

## Natural Gas -- A Fossil Fuel

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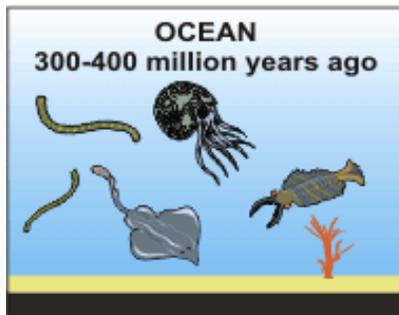
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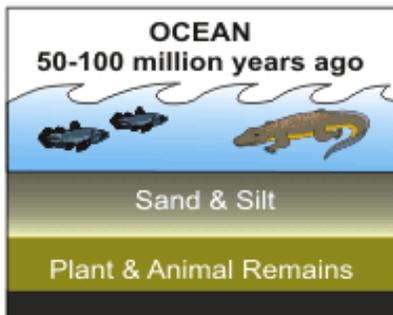
## HOW NATURAL GAS WAS FORMED

Millions of years ago, the remains of plants and animals decayed and built up in thick layers. This decayed matter from plants and animals is called organic material -- it was once alive. Over time, the mud and soil changed to rock, covered the organic material and trapped it beneath the rock. Pressure and heat changed some of this organic material into coal, some into oil (petroleum), and some into natural gas -- tiny bubbles of odorless gas. The main ingredient in natural gas is methane, a gas (or compound) composed of one carbon atom and four hydrogen atoms.

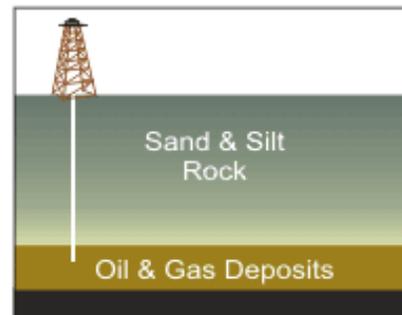
### PETROLEUM & NATURAL GAS FORMATION



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



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.

In some places, gas escapes from small gaps in the rocks into the air; then, if there is enough activation energy from lightning or a fire, it burns. When people first saw the

flames, they experimented with them and learned they could use them for heat and light.

## HOW WE GET NATURAL GAS

The search for natural gas begins with geologists (people who study the structure of the earth) locating the types of rock that are usually found near gas and oil deposits.

Today their tools include seismic surveys that are used to find the right places to drill wells. Seismic surveys use echoes from a vibration source at the earth's surface (usually a vibrating pad under a truck built for this purpose) to collect information about the rocks beneath. Sometimes it is necessary to use small amounts of dynamite to provide the vibration that is needed.

Scientists and engineers explore a chosen area by studying rock samples from the earth and taking measurements. If the site seems promising, drilling begins. Some of these areas are on land but many are **offshore**, deep in the ocean. Once the gas is found, it flows up through the well to the surface of the ground and into large pipelines. Some of the gases that are produced along with methane, such as butane and **propane** (also known as 'by-products'), are separated and cleaned at a gas processing plant. The by-products, once removed, are used in a number of ways. For example, propane can be used for cooking on gas grills.

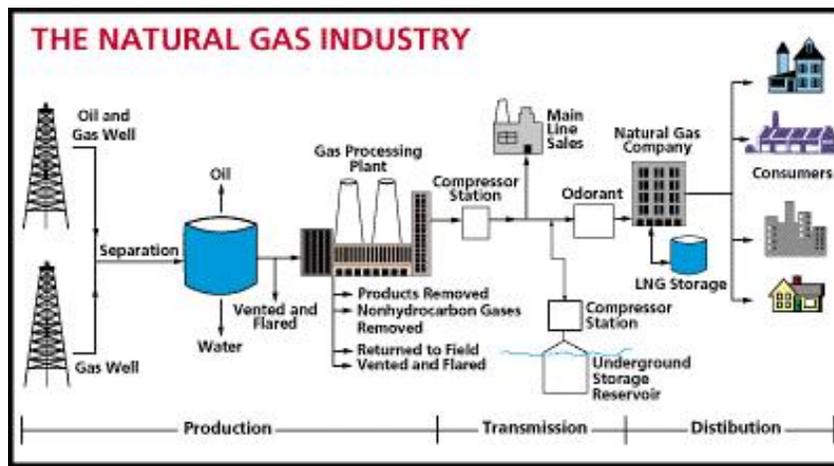
Because natural gas is colorless, odorless and tasteless, mercaptan (a chemical that has a sulfur like odor) is added before distribution, to give it a distinct unpleasant odor (smells like rotten eggs). This serves as a safety device by allowing it to be detected in the atmosphere, in cases where leaks occur.

Most of the natural gas consumed in the United States is produced in the United States. Some is imported from Canada and shipped to the United States in pipelines. Increasingly natural gas is also being shipped to the United States as liquefied natural gas(LNG).

We can also use machines called "**digesters**" that turn today's organic material (plants, animal wastes, etc.) into natural gas. This replaces waiting for thousands of years for the gas to form naturally.

## HOW NATURAL GAS IS STORED AND DELIVERED

The gas companies collect it in huge storage tanks, or underground, in old gas wells. The gas remains there until it is added back into the pipeline when people begin to use more gas, such as in the winter to heat homes.



Natural gas is moved by pipelines from the producing fields to consumers. Since natural gas demand is greater in the winter, gas is stored along the way in large underground storage systems, such as old oil and gas wells or caverns formed in old salt beds. The gas remains there until it is added back into the pipeline when people begin to use more gas, such as in the winter to heat homes.

When chilled to very cold temperatures, approximately -260 degrees Fahrenheit, natural gas changes into a liquid and can be stored in this form. Liquefied natural gas (LNG) can be loaded onto tankers (large ships with several domed tanks) and moved across the ocean to deliver gas to other countries. Once in this form, it takes up only 1/600th of the space that it would in its gaseous state. When this LNG is received in the United States, it can be shipped by truck to be held in large chilled tanks close to users or turned back into gas to add to pipelines.

When the gas gets to the communities where it will be used (usually through large pipelines), the gas is measured as it flows into smaller pipelines called "MAINS". Very small lines, called "SERVICES", connect to the mains and go directly to homes or buildings where it will be used.

## HOW NATURAL GAS IS MEASURED

We measure and sell natural gas in cubic feet (volume) or in **British Thermal Units** (heat content). Heat from all energy sources can be measured and converted back and forth between British thermal units (Btu) and metric units. See the [Energy Calculator](#) for help with converting natural gas units.

One Btu is the heat required to raise the temperature of one pound of water one degree Fahrenheit. Ten burning kitchen matches release 10 Btu. One cubic foot of natural gas has about 1031 Btu. A box 10 feet deep, 10 feet long, and 10 feet wide would hold one thousand cubic feet of natural gas.

For example, a candy bar has about 1000 Btu.

Pipeline companies buy natural gas in thousands of cubic feet or Mcf. M = one thousand.

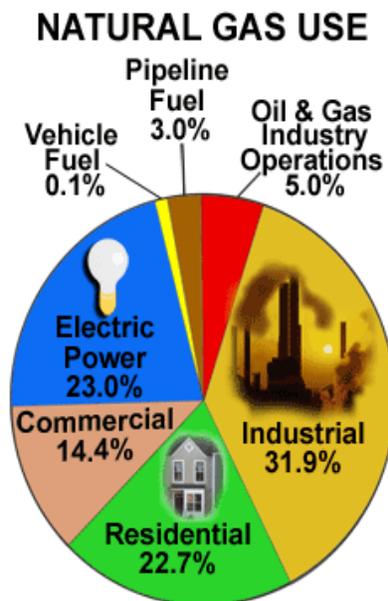
## WHAT NATURAL GAS IS USED FOR

Approximately 23 percent of the energy consumption of the U.S. comes from natural gas. Over one-half of the homes in the U.S. use natural gas as their main heating fuel.

Natural gas is also an essential raw material for many common products, such as: paints, fertilizer, plastics, antifreeze, dyes, photographic film, medicines, and explosives. We also get [propane](#), a fuel we use in many of our backyard barbecue grills, when we process natural gas.

Industry depends on it. Natural gas has thousands of uses. It's used to produce steel, glass, paper, clothing, brick, electricity and much more!

Homes use it too. More than 61.9 million homes use natural gas to fuel stoves, furnaces, water heaters, clothes dryers and other household appliances. It is also used to roast coffee, smoke meats, bake bread and much more.



## NATURAL GAS AND THE ENVIRONMENT

Natural gas burns more cleanly than other fossil fuels. It has fewer emissions of sulfur, carbon, and nitrogen than coal or oil, and it has almost no ash particles left after burning. Being a clean fuel is one reason that the use of natural gas, especially for electricity generation, has grown so much and is expected to grow even more in the future.

Of course, there are environmental concerns with the use of any fuel. As with other fossil fuels, burning natural gas produces carbon dioxide, which is the most important

**[greenhouse gas](#)**. Many scientists believe that increasing levels of carbon dioxide and other greenhouse gases in the earth's atmosphere are changing the global climate.

As with other fuels, natural gas also affects the environment when it is produced, stored and transported. Because natural gas is made up mostly of methane (another greenhouse gas), small amounts of methane can sometimes leak into the atmosphere from wells, storage tanks and pipelines. The natural gas industry is working to prevent any methane from escaping. Exploring and drilling for natural gas will always have some impact on land and marine habitats. But new technologies have greatly reduced the number and size of areas disturbed by drilling, sometimes called "footprints." Satellites, global positioning systems, remote sensing devices, and 3-D and 4-D seismic technologies, make it possible to discover natural gas reserves while drilling fewer wells. Plus, the use of horizontal and **[directional drilling](#)** make it possible for a single well to produce gas from much bigger areas.

Natural gas pipelines and storage facilities have a very good safety record. This is very important because when natural gas leaks it can cause explosions. Since raw natural gas has no odor, natural gas companies add a smelly substance to it so that people will know if there is a leak. If you have a natural gas stove, you may have smelled this "rotten egg" smell of natural gas when the pilot light has gone out.

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Sources: Energy Information Administration, *Natural Gas Annual 2003*, December 2004.

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