of the wind is not as important to energy production as daily speed of the wind.
Ⓒ In strong winds the air pressure is too great for the blades of the turbine to turn.
Ⓓ There is no energy produced when the winds are blowing strongly.