

Fossil Fuels

Coal



Natural Gas



Petroleum Oil



Propane



Conservation of Energy

Your parents may tell you to conserve energy. “Turn off the lights,” they say. To scientists, **energy conservation** is not just about saving energy. The **Law of Conservation of Energy** says that energy is neither created nor destroyed. When we use energy, it doesn't disappear. We change one form of energy into another.

A car engine burns gasoline, converting the chemical energy in gasoline into motion energy. Solar cells change radiant energy into electrical energy. Energy changes form, but the total amount of energy in the universe stays the same.

Efficiency

Energy efficiency is the amount of useful energy you get from a system. A perfect, energy efficient machine would change all the energy put in it into useful work—a technological impossibility today. Converting one form of energy into another form always involves a loss of usable energy.

Most energy transformations are not very efficient. The human body is a good example of this. Your body is like a machine, and the fuel for your machine is food. Food gives you the energy to move, breathe, and think.

Your body isn't very efficient at converting food into useful work. Most of the energy in your body is transformed and released as thermal energy (heat). You can really feel that heat when you exercise! This is very much like most energy transfers. The loss of useable energy is often in the form of thermal energy (heat).

Sources of Energy

We use many different energy sources to do work for us. They are classified into two groups—renewable and nonrenewable.

In the United States, most of our energy comes from **nonrenewable** energy sources. Coal, natural gas, petroleum, propane, and uranium are nonrenewable energy sources. They are used to make electricity, heat our homes, move our cars, and manufacture all kinds of products. These energy sources are called nonrenewable because their supplies are limited. Petroleum, a **fossil fuel**, for example, was formed hundreds of millions of years ago from the remains of ancient sea plants and animals. We can't make more petroleum deposits in a short time.

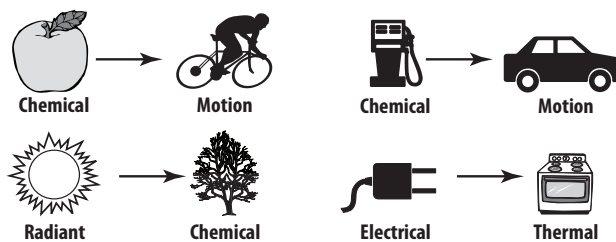
Renewable energy sources include biomass, geothermal energy, hydropower, solar energy, and wind energy. They are called renewable because they are replenished in a short time. Day after day, the sun shines, the wind blows, and the rivers flow. We use renewable energy sources mainly to make electricity.

Electricity

Electricity is different from the other energy sources because it is a **secondary source of energy**. We must use another energy source to produce electricity. In the U.S., coal is the number one energy source used for generating electricity.

Electricity is sometimes called an **energy carrier** because it is an efficient and safe way to move energy from one place to another, and it can be used for so many tasks. As we use more technology, the demand for electricity grows.

Energy Transformations



U.S. Energy Consumption by Source, 2014

NONRENEWABLE, 90.3%



Petroleum 34.9%
Uses: transportation, manufacturing



Natural Gas 27.5%
Uses: electricity, heating, manufacturing



Coal 18.0%
Uses: electricity, manufacturing



Uranium 8.3%
Uses: electricity



Propane 1.6%
Uses: heating, manufacturing

RENEWABLE, 9.6%



Biomass 4.8%
Uses: electricity, heating, transportation



Hydropower 2.5%
Uses: electricity



Wind 1.7%
Uses: electricity



Solar 0.4%
Uses: electricity, heating



Geothermal 0.2%
Uses: electricity, heating

Data: Energy Information Administration
*Total does not equal 100% due to independent rounding.



Coal

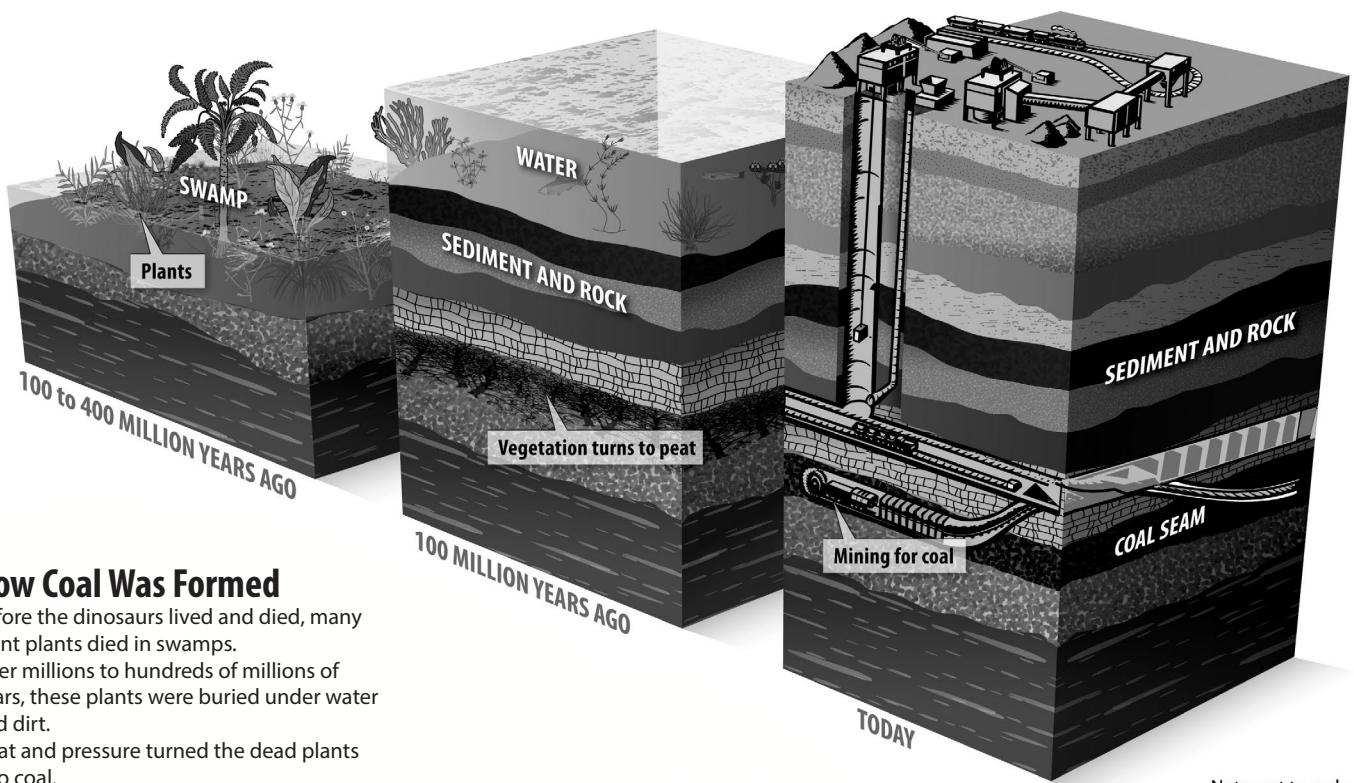
Coal looks like shiny, black rock. Coal has lots of energy in it. When it is burned, it makes heat and light energy. Many years ago, Native Americans burned coal to make pots. The early settlers didn't use much coal—they burned wood.

People began using coal in the 1800s to heat their homes. Trains and ships used coal for fuel. Factories used coal to make iron and steel. Today, we burn coal mainly to make electricity.

Coal is a Fossil Fuel

Coal was formed millions to hundreds of millions of years ago, before the dinosaurs. Back then, much of the Earth was covered by huge swamps. They were filled with giant ferns and plants. As the plants died, they sank to the bottom of the swamps.

Over the years, thick layers of plants were covered by dirt and water. They were packed down by the weight. After a long time, the heat and pressure changed the plants into coal. Coal is called a **fossil fuel** because it was made from plants that were once alive. The energy in coal came from the sun.



How Coal Was Formed

Before the dinosaurs lived and died, many giant plants died in swamps. Over millions to hundreds of millions of years, these plants were buried under water and dirt. Heat and pressure turned the dead plants into coal.

Note: not to scale

Coal is Nonrenewable

The coal we use today took millions of years to form. We can't make more in a short time. That is why it is called **nonrenewable**. There is a lot of coal in the United States. There is enough to last up to 250 years.

Digging for Coal

Most coal is buried under the ground. We must dig it out—mine it. If the coal is deep in the ground, tunnels called **mine shafts** are dug down to the coal. Machines dig the coal and carry it to the surface. Some mine shafts are 1,000 feet deep. This is called **deep mining**.

If coal is near the surface, miners dig it up with huge machines. First, they scrape off the dirt and rock, then dig out the coal. This is called **surface mining**.

After the coal is mined, they put back the dirt and rock. They plant trees and grass. The land can be used again. This is called **reclamation**.

Electricity

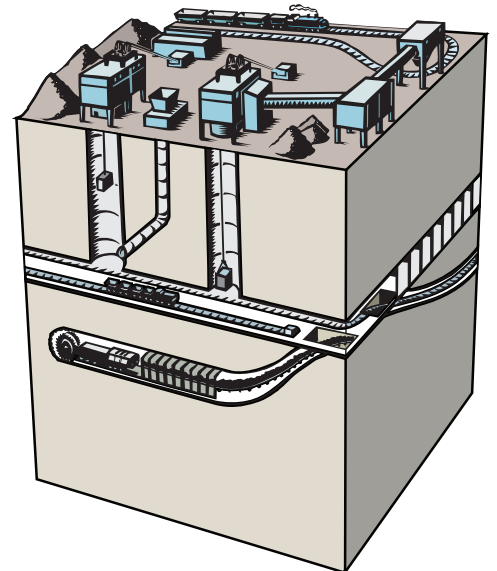
After the coal is mined, it is cleaned and shipped to market. Most coal is moved by trains to power plants and factories. Sometimes it is moved on barges along rivers.

Power plants burn the coal to make **electricity**. Coal is one of our most important energy sources. It gives us 39 percent of the electricity we use and almost one-fifth (18 percent) of our total energy.

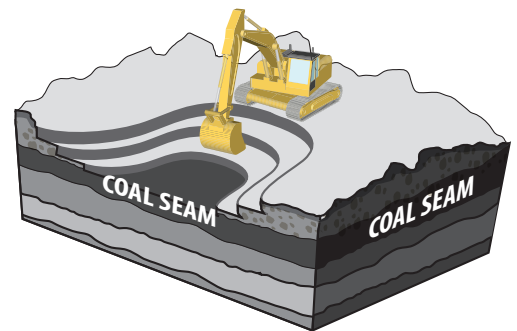
Coal Can Pollute the Air

When coal is burned, it can pollute the air. Power plants and factories work hard to keep the **pollution** from getting into the air. They clean the coal before they burn it. They use **scrubbers** to clean the smoke before it goes into the air.

Deep Mining



Surface Mining





Natural Gas

Natural gas is similar to air—it is a mixture of gases you can't see, smell, or taste. But it is different, too. It has a lot of energy in it. You can burn it to make heat. The early Chinese burned natural gas for heat to separate salt from sea water.

Natural Gas is a Fossil Fuel

Natural gas was formed in the Earth long before the dinosaurs lived. Oceans covered much of the Earth, filled with tiny sea plants and animals.

When the plants and animals died, they sank to the bottom and were covered by sand. Layers of dead plants, animals, and sand built up over time and turned into **sedimentary rock**.

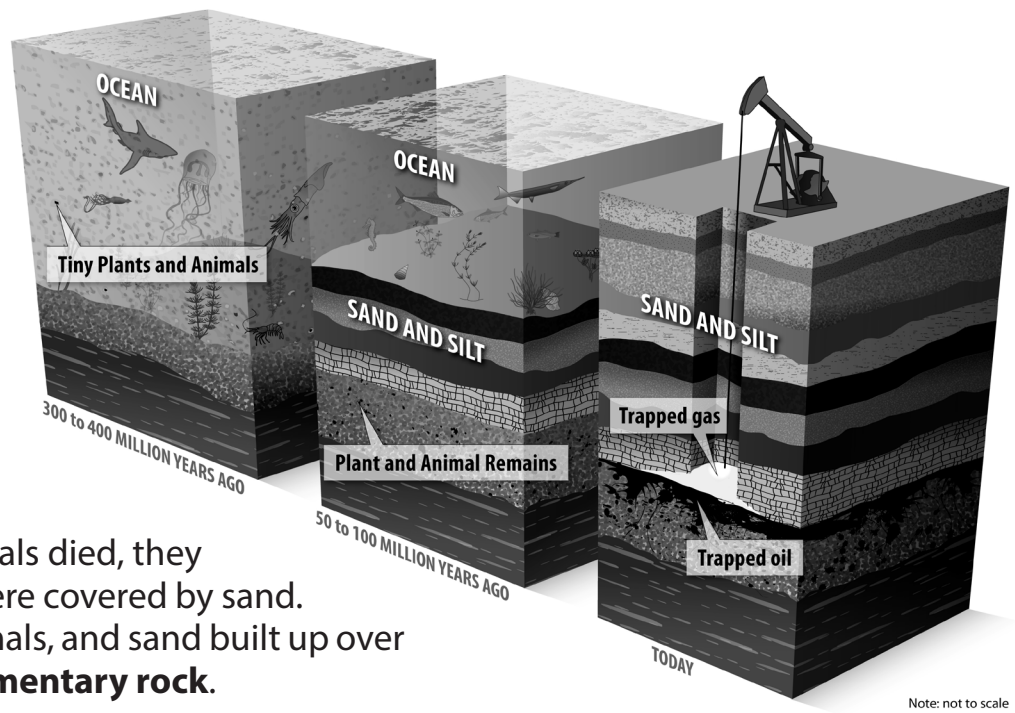
Heat from the Earth and pressure from the rock layers above turned the remains of the plants and animals into natural gas and petroleum. Since natural gas is made from the remains of plants and animals, it is called a **fossil fuel**.

The plants and animals received their energy when they were alive from the sun. It was stored in them when they died. This is the energy in natural gas.

Natural Gas is Nonrenewable

The natural gas we use today took hundreds of millions of years to form. That's why we call it a **nonrenewable** energy source. We can't make more in a short time.

Garbage sometimes produces methane, the main gas in natural gas. **Methane** from rotting garbage is a **renewable** energy source because there will always be garbage and waste.



Drilling for Natural Gas

Natural gas is found underground in pockets of rock. We drill **wells** into the ground to reach the gas so that it can flow to the surface. Some wells are a mile or more deep!

The natural gas is piped from the wells to machines that clean it and remove any water. An odor like that of rotten eggs is added to the gas so that leaks can be detected.



Photo courtesy of istockphoto

Natural gas is transported through pipelines.

Transporting Natural Gas

We move natural gas from one place to another in **pipelines**. There are more than two million miles of pipeline all across the United States moving natural gas from wells to processing plants to our homes, factories, and buildings.

We Use Natural Gas Every Day

Almost everyone uses natural gas. Most homes use natural gas for heat. So do schools and hospitals. Many stoves and water heaters use natural gas, too.

Factories burn natural gas to make products like paper and cement. Natural gas is also an ingredient in paints, glues, fertilizers, plastics, medicines, and many other products.

Power plants burn natural gas to make **electricity**. Most new power plants burn natural gas. Natural gas can be used to run cars, trucks, and buses.

Natural Gas is Cleaner to Burn

Natural gas is the cleanest burning fossil fuel. It doesn't pollute the air as much as coal or oil. That's why it is a good fuel for heating our homes and making electricity.

If connected end to end, natural gas pipelines in the U.S. would be long enough to stretch from the Earth to the moon three times!



Photo courtesy of EPA

Some city buses are fueled by natural gas.



Petroleum

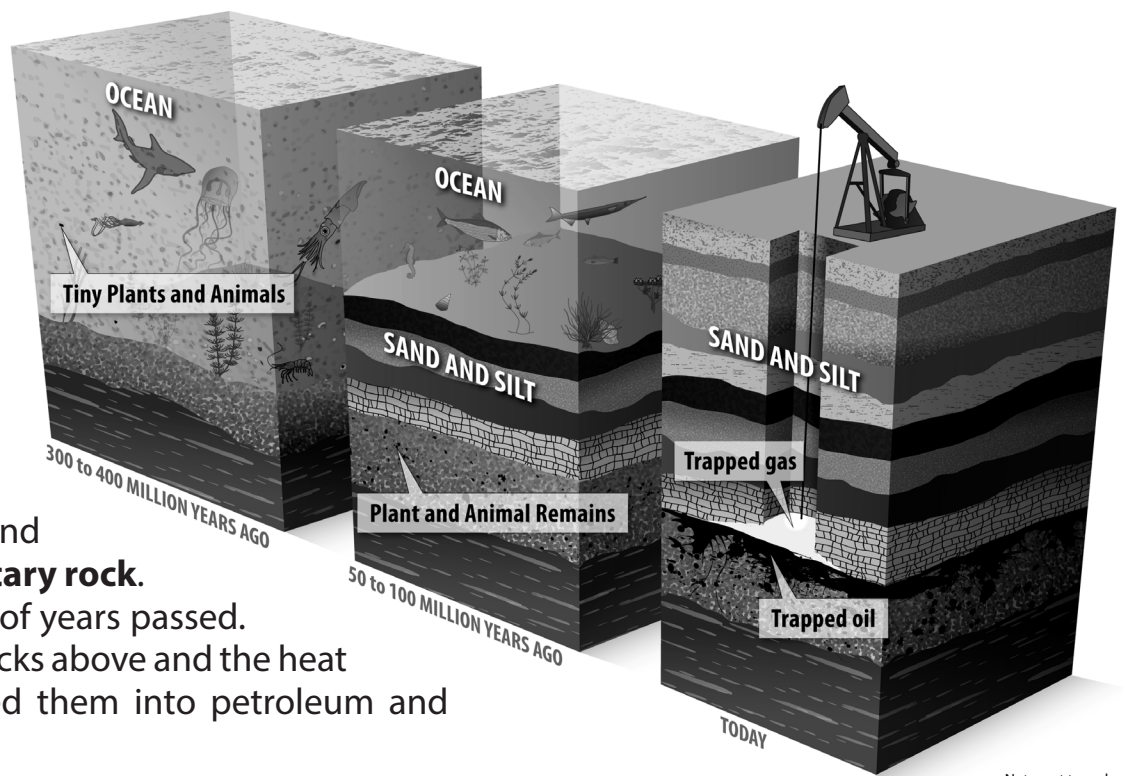
Petroleum is a liquid that is found underground. Sometimes we call it **oil**. Oil can be as thick and black as tar or as thin as water. Petroleum has a lot of energy. We can turn it into different fuels—like **gasoline, kerosene**, and heating oil. Most plastics and inks are made from petroleum, too.

People have burned oil for a long time. Long ago, they didn't dig for it. They gathered oil that seeped from under the ground into ponds. It floated on top of the water.

Petroleum is a Fossil Fuel

Long before the dinosaurs, oceans covered most of the Earth. They were filled with tiny sea animals and plants. As the plants and animals died, they sank to the ocean floor. Sand and sediment covered them and turned into **sedimentary rock**.

Hundreds of millions of years passed. The pressure of the rocks above and the heat from the Earth turned them into petroleum and natural gas.



Petroleum is called a **fossil fuel** because it was made from the remains of tiny sea plants and animals. The energy in petroleum came from the energy in the plants and animals. That energy came from the sun.

Petroleum is Nonrenewable

The petroleum we use today was made hundreds of millions of years ago. We can't make more in a short time. That's why we call petroleum **nonrenewable**. The United States doesn't produce enough oil to meet our needs. We import 48 percent of the oil we use from other countries.

We Drill Oil Wells

Petroleum is buried underground in tiny pockets in rocks. We drill oil **wells** into the rocks to pump out the oil. The typical well is about one mile deep. Texas is the state that produces the most oil.

A lot of oil is also under the oceans along our shores. Floating oil rigs are used to reach this oil. Most of these wells are in the Gulf of Mexico.



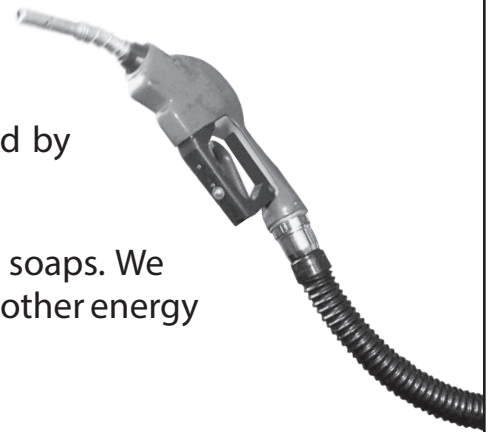
An oil rig pumps oil from a well.

After the oil is pumped to the surface, it is sent to **refineries**. At the refineries, it is separated into different types of products and made into fuels. Most of the oil is made into gasoline. The oil is moved from one place to another through **pipelines** and by ships and trucks.

We Use Petroleum Every Day

What would we do without petroleum? Our country would come to a stop. Most of our cars, trucks, and planes are powered by fuel made from oil.

Our factories use oil to make plastics and paints, medicines and soaps. We even burn oil to make electricity. We use more petroleum than any other energy source.



Petroleum Can Pollute

Petroleum keeps us going, but it can damage our environment. Burning fuels made from oil can pollute the air. **Pollution** from cars is a big problem in many parts of the country. Oil companies are making cleaner gasoline and diesel fuel every year.

Oil can pollute soil and water, harming the animals that live in the area. Oil companies work hard to drill and ship oil as safely as possible. They try to clean up any oil that spills.



Photo courtesy of gettyimages

Petroleum fuels can contribute to air pollution.



Propane

Propane is the gas we use to fuel our backyard grills. It is a lot like natural gas—you cannot see it, smell it, or taste it, but you can burn it to produce heat energy.

Propane has been around for millions of years, but no one knew it. It is buried underground in **sedimentary rocks** with natural gas and petroleum.

Propane wasn't discovered until 1912. The scientists knew they had found a good, new energy source. One year later, people were using it to heat their homes.

Propane is a Fossil Fuel

Propane is a **fossil fuel**. It was formed hundreds of millions of years ago, long before the dinosaurs. Like oil and natural gas, it was formed from tiny sea animals and plants.

The plants got their energy from the sun. This is the energy in propane. Propane's energy came from the sun.

Propane is mixed with natural gas and petroleum when it comes from the ground. It is separated out at natural gas processing plants and oil refineries.

Propane is Nonrenewable

The propane we burn today was made a long time ago. It took hundreds of millions of years to form. We can't make more propane in a short time. It is a **nonrenewable** source of energy.

We get propane from **petroleum** and **natural gas**. Our supply of propane depends on our supply of these other fossil fuels.



Pipelines are used to transport propane and natural gas to a processing facility.

Propane is Portable

When propane comes out of the ground, it is a gas. But when it is put under pressure, it becomes a liquid. A lot more liquid can be put into a tank than gas. A tank of propane gas might last a week. The same sized tank of liquid propane could last five years!

Liquid propane is portable—that means it is easy to move from place to place. We use small tanks of liquid propane for our barbecue grills. One tank can last all summer.



A propane grill.

We Use Propane Every Day

Many farms in the United States use propane to dry crops, run tractors, and heat barns. Businesses use propane for heating and cooking. Most of the carts and vehicles that we drive inside buildings use propane for fuel. It is a clean burning fuel.

Some cars and buses use propane for fuel. It is a very clean fuel. It doesn't pollute the air like gasoline. Engines must be changed to use propane though, and that is expensive.

Some people in the country don't have natural gas pipelines near their homes. They use propane instead. They put big propane tanks outside their houses. Delivery trucks bring the propane right to their houses.



This forklift is fueled by propane.



Propane is stored in a large tank. It is used to provide energy for heating, cooking, and drying clothes.