

## What is LNG?

### What is Natural Gas?

Natural gas comes from reservoirs beneath the earth's surface. Sometimes it occurs naturally and is produced by itself (non-associated gas), sometimes it comes to the surface with crude oil (associated gas), and sometimes it is produced constantly such as in landfill gas. Natural gas is a fossil fuel, meaning that it is derived from organic material deposited and buried in the earth millions of years ago. Other fossil fuels are coal and crude oil. Together crude oil and gas constitute a type of fossil fuel known as "hydrocarbons" because the molecules in these fuels are combinations of hydrogen and carbon atoms. The main component of natural gas is methane. Methane is composed of one carbon and four hydrogen atoms (CH<sub>4</sub>). When natural gas is produced from the earth, it includes many other molecules, like ethane (used for manufacturing), propane (which we commonly use for bbq's) and butane (used in lighters).

We can find natural gas around the world by exploring for it in the earth's crust and then drilling wells to produce it. Natural gas can be transported over long distances in pipelines or as LNG transported in ships across oceans. Natural gas can be stored until needed in underground caverns and reservoirs or as LNG in atmospheric tanks.

### What is LNG?

Liquefied natural gas (LNG) is natural gas that has been cooled to the point that it condenses to a liquid, which occurs at a temperature of approximately -256°F (-161°C) and at atmospheric pressure. Liquefaction reduces the volume by approximately 600 times, making it more economical to transport between continents in specially designed ocean vessels. LNG technology makes natural gas available throughout the world.

To make LNG available for use, energy companies must invest in a number of different operations that are highly linked and dependent upon one another. The major stages of the LNG value chain, excluding pipeline operations between the stages, consist of the following.

- Exploration to find natural gas in the earth's crust and production of the gas for delivery to gas users. Most of the time natural gas is discovered during the search for oil.
- Liquefaction to convert natural gas into a liquid state so that it can be transported in ships.
- Shipping the LNG in special purpose vessels.
- Storage and Regasification, to convert the LNG stored in specially made storage tanks, from the liquefied phase to the gaseous phase, ready to be moved to the final destination through the natural gas pipeline system

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## Composition of Natural Gas and LNG

Natural gas is composed primarily of methane, but may also contain ethane, propane and heavier hydrocarbons. Small quantities of nitrogen, oxygen, carbon dioxide, sulfur compounds, and water may also be found in natural gas. The figure above provides a typical natural gas composition. The liquefaction process requires the removal of some of the non-methane components such as water and carbon dioxide from the produced natural gas to prevent them from forming solids when the gas is cooled to about LNG temperature (-256°F). As a result, LNG is typically made up mostly of methane.

LNG is odorless, colorless, non-corrosive, and non-toxic. However, as with any gaseous material besides air and oxygen, the natural gas vaporized from LNG can cause asphyxiation in an unventilated confinement.

## LNG Liquefaction

Feed gas to the liquefaction plant comes from the production field. The contaminants found in produced natural gas are removed to avoid freezing and damaging equipment when the gas is cooled to LNG temperature (-256°F) and to meet pipeline specifications at the delivery point. The liquefaction process can be designed to purify the LNG to almost 100 percent methane.

The liquefaction process entails cooling the clean feed gas by using refrigerants. The liquefaction plant may consist of several parallel units ("trains"). The natural gas is liquefied for shipping at a temperature of approximately -256°F. By liquefying the gas, its volume is reduced by a factor of 600, which means that LNG at -256°F uses 1/600th of the space required for a comparable amount of gas at room temperature and atmospheric pressure.

LNG is a cryogenic liquid. The term "cryogenic" means low temperature, generally below -100°F. LNG is clear liquid, with a density of about 45 percent the density of water.

The LNG is stored in double-walled tanks at atmospheric pressure. The storage tank is really a tank within a tank that is filled with insulation. The inner tank, in contact with the LNG, is made of materials suitable for cryogenic service and structural loading of LNG. These materials include 9 percent nickel steel, aluminum and pre-stressed concrete. The outer tank is generally made of carbon steel or pre-stressed concrete.

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