

Gas Industry

Liquefied Natural Gas - an attractive alternative for gas-based utility systems

Ferox, an Active Participant

Ferox a.s. is a major European company supplying equipment for the storage and distribution of cryogenic gases including liquefied natural gas. LNG is steadily gaining acceptance as an alternative energy source for a variety of applications. Ferox decided early on to be a part of this emerging market and committed resources to the development of expertise in engineering, design and applications.

What is happening?

Norway

Norway is an independent country with rich resources of crude oil and natural gas from large fields in the Norwegian Sea off its western and northern coasts. Presently, as much as 98% of non-processed materials are exported from Norway. Now, in order to stimulate domestic utilization of these products, Norway's Parliament has adopted a strategy to encourage formation of an infrastructure needed for distribution of natural gas. An important part of this is the construction of liquefaction facilities to produce LNG. Why is LNG so attractive for Norway? A cursory study of a map of Norway reveals a topography full of mountains and fjords. Traditional under-ground pipelines, widely used in Continental Europe, are too costly for conditions in Norway. As a result, LNG will be produced in quantity at various key locations and then distributed as liquid to points of use. The first such plant, at Tjeldbergodden, was commissioned several years ago. Its successful operation has helped Norway's politicians and business community to recognize the many advantages offered through this energy alternative. Presently, new liquefaction plants are scheduled to go on stream at Kollsnes. This plant will supply industrial energy users in the areas of Haugesund and Stavanger while the Kollsnes facility will handle customers in Bergen and further north. These plants, at 60 and 120 tons per day, respectively, will be dwarfed by another liquefaction plant scheduled to go on stream in 2006 at Hammerfest. Here, 300 kilometers above the Polar Circle, Europe's largest liquefier will process natural gas piped in from a the



An overall view to a liquefier in Norwegian Tjeldbergodden.



Installation of an LNG vaporization unit for KRI Poland.

Sn_vit-fields. Most of the LNG from this plant will be shipped by special LNG carriers to Spain, the US and Canada. However, significant quantities will be made available for Scandinavian markets. This is where Ferox "enters the picture" with its vacuum insulated products. Ferox expects to participate in these new opportunities by supplying terminals of capacities of 2000m³ to 4000m³. Ferox' strategy is to support local gas companies with turn-key terminals located in centers with concentration of industrial users. Typically, such terminals consist of several 500 m³ vacuum insulated storage vessels, vaporizers of different types and control and safety equipment.

Poland

In Poland, the technology of using LNG has developed quickly. Ferox works closely with KRI Poznań which is active in developing conversion into gas-based utility systems for towns and communities by making use of LNG technology. Recently, Ferox supplied components for seven vaporization units each with a capacity of 2000 Nm³/hour. A typical terminal has a storage capacity of 60 m³. KRI is interested in building a liquefying plant of 100 tons per day capacity. Such a plant would serve to promote further expansion of LNG in Poland. Another possible project is

a sea terminal for the receipt, storage, and distribution of LNG to the town of Szczecin, similar to the terminals in France and Belgium.

Important contracts

The interest in and usage of LNG is now spreading throughout the World. This trend is demonstrated by already completed projects. Ferox has signed a contract with Hamworthy KSE to supply of a storage terminal for a liquifying plant at K_rst_ in Norway. The future owner of this facility is Gasnor, a local gas company. The terminal is designed for the storage of LNG which will flow continuously from the liquefier to the storage tank for subsequent dispensing to LNG road tankers using a cryogenic pump of 1000 liters per minute capacity. Ferox supplies all equipment for this turn-key terminal. For the actual installation, Ferox has entered into a strategic alliance with Intergas, a.s., a local company specializing in engineering and installation work for gas equipment. Naturgass Vest AS is another important Ferox customer. This company, which presently serves the area of Bergen with pipeline and trucked compressed natural gas sourced from an ocean pipeline from the Troll field, has ambitious plans for the future use of LNG. In September 2001, the company sent out inquiries to supply several LNG terminals for both gaseous and liquid natural gas. The 9-month bidding procedure and negotiations ended with Ferox being awarded the supply of three LNG terminals with a total capacity of 2350m³ of LNG. The largest of these is a vaporization unit to be located in the coastal town of Sunndalsora. It will supply natural gas to Europe's largest foundry for processing aluminum at Hydro Aluminum. This terminal is designed to receive LNG from a 1000 m³ ocean-going LNG tanker, store it and vaporize as much as 4.200 Nm³/hour. The operation of the plant is continuous and must not be interrupted since unacceptable losses in the production of aluminium would occur. Therefore, the terminal is equipped to provide 100% back-up. Ferox is the general contractor and is, again,

using Intergas to do the installation. This contract marks an important step toward penetrating the Norwegian and European markets with LNG terminals. To date, Ferox has been awarded business worth in excess of 5 million Euro. Part of this is for two gas terminals, 60 and 125 m³, for Gasnor to go on stream in February 2003. Gasnor, like Naturgass Vest, focuses on the development of smaller natural gas networks for local areas.

LNG vaporization plants

The primary principle of vaporization plants consists of the withdrawal of deeply cooled liquid (-161°C) from a storage tank and its subsequent evaporation in vaporization units by making use of heat exchange with either ambient air or other medium such as heated water. LNG is mostly pure methane since impurities such as nitrogen, propane, butane etc. are removed in the liquefaction process. LNG is stored in vacuum-insulated storage tanks which resemble thermo-flasks. The working pressure is about 6 bar

as in gas furnaces, etc. Natural gas is also finding increased usage as an alternative vehicle fuel. The impetus for this application is improved environmental ecology. The use as vehicle fuel has been known for several years and mainly as compressed gas (CNG). However, improvements in on-board LNG storage vessels and vaporizer systems have opened new opportunities for the use of liquid and also offered advantages through enhanced safety and vehicle travel range. LNG is used more for large distribution fleets, buses and garbage trucks. Filling stations can be equipped to dispense both LNG and CNG, thus improving their effectiveness.

There is a future for cryogenic technologies!

Presently, there is stagnation in the use of conventional industrial gases - oxygen, nitrogen and argon. Ferox' traditional business is to provide vacuum insulated storage and distribution equipment for these gases. It is not clear today if the



An LNG storage tank on transshipment into a ship in the Děčín port.

with downstream gas pressures, depending on customer requirements, ranging from 1 to 4 bar.

A typical installation for gaseous withdrawal consists of:

- LNG storage tank of either vertical or horizontal configuration
- vaporizer - ambient type or hot-water type

Ambient air vaporizers use heat transferred from ambient air to sub-cooled liquid. This process does not require the addition of other heat energy and hence, its operation is inexpensive. Conversely, hot-water vaporizers use the energy exchange between hot water and the sub-cooled liquid. The water is typically heated by a gas-fired burner which consumes about 2% of the available natural gas for this activity. This type of vaporizers are thus more costly to operate, but may be required in when atmospheric conditions are severe.

- gas controller
- odorizer - because natural gas (methane) has no odor and that leaks are possible in piping systems, it is necessary to odorize the vaporized gas.

Use of LNG

Vaporized gas is used for residential heating for space, water and cooking, heat for public buildings, industrial heating applications such

historical level this business will return. In the meantime, developing markets for LNG offer an opportunity to replace this "lost business". To meet this challenge, Ferox is aggressively pursuing a dominant role in this market by investing wisely in qualified personnel, methods and systems. The record to date speaks for itself.

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