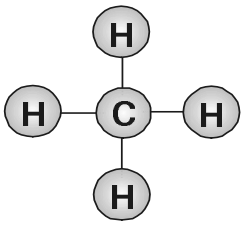
Natural Gas



The chemical formula for methane is CH_4

2000 Facts at a Glance

Classification: Nonrenewable Energy Source

Percent of energy produced in US:	**29.0% (21.1 Q)**
Percent of energy consumed in US:	**22.0% (21.3 Q)**

Major uses: heating, industrial production

What Is Natural Gas?

Natural gas is generally considered a **nonrenewable fossil fuel**. *(There are some renewable sources of natural gas also discussed in this infosheet.)* Natural gas is called a fossil fuel because most scientists believe that natural gas was formed from the remains of tiny sea animals and plants that died 200-400 million years ago.

When these tiny sea animals and plants died, they sank to the bottom of the oceans where they were buried by layers of sand and silt. Over the years, the layers of sand and silt became thousands of feet thick, subjecting the energy-rich plant and animal remains to enormous pressure. Most scientists believe that the pressure, combined with the heat of the earth, changed this organic mixture into petroleum and natural gas. Eventually, concentrations of natural gas became trapped in the rock layers like a wet sponge traps water.

Raw natural gas is a mixture of different gases. Its main ingredient is methane, a natural compound that is formed whenever plant and animal matter decays. By itself, **methane** is odorless, colorless, and tasteless. As a safety measure, natural gas companies add a chemical odorant called **mercaptan** (it smells like rotten eggs) so escaping gas can be detected. Natural gas should not be confused with gasoline, which is made from petroleum.

History of Natural Gas

The ancient peoples of Greece, Persia, and India discovered natural gas many centuries ago. The people were mystified by the burning springs created when natural gas seeping from cracks in the ground was ignited by lightning. They sometimes built temples around these eternal flames so they could worship the fire.

About 2,500 years ago, the Chinese recognized that natural gas could be put to work. The Chinese piped the gas from shallow wells and burned it under large pans to evaporate sea water for salt.

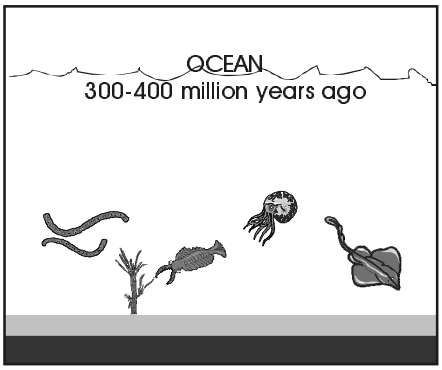
Natural gas was first used in America to illuminate the streets of Baltimore in 1816. Soon after, in 1821, William Hart dug the first successful American natural gas well in Fredonia, New York. His well was 27 feet deep, quite shallow compared to today's wells. The Fredonia Gas Light Company opened its doors in 1858 as the nation's first natural gas company. By 1900, natural gas had been discovered in 17 states. In the past 40 years, the use of natural gas has grown. Today, natural gas accounts for about 22 percent of the energy we use.

Producing Natural Gas

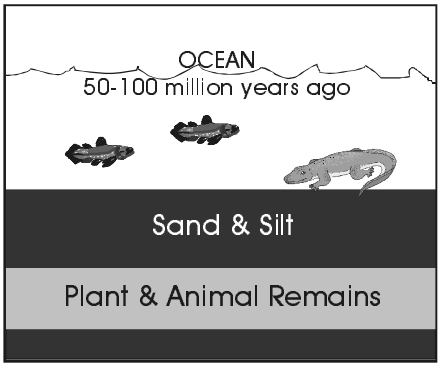
Natural gas can be hard to find since it can be trapped in porous rocks deep underground.

Scientists use many methods to find natural gas deposits. They may look at surface rocks to find clues about underground formations. They may set off small explosions or drop heavy weights on the surface and record the sound waves as they bounce back from the rock layers underground. They also may measure the gravitational pull of rock masses deep within the earth.

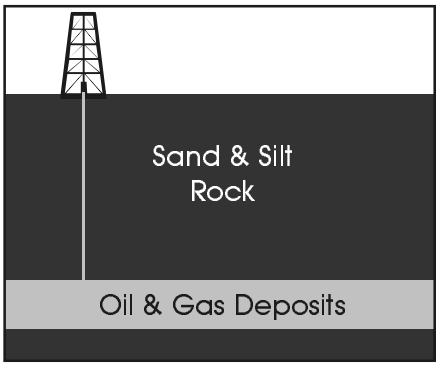
PETROLEUM & NATURAL GAS FORMATION



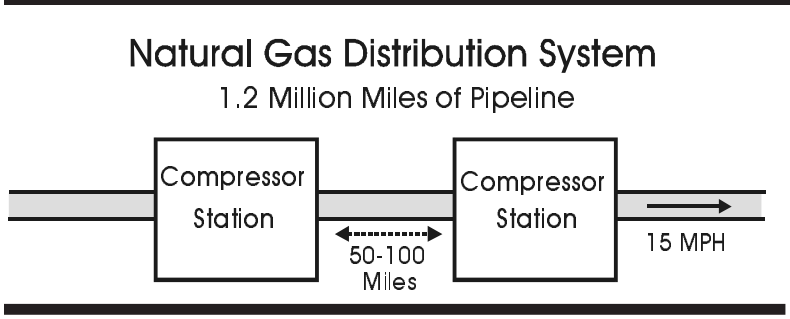
Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of sand and silt.



Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.



Today, we drill down through layers of sand, silt, and rock to reach the rock formations that contain oil and gas deposits.



If test results are promising, the scientists may recommend drilling to find the natural gas deposits. Natural gas wells average 6,100 feet deep and can cost a hundred dollars per foot to drill, so it's important to choose sites carefully.

Only about 48 percent of the exploratory wells produce gas. The others come up dry. The odds are better for developmental wells—wells drilled on known gas fields. On average, 85 percent of the developmental wells yield gas. Natural gas can be found in pockets by itself or in petroleum deposits.

After natural gas comes out of the ground, it goes to a processing plant where it is cleaned of impurities and separated into its various components. Approximately 90 percent of natural gas is composed of methane, but it also contains other gases such as propane and butane.

Natural gas may also come from several other sources. One source is the methane gas found in coalbeds. Until recently, coalbed gas was just considered a safety hazard to miners, but now it is a valuable source of natural gas.

Another source of natural gas is the gas produced in landfills. Landfill gas is considered a renewable source of natural gas since it comes from decaying garbage. The gas from coalbeds and landfills accounts for six percent of the total gas supply today—that could double by the year 2010. The gas recovered from landfills is usually burned on the landfill site to generate electricity for the facility itself.

Today, natural gas is produced in 32 states, but the top five states—Texas, Louisiana, Oklahoma, New Mexico, and Wyoming—produce 80 percent of the total. Altogether, the U.S. produces about 25 percent of the world's natural gas each year.

Transporting and Storing Natural Gas

How does natural gas get to you? Usually by pipeline. More than one million miles of underground pipelines link natural gas fields to major cities across the United States. Natural gas is sometimes transported thousands of miles by pipeline to its final destination.

A machine called a **compressor** increases the pressure of the gas, forcing the gas to move along the pipelines. Compressor stations, which are spaced about 50 to 100 miles apart, move the gas along the pipelines at about 15 miles per hour.

Some gas moved along this subterranean highway is temporarily stored in huge underground reservoirs. The underground reservoirs are typically filled in the summer so there will be enough natural gas during the winter heating season.

Eventually, the gas reaches the **city gate** of a local gas utility. The pressure is reduced and an odorant is added so leaking gas can be detected. Local gas companies use smaller pipes to carry gas the last few miles to homes and businesses. A gas meter measures the volume of gas a consumer uses.

Natural Gas Use

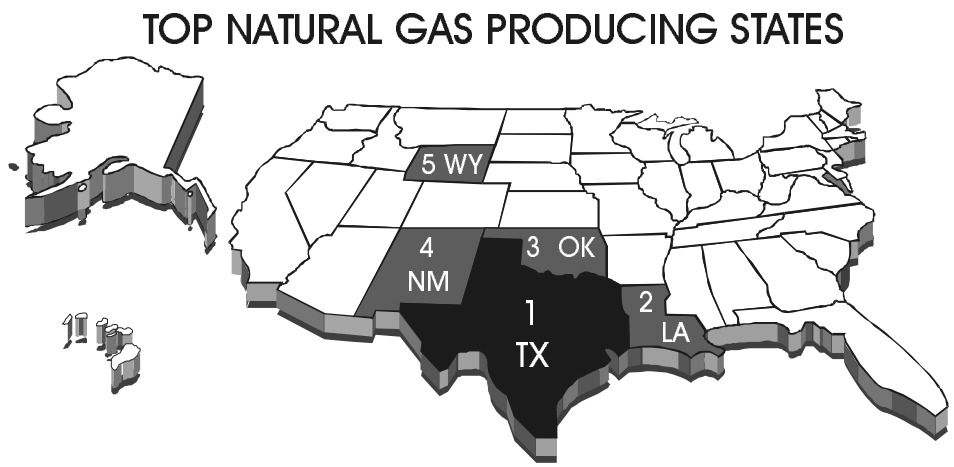
Just about everyone in the United States uses natural gas. Natural gas ranks number three in energy use, right after petroleum and coal. About 22 percent of the energy we use in the United States comes from natural gas.

Industry is the biggest consumer of natural gas, using it mainly as a heat source to manufacture goods. Industry also uses natural gas as an ingredient in fertilizer, photographic film, ink, glue, paint, plastics, laundry detergent, and insect repellents. Synthetic rubber and man-made fibers like nylon also could not be made without the chemicals derived from natural gas.

Residences—people's homes—are the second biggest users of natural gas. Six in ten homes use natural gas for heating. Many homes also use gas water heaters, stoves, and clothes dryers. Natural gas is used so often in homes because it is clean-burning.

Like residences, commercial use of natural gas is mostly for indoor space heating of stores, office buildings, schools, churches, and hospitals.

Natural gas is also used to make electricity—it is the third largest producer of electricity after coal and uranium. Many people in the energy industry believe natural gas will play a bigger role in electricity production as the demand for electricity increases in the future.

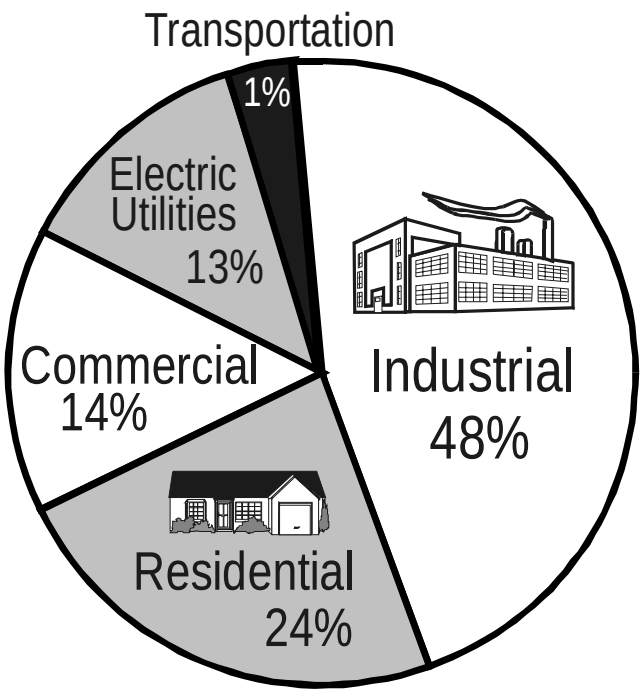


ENERGY INFORMATION ADMINISTRATION

Natural gas power plants are cleaner than coal plants, and can be brought on-line very quickly. Natural gas plants produce electricity about 20 percent more efficiently than new coal plants, and produce it with fewer emissions. Today, natural gas generates 15 percent of the electricity in the U.S.

To a lesser degree, natural gas is becoming popular as a transportation fuel. Natural gas can be used in any vehicle with a regular internal combustion engine, although the vehicle must be outfitted with a special carburetor and fuel tank.

Natural gas is cleaner burning than gasoline, costs less, and has a higher octane (power boosting) rating. In 2000, more than 100,000 vehicles ran on natural gas in the United States.



Natural Gas Reserves

People in the energy industry use two special terms when they talk about how much natural gas there is—resources and reserves.

Natural gas resources include all the deposits of gas that are still in the ground waiting to be tapped.

Natural gas reserves are only those gas deposits that scientists know, or strongly believe, can be recovered given today's prices and drilling technology.

In other words, when scientists estimate the amount of known gas reserves, they do not include gas deposits that may be discovered in the future or gas deposits that are not economical to produce given today's prices.

Think of reserves this way. If it cost you $10 to manufacture a toy that you could sell for $8, would you make the toy? Of course not! You would lose $2 on every toy.

The United States has large reserves of natural gas. Most reserves are in the Gulf of Mexico and in the following states: Texas, Louisiana, Oklahoma, New Mexico, Wyoming, Kansas, and Alaska.

If we continue to use natural gas at the same rate as we use it today, the United States has about a 50-year supply of natural gas, though another 200 years of additional gas supplies could be produced if people are willing to pay more for the gas they use.

Natural Gas Prices

Since 1985, natural gas prices have been set by the market. The federal government sets the price of transportation for natural gas that crosses state lines.

MEASURING*natural gas*

Gasoline is sold in gallons, coal in pounds, and wood in cords. Natural gas is sold in cubic feet. How can we compare energy sources if there are all these different measuring sticks? After all, comparing gallons to cubic feet is like comparing apples to oranges.

We can measure the heat energy contained in all these energy sources by one common unit of measure. The heat energy stored in a gallon of gasoline, a pound of coal, a cord of wood, or a cubic foot of natural gas can all be measured in British thermal units or Btu's.

One Btu is the amount of heat energy needed to raise the temperature of one pound of water one degree Fahrenheit. A burning kitchen match releases about one Btu. One candy bar (an energy source for the human body) has about 1,000 Btu. One cubic foot of natural gas has about 1,031 Btu.

Natural gas is usually sold to pipeline companies in standard measurements of thousands of cubic feet (Mcf). One thousand cubic feet of natural gas would fit into a box that is 10 feet deep, 10 feet long, and 10 feet wide.

Most residential customers are billed by the number of therms of natural gas they use each month. One therm is equal to 97 cubic feet.

State public utility commissions will continue to regulate natural gas utility companies—just as they regulate electric utilities. These commissions regulate how much utilities may charge their customers, and they monitor the utilities' policies.

So how much does it costs to heat your home with natural gas? Compared to other energy sources, natural gas is a good buy. Heating with natural gas is cheaper than any other major heating source. It is nearly four times cheaper than electricity when you use resistance heat and is 25 percent less expensive than electric heat pumps.

Natural Gas and the Environment

All the fossil fuels—coal, petroleum, and natural gas—release pollutants into the atmosphere when burned. The good news is that natural gas is the most environmentally friendly fossil fuel.

Burning natural gas produces less sulfur, carbon, and nitrogen than burning other fossil fuels. Natural gas also emits little ash particulate into the air when it is burned.

Like all fossil fuels, burning natural gas produces carbon dioxide, a greenhouse gas. Many scientists believe that increasing levels of carbon dioxide in the atmosphere, caused in large part by fossil fuel use, could have long-term effects on global climate.

In 1997, the United States and many other industrialized countries agreed upon a plan to reduce emissions of greenhouse gases. This treaty, called the Kyoto Protocol, has been signed by the United States, but not approved by the Senate. President Bush has announced he will not approve the treaty in its present form because it exempts emerging countries such as China, which will soon surpass the U.S. as the top emitter of greenhouse gases.

INNOVATIVE IDEAS

Natural Gas in the Future

Fuel Cells

Many scientists are interested in using natural gas to generate electricity. Engineers have already developed ways to use coal, petroleum and natural gas together to generate electricity, but a fuel cell can use natural gas alone. A fuel cell is similar to a battery. It uses a chemical process rather than combustion (burning) to convert the energy content of a fuel into electricity. The chemical process is much more energy-efficient than combustion, and it emits no air pollutants. Fuel cells today are expensive; the technology to generate electricity from fuel cells must be improved if they are to be commercially successful.

Methane Hydrates

Buried in the sediments of the ocean floor is a reserve of methane so vast it could possibly fuel the entire world. In sediments on the ocean floor, tiny bacteria continuously break down the remains of sea animals and plants, producing methane gas. Under the enormous pressures and cold temperatures at the bottom of the sea, this methane gas dissolves and becomes locked in water molecules to form crystals. These crystals cement together the ocean sediments into solid layers—called methane hydrates—which can extend down into the sea floor.

Scientists also suspect that huge deposits of free methane gas are trapped beneath the hydrate layer. Researchers estimate there is more carbon trapped in hydrates than in all the fossil fuels. They aren't sure how to capture this methane. When a hydrate breaks down, it loses its solidity and turns to mush, causing major landslides and other disturbances to the ocean floor, as well as an increase in methane escaping into the atmosphere.

Biomass

Scientists are also researching new ways to obtain natural (methane) gas from biomass—a fuel source derived from plant and animal wastes. Methane gas is naturally produced whenever organic matter decays.

Today, we can drill shallow wells into landfills to recover the methane gas. Landfills are already required to collect methane gas as a safety measure. Typically, landfills collect the gas and burn it to get rid of it. But the gas can be put to work. Last year, over four billion cubic feet of landfill methane gas was used for heating and electricity production.

There are other ways to convert biomass into natural gas. One method converts aquatic plants, such as sea kelp, into methane gas. In the future, huge kelp farms could also produce renewable gas energy.

Liquid Natural Gas

Another successful development has been the conversion of natural gas into a liquid state. In its liquid state, natural gas is called LNG, or liquid natural gas.

LNG is made by cooling natural gas to a temperature of minus 260°F. At that temperature, natural gas becomes a liquid and its volume is reduced 615 times. (A car reduced 615 times would fit on your thumbnail.) Liquid natural gas is easier to store than the gaseous form since it takes up much less space. LNG is also easier to transport. People can put LNG in special tanks and transport it on trucks or ships.

Today, more than 100 LNG storage facilities are operating in the United States.