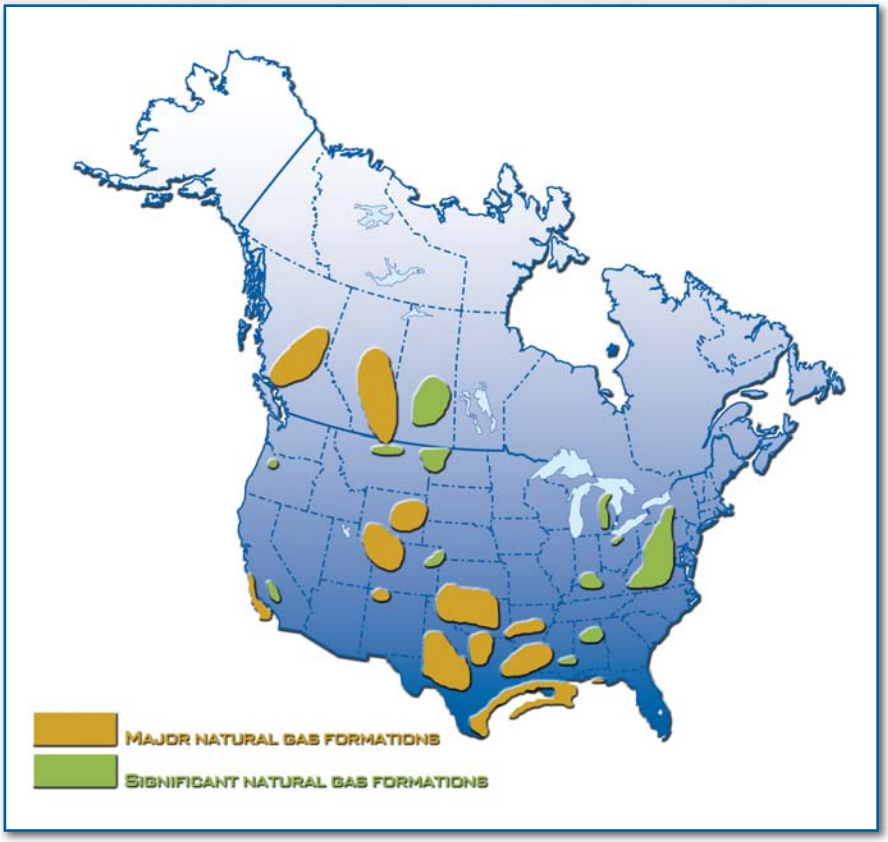
Natural gas is, in many ways, the ideal fossil fuel. It is clean, easy to transport, and convenient to use. Industrial users use almost half of the gas produced in the United States. A large portion is also used in homes for heating, lighting, and cooking.

WHERE IS NATURAL GAS FOUND?

Like petroleum, natural gas can be found throughout the world. It is estimated that there are still vast amounts of natural gas left in the ground. However, it is very difficult to estimate how much natural gas is still underground. New technologies are helping to make the process a little easier and more accurate.

Recent estimates show that most of the world's natural gas reserves are located in the Middle East, Europe, and the former U.S.S.R., with these reserves making up nearly 75 percent of total worldwide reserves. Roughly 16 percent of the reserves are located in Africa and Asia and another 4 percent in Central and South America. The United States makes up almost 4 percent.

While the United States may only have a small percentage of natural gas when compared to worldwide reserves, there is still plenty in the country to last for at least another 60 years or longer, as a lot of gas may be undiscovered or unrecoverable with today's technologies. Natural gas is produced in 32 states. The top producing states are Texas, Oklahoma, New Mexico, Wyoming, and Louisiana, which produce more than 50 percent of U.S. natural gas.



Natural Gas Formations

These are the areas of the United States and Canada where natural gas formations are found.

USES FOR NATURAL GAS

For many years, natural gas was considered worthless and was discarded by being burned in giant flares. But it wasn't long before it was discovered as a useful energy source. Today, approximately 24 percent of the energy consumption of the United States comes from natural gas. More than one-half of the homes in the country use natural gas as their main heating fuel. Natural gas is a colorless, shapeless, and odorless gas. Because it has no odor, gas

companies add a chemical to it that smells similar to rotten eggs. This way you can tell if there is a gas leak in your house.

Natural gas is also an essential raw material for many common products, including paints, fertilizers, plastics, antifreeze, and medicine. We also get propane—a fuel often used in many barbecue grills—when we process natural gas.

DRILLING FOR NATURAL GAS

The exploration for and production of natural gas is very similar to that of petroleum. In fact, natural gas is commonly found in the same reservoirs as petroleum. Because natural gas is lighter, it is often found on top of the oil. And like oil, some natural gas flows freely to wells because of the natural pressure of the underground reservoir forces the gas through the reservoir rocks. These types of gas wells require only a "**Christmas tree**," which is a series of pipes and valves on the surface that are used to control the flow of gas. Only a small number of these free-flowing gas formations still exist in the U.S. gas fields.

Natural gas

from underground formations flows through pipes on the surface sometimes called a "Christmas Tree."

Most now need some type of pumping system to extract the gas still trapped in the underground formation.

One of the most common is the "**horse head**" pump, which rocks up and down to lift a rod in and out of a well bore, bringing gas and oil to the surface.

Often the flow of gas through a reservoir can be improved by creating tiny cracks in the rock, called fractures, that serve as open pathways for the gas to flow. In a technique called "**hydraulic fracturing**," drillers force high pressure fluids (like water) into a formation to crack the rock. A "**propping agent**," like sand or tiny glass beads, is added to the fluid to prop open the fractures when the pressure is decreased.

Natural gas can be found in a variety of different underground formations, including: shale formations; sandstone beds; and coal seams. Some of these formations are more difficult and more expensive to produce than others, but they hold the potential for vastly increasing the nation's available gas supply.

Recent research is exploring how to obtain and use gas from these sources. Some of the work has been in **Devonian shales**, which are rock formations of organic rich clay where gas has been trapped. Dating back nearly 350 million years (to the Devonian Period), these black or brownish shales were formed from sediments deposited in the basins of inland seas during the erosion that formed the Appalachian Mountains.

Other sources of gas include "**tight sand lenses**." These deposits are called "tight" because the holes that hold the gas in the sandstone are very small. It is hard for the gas to flow through these tiny spaces. To get the gas out, drillers must first crack the dense rock structure to create ribbon-thin passageways through which the gas can flow.

Coalbed methane gas that is found in all coal deposits was once regarded as only a safety hazard to miners but now, due to research, is viewed as a valuable potential source of gas.

STORAGE AND DELIVERY OF NATURAL GAS

Once natural gas is produced from underground rock formations, it is sent by pipelines to storage facilities and then on to the end user. The United States has a vast pipeline network that transports gas to and from nearly any location in the lower 48 states. There are more than 210 natural gas pipeline systems, using more than 300,000 miles of interstate and intrastate transmission pipelines. There are more than 1,400 compressor stations that maintain pressure on the natural gas to keep it moving through the system. There are more than 400 underground natural gas storage facilities that can hold the gas until it is needed back in the system for delivery to the more than 11,000 delivery points, 5,000 receipt points, and 1,400 interconnection points that help transfer the gas throughout the country.

Pipelines

The United States has a vast pipeline network that transports gas to and from nearly any location in the lower 48 states.

HISTORY OF NATURAL GAS

100 to 125 A.D.: Greek historian Plutarch writes about the "eternal flames" in what is present-day Iraq. These flames may have been natural gas escaping from cracks in the ground and ignited by lightning.

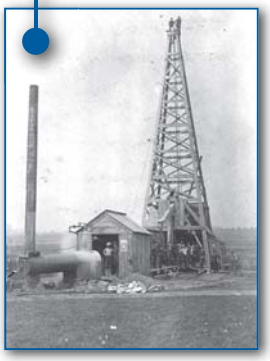
1800s: Natural gas is used almost exclusively as fuel for lamps, including street lamps.

1821: In Fredonia, New York, William A. Hart drills a 27-foot-deep well in an effort to get a larger flow of gas from a surface seepage of natural gas, creating the first well intentionally drilled to obtain natural gas.

1885: Robert Bunsen invents a burner that mixes air with natural gas. The "Bunsen Burner" showed how gas could be used to provide heat for cooking and warming buildings.

1890s: Cities begin converting street lamps to electricity, leading gas producers to search out new markets for their product.

1891: The first natural gas pipeline is constructed, carrying gas from fields in central Indiana through 120 miles of pipelines into Chicago.

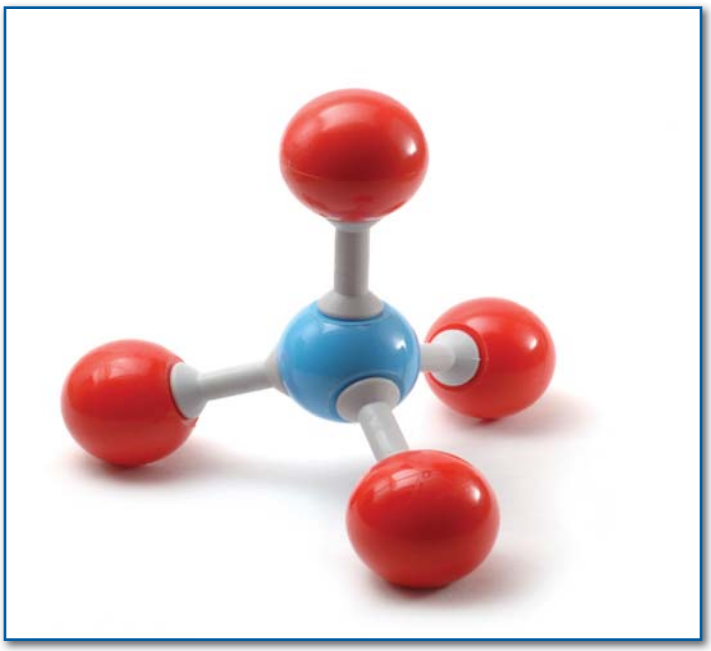


1940s, 1950s to 1960s

Today: The U.S. pipeline network, if laid out end-to-end, would stretch to the moon and back twice!

1950s – 1960s: The United States begins building its pipeline network. Thousands of miles of pipelines are constructed during this period.

1940s: After World War II, the construction of natural gas pipelines expands throughout the United States as improvements in metals, welding techniques, and pipe making make pipeline construction more economically attractive.



Methane

Natural gas is made up mainly of the chemical methane, a simple compound that has a carbon atom surrounded by four hydrogen atoms. Methane is highly flammable and burns almost completely, with no ash and very little air pollution.

Methane Hydrate

is a cage-like lattice of ice inside of which are trapped molecules of methane, the chief component of natural gas.

MEETING OUR FUTURE NATURAL GAS NEEDS

Natural gas is an important energy source for the U.S. economy, providing 24 percent of all energy used in our Nation's diverse energy portfolio. A reliable and efficient energy source, natural gas is also the least carbon-intensive of the fossil fuels.

Historically, the United States has produced much of the natural gas it has consumed, with the balance imported primarily from Canada through pipelines. The total U.S. natural gas consumption is expected to increase from about 23 trillion cubic feet today to 24 trillion cubic feet in 2035.

METHANE HYDRATE

Production of domestic conventional and unconventional natural gas cannot keep pace with demand growth. The development of new, cost-effective resources such as **methane hydrate** can play a major role in moderating price increases and ensuring adequate future supplies of natural gas for American consumers.

Methane hydrate is a cage-like lattice of ice inside of which are trapped molecules of methane, the chief component of natural gas. If methane hydrate is either warmed or depressurized, it will revert back to water and natural gas. When brought to the earth's surface, one cubic meter of gas hydrate releases 164 cubic meters of natural gas. Hydrate deposits may be several hundred meters thick and generally occur in two types of settings: under Arctic permafrost, and beneath the ocean floor. Methane that forms hydrate can be both biogenic, created by biological activity in sediments, and thermogenic, created by geological processes deeper within the earth.

While global estimates vary considerably, the energy content of methane occurring in hydrate form is immense, possibly exceeding the combined energy content of all other known fossil fuels. However, future production volumes are speculative because methane production from hydrate has not been documented beyond small-scale field experiments.

LIQUEFIED NATURAL GAS

Another way to ensure the United States has enough natural gas to meet demands is through importing gas from foreign countries. Currently, most of the demand for natural gas in the United States is met with domestic production and imports via pipeline from Canada. However, a small but growing percentage of gas supplies is imported and received as **liquefied natural gas** (LNG). A significant portion of the world's natural gas resources are considered "**stranded**" because they are located far from any market. Transportation of LNG by ship is one method to bring this stranded gas to the consumer.

LNG is produced by taking natural gas from a production field, removing impurities, and liquefying the natural gas. In the liquefaction process, the gas is cooled to a temperature of approximately -260 degrees F at ambient pressure. The condensed liquid form of natural gas takes up 600 times less space than natural gas. The LNG is loaded onto double-hulled ships which are used for both safety and insulating purposes. Once the ship arrives at the receiving port, the LNG is typically off-loaded into well-insulated storage tanks. Regasification is used to convert the LNG back into its gas form, which enters the domestic pipeline distribution system and is ultimately delivered to the end-user.

In 2008, the United States imported 352 billion cubic feet (Bcf) of LNG from a variety of exporting countries but primarily from Trinidad and Tobago. There are currently nine LNG import terminals located along the Atlantic and Gulf coasts. The mainland terminals are: Everett, Massachusetts; Cove Point, Maryland; Elba Island, Georgia; Freeport, Texas; Sabine Pass, Louisiana; Cameron, Louisiana; and Lake Charles, Louisiana. The offshore terminals are Gulf Gateway Energy Bridge in the Gulf of Mexico and Northeast Gateway, located offshore Boston. As of July 2009, the government reported 34 new or expanded facilities that have been approved or proposed to serve U.S. markets.

LNG Tanker

A LNG tanker is docked at ConocoPhillips' first LNG facility in Kenai, Alaska.