



Liquefied natural gas in the arctic

Process plants located in this harsh environment require technical heating

by Søren Lykke Larsen



Figure 1: Melkøya island in October 2006 (picture. Statoil, Eiliv Leren)

Tranberg AS, the new member of R.STAHL Technologies group, supplies complete heat tracing solutions for the petrochemical industry.

With headquarters in Stavanger, Norway, Tranberg AS has been designing, manufacturing and supplying high quality electro-mechanical products for use on ships, offshore installations and petrochemical plants since 1901.

During its long life, the company has worked together with its customers to develop solutions and products for the harsh North Sea environment. Today, Tranberg has two major product lines: Lighting for the shipping industry and heating for the process industry.

The Tranberg Heating Systems Division supplies total packages for heat tracing, including engineering, material supply and installation support. Over the years, they have supplied these packages to a large number of on- and offshore petrochemical projects. Tranberg supplies the Statoil ›Snøhvit‹ (Snow White) Liquefied Natural Gas (LNG) project with the supply of lighting and de-icing systems for supply boats and tankers working in the Barents Sea.

The ›Snøhvit‹ Challenge

The Statoil ›Snøhvit‹ project on the island Melkøya (Figure 1) is by many measures a very exciting project – apart from being the biggest European natural gas liquefaction and export plant it is the northernmost located plant at Hammerfest in the north of Norway, only 200 km from the North Cape (Figures 2 and 3).

Due to the harsh weather conditions and limited infrastructure at Hammerfest the different modules had to be made in prefabrication at a number of sites in Europe.

In the spring of 2003 Tranberg received the order for the total heat tracing package from Statoil and its engineering partner Linde, Munich. Tranberg and their partner Thermon, the world recognised heat tracing specialist, appointed a project team to cope with the work of this enormous project.

The Heating Project

The scope of the work was comprehensive and includes project management, detailed engineering, installation support, and site supervision. The supply of the complete material package of heat tracing distribution boards, monitoring panels, a wide range of heat tracing cables tailored for the applications, stainless steel heat tracing junction boxes, and field mounted temperature controllers – as well as all other accessories necessary to making the system reliable in this climate.

Any gas liquefaction plant will require some heating in order to maintain pipes and equipment at the desired process temperature or to prevent pipes and equipment from freezing or condensing.

The location at Hammerfest, where the average ambient temperature is 1°C and the low design temperature is –22.5°C, puts heavy demands on the reliability and extent of the heating system.

The gas is produced on the seabed of the Barents Sea 250 to 340 m under the surface using a subsea technology and brought to land in a 140 km long pipe line. On the onshore plant the gas is cooled to –163 °C to reduce its volume 600-fold to make it possible to transport the gas over long distances in special-built ships. →

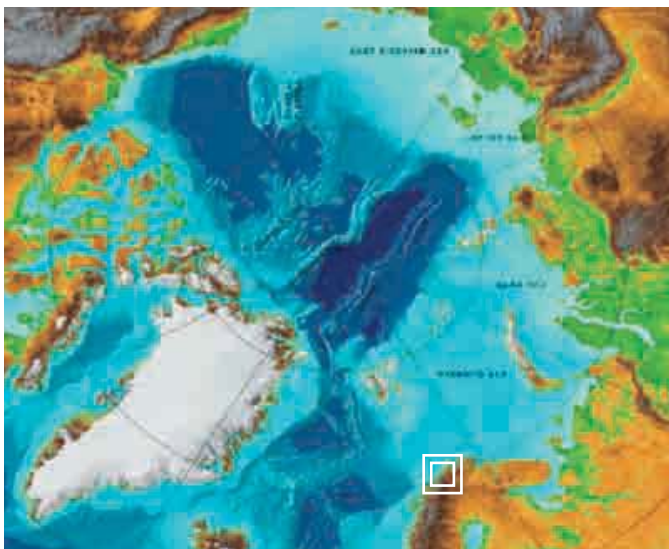


Figure 2: Position of Melkøya island near Hammerfest only 200 km from North Cape



Figure 3: Snøhvit liquefaction and export plant. 5.7 billion m³ were processed and exported

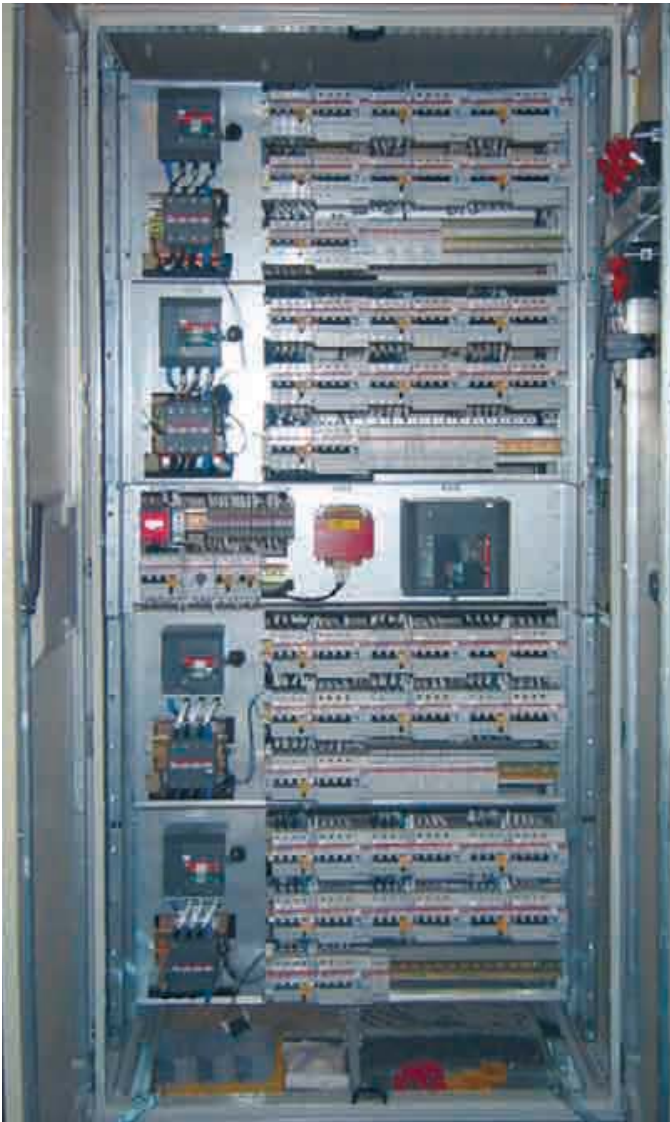


Figure 4: Heat tracing panel. Tranberg delivered more than 4,000 panels for 16 A heat tracing circuits

The transformation of gas into LNG consists of a number of processes:

- › Slug catcher: separation of water and gas
- › Inlet facility: preheating of gas
- › Pre-treatment: CO₂ removal, dehydration mercury removal
- › Fractionation: separation of LNG and NGL (Natural Gas Liquids)
- › Liquefaction: cooling of the gas from approx. -13 °C to -163 °C
- › Storage: storage of the gas in tanks before export
- › LPG: separation of heavy hydrocarbons into liquefied petroleum gas (LPG)
- › Condensate: removal of gas, water and MEG (monoethylene glycol) before storage
- › MEG: recycling of the monoethylene glycol

At all these process modules Tranberg had many different heating applications to solve.

Due to the harsh climatic conditions, this project also required frost protection on most of the utility systems, including hot oil systems, water supply and gullies, pits and other surfaces.

Applications, Products, Solutions

The -163 °C cold LNG gas is stored in a number of large tanks. In order to prevent cold from the liquid LNG gas from being transferred into the soil, the so called frostheave protection, a heating system, was built into the foundation of the tanks.

During the design phase Tranberg and their partners produced design and installation documentation that amounted to more than 4,000 heat tracing isometric drawings as well as a large number of single loop documents, instrument hook-up drawings, etc.

Tranberg has also delivered a number of heat tracing panels (Figure 4) meant to supply more than 4,000 heat tracing circuits of 16 A along with a number of monitoring panels for the circuits.

More than 210,000 meters of different types of heating cables for freeze protection and process temperature maintenance as well as cables able to maintain temperatures up to 600 °C were delivered (Figure 5).

The heat tracing design philosophy for this project stipulated that most heating circuits had to be temperature controlled. For this purpose Tranberg delivered a number of solutions: from 16 A capillary thermostats to electronic controllers (Figure 6). This equipment for use in harsh environments has proven its reliability over a number of years' service in the North Sea, and includes the series of heat tracing junction boxes in 316 L stainless steel, that in the arctic version can be used in temperatures from -60 °C to +90 °C.

As the modules for the different processes were built at different locations around Europe, Tranberg supplied installation support and site supervision for the heat tracing at yards in Spain, France, Germany and The Netherlands. Also, when the fabrication and assembly of the modules started at Hammerfest, Tranberg had a project engineer allocated to support the project on site.

Safety and Stability

The combination of Tranberg's strong presence within lighting and their expertise within heating has meant that Tranberg has become an important partner not only when it comes to providing reliable solutions for onshore oil and gas activities in the Arctic, but also as a competent supplier of total solutions to the ship building industry. Today, Tranberg offers a wide range of solutions for the de-icing of helidecks, safe passage stairways, etc. for the safety of the crew, and also for de-icing of the superstructure of ships in order to maintain stability.



Figure 5: Heated valves before the thermal insulation is mounted. Tranberg delivered more than 2,000 m heating cable at the Snøhvit project



Figure 6: Temperature controllers and safety thermostats. Tranberg delivered temperature controllers for more than 3,000 measuring points