

# Liquefied Natural Gas: A Primer

## INTRODUCTION

Liquefied natural gas (LNG) is expected to play an increasingly important role in the North American energy industry. This report, the first in a series of three dedicated to LNG, introduces the reader to LNG, describes the LNG supply chain and defines domestic and imported LNG.

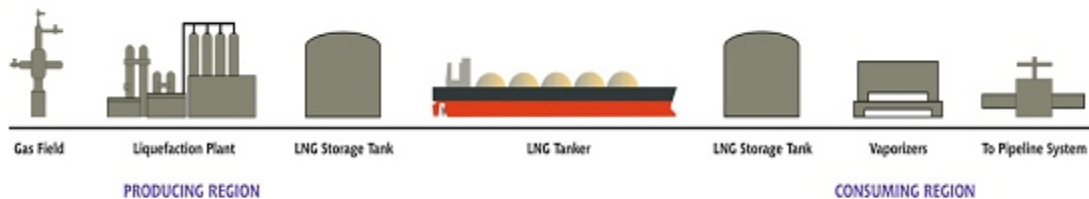
## WHAT IS LNG?

Liquefied natural gas, or LNG, is simply natural gas in its liquid state. When natural gas is chilled to a temperature of about minus 160° C (or minus 260° F) at atmospheric pressure, it becomes a clear, colourless, and odourless liquid. LNG is non-corrosive and non-toxic. The liquefaction process removes any oxygen, carbon dioxide, sulfur compounds and water contained within the natural gas, resulting in an LNG composition of mostly methane with small amounts of other hydrocarbons and nitrogen. As a liquid, natural gas is reduced to one six-hundredth of its original volume, which makes it feasible to transport over long distances in specially designed ocean tankers for storage, re-gasification and delivery to markets.

## LNG SUPPLY CHAIN

The LNG supply chain (as illustrated in the figure below) consists of several interconnected elements. In producing countries, natural gas is extracted from basins and transported by pipeline to liquefaction plants where the natural gas is liquefied and stored. Liquefaction plants are built at marine terminals so the LNG can be loaded onto special tankers for transport overseas. Tankers deliver the LNG cargo to import terminals in other countries where the LNG is stored, re-gasified and injected into pipeline systems for delivery to end users.

### LNG Supply Chain



Source: CMS Energy

## WHERE DOES LNG COME FROM?

World natural gas reserves are abundant. Much of this natural gas is considered “stranded” as it is located in regions distant from consuming markets (e.g., Russia and Qatar). Liquefying this natural gas and shipping it overseas provides an opportunity for these regions to monetize its natural gas reserves. Twelve countries currently produce and ship LNG: Algeria, Australia, Brunei, Indonesia, Libya, Malaysia, Nigeria, Oman, Qatar, Trinidad and Tobago, United Arab Emirates, and the US. The five largest exporters of LNG are: Algeria, Australia, Indonesia, Malaysia, and Qatar. For more than thirty years, small quantities of LNG has been produced in Kenai, Alaska, for export to Japan. Russia and Norway are also scheduled to be exporting LNG by 2006.

## WHERE IS LNG DELIVERED?

Natural gas is consumed by many countries. However, not all nations have readily available supplies of natural gas (e.g., Japan), while some countries (e.g., US) consume more natural gas than what is produced domestically. In both cases, importing LNG is a favourable option to meet these demands. Fourteen countries currently import LNG: Belgium, Dominican Republic, France, Greece, India, Italy, Japan, Korea, Portugal, Puerto Rico, Spain, Taiwan, Turkey, and the US. The five largest importers of LNG are: Japan, Korea, Spain, Taiwan, and the US. China and the U.K. are expected to begin importing LNG in 2005 and 2006, respectively.

## DOMESTIC AND IMPORTED LNG

LNG, which has been commercially used in North America for more than sixty years, is available from domestic and foreign sources of natural gas. Domestic LNG is natural gas produced, liquefied and stored in North America. Marine, or imported LNG, is foreign-produced natural gas, which is liquefied abroad and transported to North America via large ocean tankers.

There are 103 LNG (i.e., storage or import) facilities in North America:

- 96 US LNG storage facilities;
- 4 US LNG import facilities; and,
- 3 Canadian LNG storage facilities.

**Peak-Shaving LNG Storage Facility**



*Source: CH-IV International*

## Domestic LNG

Domestic LNG serves as a ‘peak-shaving’ fuel in North America. A peak shaving LNG facility (as illustrated in the figure above) liquefies and stores domestically-produced natural gas for re-gasification and distribution during periods of high demand. These facilities are typically located close to urban areas where the demand for natural gas is highly seasonal (e.g., US northeast).

There are three peak-shaving LNG storage facilities in Canada: Union Gas LNG facility near Sudbury, Ontario; Gaz Métro LNG facility near Montreal, Quebec; and, Terasen Gas LNG facility in the Lower Mainland of Vancouver, British Columbia. Terasen Gas is also proposing to construct a peak-shaving LNG storage facility on Vancouver Island, British Columbia. The project is scheduled to begin construction in 2005 and is expected to be operational by 2007.

## Imported LNG

A marine LNG import terminal (as illustrated in the figure below) is a deepwater port equipped with infrastructure (i.e., jetty, berthing facilities, and unloading arms) designed to berth and unload LNG tankers. Once the LNG is discharged, it is stored in specially designed tanks. Finally, vaporization equipment warms the LNG prior to it being distributed through the natural gas pipeline grid.

Imported LNG has supplemented US natural gas production since the 1970's. In recent years, North American demand for imported LNG has increased significantly, largely the result of a tighter supply-demand balance, higher domestic natural gas prices, and declining LNG costs.

There are four LNG import facilities in the US:

- Southern Union at Lake Charles, LA;
- El Paso at Elba Island, GA;
- Tractabel at Everett, MA; and,
- Dominion at Cove Point, MD.

Combined, they imported 652 billion cubic feet in 2004, accounting for about 2% of total US natural gas consumption.

Currently, Canada does not import any LNG. However, there are eight proposals to construct LNG import facilities in Canada. The second report in this series, “*Canadian Liquefied Natural Gas Import Projects*,” will provide background information on these projects.

**Marine LNG Import Terminal**



Source: Trunkline LNG