*International Journal of Latest Trends in Engineering and Technology*
*Vol.(15)Issue(1), pp.030-032*
*DOI: http://dx.doi.org/10.21172/1.151.06*
*e-ISSN:2278-621X*

# LIQUEFIED NATURAL GAS (LNG); A NEW WORLD ORDER

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**Abstract: The paper discusses about Liquefied Natural Gas (LNG) as a safe fuel and its role in the new world order. Natural gas consists almost entirely of methane (CH4), the simplest hydrocarbon compound. Typically, LNG is 85 to 95-plus percent methane, along with a few percent ethane, very small amount of propane and butane, and trace amounts of nitrogen. When natural gas is cooled to temperatures below -260° F it condenses into liquefied natural gas, or LNG. As a liquid, natural gas occupies only 1/600th the volume of its gaseous state, so it is stored more effectively in a limited space and is more readily transported.The International Energy Agency (IEA) has estimated that worldwide investments in LNG liquefaction, shipping, and regasification may total $252 billion between 2001 and 2030. LNG prices are substantially lower in North America than in Asia, Europe, and South America.LNG is usually reverted to its gaseous state (regasified) at the import terminals in the receiving countries, where it can then be injected into natural gas pipelines to be moved to power plants and distribution companies for various industrial uses.**
**Keywords: LNG, Air Pollution, Utilization, liquefaction**

## 1. INTRODUCTION

Natural gas is the fastest growing fossil fuel in the new policies scenario, overtaking coal by 2030 to become the second-largest source of energy after oil according to the report. The combination of growing supplies of liquefied natural gas (LNG) and new requirements for less polluting fuels in the international industry has intensified interest in LNG as a fuel. For period of time, LNG tanker ships have been capable of burning boil-off gas from their LNG cargoes as a secondary fuel. However, using LNG as a primary fuel is a relatively new endeavor; the first LNG-powered vessel—a Norwegian ferry—began service in 2000.LNG as an engine, or "bunker," fuel possibly could help the world to reduce harmful air emissions, it could create a new market for domestic natural gas, and it could create economic opportunities in domestic field. The storage, delivery, and use of LNG also has safety implications.LNG is stored at temperatures below - 162 °C (-260 °F), far below the -20°C at which the carbon steels typically used in shipbuilding become brittle. Consequently, extreme care must be taken to ensure that LNG does not drip or spill onto ship hulls or decking because it could lead to brittle fracture, seriously damaging a ship or bunkering barge. This paper discusses the conditions in which LNG may compete to become a common bunker fuel for the world, and the current status of LNG globally and in the United States.

## 2. LNG; A CHEMICALCOMPOUND

LNG is more practically applicable than liquefied petroleum gas (LPG) or other liquid gases, particularly for use in large volumes, because it has the same chemical composition as natural gas.
LNG utilization has made it possible to consume natural gas from remote areas of the world where it previously had no commercial use and was burnt. Special tankers, known as LNG carriers, equipped with super cooled cryogenic tanks, transport LNG in countries like Qatar, Australia, Indonesia to market in China, Europe, and Japan. In the early 21st century, with the expansion of natural gas pipelines in the United States, the country became a net exporter of LNG, whereas it previously had been an important importer of the product. LNG is usually reverted to its gaseous state (regasified) at the import terminals in the receiving countries, where it can then be injected into natural gas pipelines to be moved to power plants and distribution companies for various industrial uses.(1)

### *2.1 Production of LNG*

The figure 1 illustrates the components of an LNG liquefaction plant. The raw feed gas supply arriving from a producing gas field must be clean and dry before liquefaction. It should be cleaned of entrained hydrocarbon liquids and dirt and treated to remove trace amounts of two common natural gas contaminants: hydrogen sulphide and carbon dioxide.

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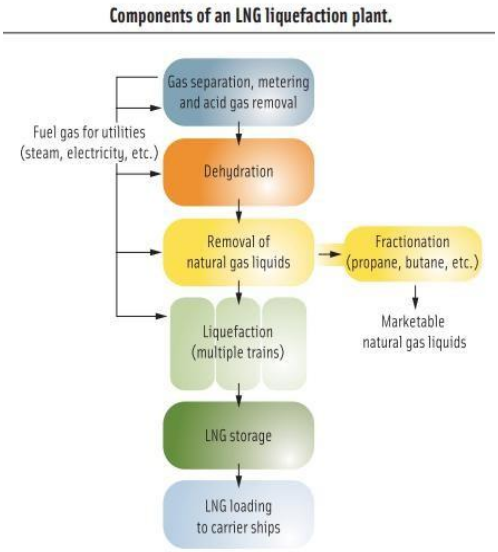


Figure 1.The components of an LNG liquefaction plan(2)

Next, the gas is cooled to allow water to condense and then further dehydrated to remove even small amounts of water vapor. If mercury is present in the feed gas, it must be removed at this stage. The clean and dry gas may then be filtered before liquefaction begins. It is important that the gas consist primarily of methane with only small amounts of light hydrocarbons to secure an efficient process. Liquefaction takes place through cooling of the gas using heat exchangers. In these vessels, gas circulating through aluminum tube coils is exposed to a compressed hydrocarbon- nitrogen refrigerant. Heat transfer is accomplished as the refrigerant vaporizes, cooling the gas in the tubes before it returns to the compressor. The liquefied natural gas is pumped to an insulated storage tank where it remains until it can be loaded onto a tanker. The liquefaction process can have variations.

*2.2 Global LNG supplyand demand 2017- 2030*

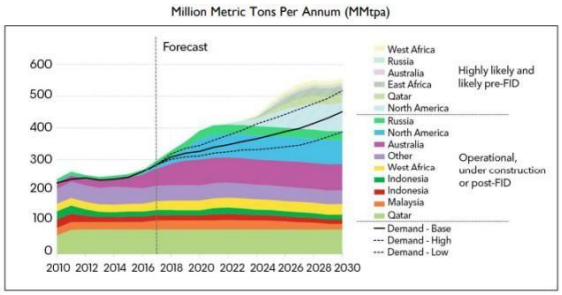


Figure 2.Global LNG Supply and Demand 2017- 2030 (3)

World production of LNG has been rising rapidly over the last few years, driven by growth in the natural gas sector in new regions—especially Australia and the United States. According to one industry analysis, global LNG supply is expected to increase from 300 to 400 million metric tons per annum (MMtpa) from 2017 to 2021 based on new LNG liquefaction projects already operating or under development. LNG supply from these new liquefaction projects could exceed projections of demand, which would put downward pressure on LNG prices. While increases in the global supply of LNG do not necessarily interpret directly into an increase in LNG available for bunkering, such increases could provide options for LNG bunkering in moreports.

*2.3 Global LNG vs. Petroleum-based fuelcosts*

Recent energy sector trends suggest that LNG may be cheaper in the long-run than petroleum based, low-sulphur fuels. However, these price movements are correlated to some extent. Many existing long-term LNG contracts link LNG prices to oil prices (although such contract terms are on the decline), even in the spot market. Starting in 2008, the advent of shale natural gas production dramatically decreased natural gas prices in the United States. Natural gas spot prices in the United StatesattheHenryHub—thelargestU.S.tradinghub for natural gas—averaged around $3/MMBtu (million British Thermal Units) in 2018.(4)

*2.4 Safety in LNG transportation*

In the 50 years since they loaded their first commercial shipment, LNG carriers have safely delivered over 77,000 cargoes. These consignments all reached their destinations with no breach of a cargo containment system and with no onboard fatalities directly referable to the cargo. This is a very impressive, in fact unprecedented, safety record for the carriage of liquid hydrocarbons by sea in bulk. This exemplary safety record is due to several reasons. These include, but are not limited to, a strong, overarching safety philosophy; robust equipment and systems design; good operational and maintenance procedures; operating in excess of the minimum requirements and according to best practice guidelines; and high standards of training coupled with competency verification.

*2.5 Global developments in LNG bunkering*

A key requirement for ocean carriers to adopt LNG as an engine fuel is the availability of LNG bunkering facilities. Because LNG is extremely cold (-260 °F) and volatile, LNG bunkering requires specialized infrastructure for supply, storage, and fuel delivery to vessels. Depending upon the specific circumstances, LNG bunkering could require transporting LNG to a port from an offsite liquefaction facility for temporary storage at the port, or building an LNG liquefaction terminal on site. Alternatively, LNG could be delivered from offsite facilities directly to vessels in port via truck or supply vessel. Truck-to-vessel LNG bunkering, in particular, provides some fueling capabilities without large upfront capital investments. LNG tanker trucks could also bring LNG to a storage tank built on site at the port, which could then bunker the LNG to arriving ships via pipeline. Supplying LNG using tanker trucks in this way may face capacity limitations due to truck size, road limitations, or other logistical constraints, but it has been demonstrated as a viable approach to LNG bunkering at smaller scales.

## 3. SUMMARY

As discussed above, depending upon the adoption of LNG bunkering in the global fleet, the LNG bunker fuel market could grow to several billion dollars by 2030. LNG producers were to supply a significant share of this market—on the strength of comparatively low LNG production costs—LNG bunkering could increase demand for U.S. natural gas production, transportation, and liquefaction.

On the other hand domestically constructed LNG bunkering barges could be one significant area of economic growth. Engineering and construction firms could benefit from new opportunities to develop new port infrastructure for LNG storage and transfer. Such projects could create jobs in engineering, construction, and operation, which could be important to local communities.

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