LNG basics

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LNG basics

Definition: Liquefied Natural Gas (LNG) is the liquid form of natural gas. LNG is a natural gas.

LNG is a liquid. When cooled at atmospheric pressure to temperatures of about –162ºC (the exact temperature is up to the composition of the natural gas) it condenses into a liquid.

Critical temperature and pressure: around –82ºC and 46 bar, again depending upon the exact composition of the gas.

Composition of natural gas: methane (typically at least 90%), it may also contain ethane, propane, or butane, and typically less than 1% nitrogen.

Prior to liquefaction: removal of any oxygen, carbon dioxide, sulfur compounds, other trace impurities (such as mercury), and water; in order to help the handling of the LNG formed as it reduces corrosion or damage to materials of containers.
Volume benefits

600 m³ of natural gas is 1 m³ of LNG

1 tonne of LNG 50,000 cubic feet of natural gas.

Large contraction of volume makes LNG more economical to transport, which is a huge advantage.

Explosiveness

LNG is not explosive.

LNG is not flammable.
If LNG is warmed

When warming LNG vapor above –160F (–106.7C):
• It is lighter than air.
• It rises and disperse rather than collect near the ground.
• Only explosive when flammable concentrations of gas happen in confined spaces.

Energy necessary to transform Natural Gas into LNG

Approx. 10 to 20% LNG is consumed during process and transportation.

The gas consumed can be compared with long distance high pressure gas pipelines.
Storing gas as LNG: advantages

The main advantages of storing gas as LNG are the following:

- LNG facilities can be placed above ground, and so there are operators and/or many more options for locating LNG facilities compared to traditional underground gas storage.

- The amount of LNG delivered can vary, not necessarily peak conditions.
Facts related to the use of LNG

Used for more than 50 years.

Used mainly in Asia, Europe, and the United States.

Improved technology now makes it more economical to produce, transport and store in large quantities.

LNG is now an attractive alternative to oil or piped gas.
Keeping LNG cold

The main features of keeping LNG cold are listed below:

• LNG stored in large insulated tanks.
• Tanks are designed to minimize any heat ingress.
• Insulation of tanks alone does not maintain LNG at cryogenic temperatures.
• If kept at constant pressure, it will be at constant temperature.
• The vapor boil-off should have a way out of the tank to keep the temperature constant.
• This vapor is collected and can be liquefied again or be used directly as fuel.
LNG vs LPG and LNG vs NGL

Liquefied petroleum gas (LPG): propane (upward of 95%) and smaller quantities of butane, while LNG is mainly composed of methane. LPG is cleaner than gasoline. It can be kept liquid with elevated pressure as well as with temperatures of -40ºC approx. LNG, in general terms, is considered safer than LPG.

LNG is lighter than air while LPG is heavier.

Natural gas liquid (NGL): it may also have ethane, propane, butane and some condensate.
Sources of LNG

Leading exporters of LNG:
• Qatar
• Indonesia
• Australia
• Malaysia
• Trinidad
• Algeria
• Nigeria

Fast expansion and diversification of LNG supply may mean sources of LNG increase availability of LNG. Demand will be increased with the restrictions in emissions.
LNG supply chain

The supply chain may include the following elements:

• Production infrastructure for gas and pipeline to plant.
• Refrigeration plant.
• Storage facilities.
• Port loading facilities.
• LNG marine tankers.
• LNG terminal.
• Connection to a natural gas network.
LNG regasification terminals

LNG is delivered to users through terminals.

The main parts are:

- LNG unloading jetty
- LNG storage and sendout facility

The regasification process is a heating process. It is usually done with ambient temperature heat sources.
Design of terminals: safety

Mainly the design has to comply with regulations, especially regarding safety in the following terms:

- Vapor dispersion distances.
- Existence of a thermal exclusion zones according to standards.
- Assurance of the proper separation between persons and an eventual fire.
LNG and safety

The LNG industry has a long and excellent safety record. Only few accidents have occurred involving the LNG industry. Examples are:

- Cleveland LNG storage facility in 1944
- Skikda liquefaction plant (Algeria) in 2004.

The aspects considered for safety:

- Management.
- Handling facilities.
- Operation of the plant.
- Consideration of LNG spills.
THANK YOU FOR YOUR ATTENTION