Facts

Kårstø

Gas processing plant

GASSCO

equinor

Kårstø gas processing plant in Nord-Rogaland is the **largest of its type in Europe**.

The plant plays a key role in the transportation and processing of gas and condensate/light oil from important areas on the Norwegian continental shelf. Around 30 fields are tied in to Kårstø via pipelines. Every day, millions of cubic metres of gas and non-stabilised condensate/light oil flow into the plant. Here the heavier components are removed by separation, while the remainder, known as dry gas or sales gas, is exported by pipelines to the Continent.

The heavier components are known collectively as natural gas liquids (NGL). The Kårstø plant is ranked as the world's third largest LPG producer.

History

The first gas entered the plant on 25 July 1985, and the first dry gas was sent from Kårstø to Emden in Germany on 15 October that year. The plant was built to receive and process gas from the northern part of the North Sea. Since 1993, the plant has also been able to receive and stabilise condensate from the Sleipner field.

On 1 October 2000, the Kårstø plant was ready to receive gas from Åsgård and other fields in the Norwegian Sea through the Åsgard Transport pipeline. In 2005, Kårstø was ready once again to receive gas from yet another large field, the Kristin field on the Haltenbank.

Since 2014, the plant has been receiving light oil from the Gudrun field via the Sleipner pipeline.

The latest expansions have led to a significant increase in the plant's capacity to receive and process gas. More than 90 million standard cubic metres of rich gas can flow through the plant, in addition to condensate/light oil.

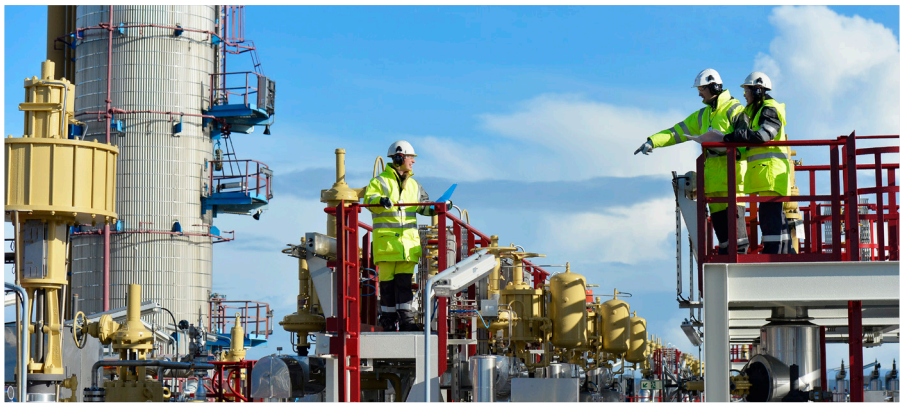
Value creation

Kårstø is an important link in the value chain from reservoir to the customer on the Continent. Following the development of the Åsgard field in the Norwegian Sea, the Åsgard Transport pipeline, the extension of the installations at Kårstø, and the Europipe II pipeline, fields in the Norwegian Sea are also connected to the European gas market.

Approximately 25 per cent of the natural gas delivered each year from Norway to European customers will be exported via Kårstø.

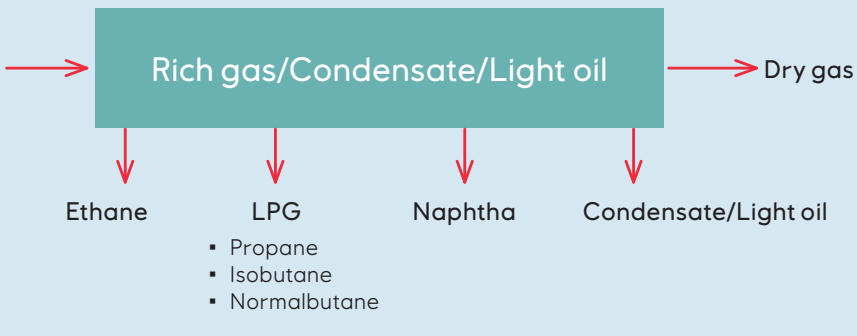
The site

Out of an area of 208 hectares, the actual plant occupies 108 hectares. It originally consisted of the Statpipe gas processing plant (1985), and has subsequently been expanded by the



The transport network

Kårstø Gas Processing



Kårstø's capacity

Production capacity: Approx. 12 million tonnes NGL and light oil per year.

112	tonnes/hour ethane
385	tonnes/hour propane
76	tonnes/hour i-butane
145	tonnes/hour n-butane
106	tonnes/hour naphta
550	tonnes/hour condensate/light oil

addition of the Sleipner condensate plant in 1993 and the Åsgard plant in 2000.

In addition to the actual processing plant, upgrades to storage tanks, shipment facilities and other technical facilities have been carried out.

The administration building consists of offices, fire station, workshops and warehouse. In 2015, a new laboratory was built.

The processes

The gas from the fields is transported to Kårstø through the Statpipe and Åsgard Transport pipelines. This gas is called rich gas. The first step of the process is to adjust the pressure and temperature. Then the water in the gas is removed so that the gas may be cooled to a low temperature (-60°C) without causing ice to form in the pipes and other equipment. The gas is then transported to the separator plant where the wet gas (NGL) is separated out.

The wet gas is then sent on to the fractional plant where it is split into propane, normalbutane, isobutane and naphtha. Ethane is separated out in a special plant and sold as a separate product.

When all these elements have been separated from the gas, the remaining gas, known as sales gas or dry gas, mainly consists of methane. This is sent via the Statpipe and Europipe II pipelines to customers on the Continent. In addition, one pipeline, Rogass, goes to Stavanger.

Kårstø also receives condensate/light oil in a separate pipeline from the Gudrun/Sleipner area. This is stabilised and fractionated in a dedicated plant.

In this process, ethane, propane, normal-butane and isobutane are distilled out. The remainder is called stabilised condensate/light oil and is transported from Kårstø by ship.

Storage tanks and caverns

Propane is stored in two large mountainside caverns with a combined capacity of 250,000m³.

Ethane, normalbutane, isobutane, naphtha and stabilised condensate/light oil are stored in tanks. These products are exported to customers worldwide.

K-lab

The Kårstø measuring and technology laboratory (K-Lab) is a large-scale laboratory for testing and certification of equipment and processes for the production and transport of hydrocarbons.

K-lab is owned by Equinor, but it carries out assignments for suppliers to the oil industry, and other oil companies. K-lab carries out tasks such as calibration of wet gas and multi-phase meters (20-150 bar), qualification of gas separators, testing of pumps and compressors, and general qualification of equipment and processes.

Busy harbour

The significant production of ethane, LPG and stabilised condensate/light oil leads to approximately 650 ship calls a year at Kårstø.

The shipment harbour, which consists of three quays and 11 loading arms, is specially equipped for LPG ships, and is the largest of its type in Europe.

A dedicated harbour office deals with the shipping traffic, and two tugboats are permanently stationed at Kårstø so that the necessary assistance may be provided.

Health, safety and environment

The whole processing plant is controlled from the main control room. The areas and processes are controlled and monitored 24 hours a day using advanced computer systems and trained operators. This includes thorough control of all emissions, including flares.

Everyone who works at the plant, or who needs to enter the area, must follow strict safety rules.

This is also in accordance with the Norwegian authorities' requirements for this type of activity.

Gassled

Gassled is a joint venture for the owners of the gas transport system linked to the Norwegian continental shelf.

The gas transport system consists of pipelines, platforms, onshore process plants, and gas terminals abroad. The system is used by all parties needed to transport Norwegian gas. Gassled also owns, in part or in full, terminals for Norwegian gas in Germany, Belgium, France and the UK. Gassled is organised into different zones with different tariff levels.

From the Norwegian Sea

Åsgard 42 inches →
Capacity approx. 72MSm^3/day
Rich gas

From the North Sea

Statpipe 30 inches →
Capacity approx. 24 MSm^3/day
Rich gas

From the North Sea

Sleipner condensate 20 inches →
Approx 13,500 tonnes/day
unstabilised condensate/light oil

Statpipe 28 inches →
Capacity: approx. 23 MSm^3/day
Sales gas/dry gas

Europipe II 42 inches →
Capacity: 74 MSm^3/day
Sales gas/dry gas

Rogass 10 inches →
Capacity: 2.8 MSm^3/day
Sales gas/dry gas

Kårstø processing plant viewed from the west.

Aerial view of the Kårstø processing plant.

Facts

Kårstø Site:

Caverns propane: 250.000 m^3
Tanks normalbutane: 1 x 35 000 m^3 and 2 x 20 000 m^3
Isobutane: 1 x 35 000 m^3 and 2 x 8 000 m^3
Naphtha: 2 x 17 000 m^3
Ethane: 1 x 25 000 m^3
Stabilised condensate/light oil: 2 x 60 000 m^3
Site area: 208 hectares
Site installation: 108 hectares

Milestones:

10.06.1981: The Norwegian Parlament resolved to build the Statpipe pipeline and the Kårstø gas processing plant.

25.03.1985: First Norwegian gas through the pipeline to Norway and Kalstø

25.07.1985: The Kårstø plant put into operation. First gas to the plant.

01.05.1988: K-Lab ready for operation

01.10.1993: The Sleipner condensate plant put into operation

01.09.2000: The Ethane plant put into operation

01.10.2000: Åsgard Transport and the Åsgard plant put into operation

01.10.2003: The Mikkel field tied in to Kårstø

01.10.2005: The Kristin field tied in to Kårstø

07.04.2014: The Gudrun field delivers light oil to Kårstø

Glossary:

GSm^3: Giga standard cubic meter=1 billion m3 of gas at 1.01325 bar and 15°C.

CNG: Compressed natural gas

LNG: Liquefied natural gas - i.e. mainly methane liquefied by cooling to minus 163 °C at atmospheric pressure. 1 tonne LNG corresponds to approx. 1,400 standard m3 of gas.

LPG: Liquefied petroleum gas. Consists mainly of propane and butane. At Kårstø LPG is made by fractionating and cooling.

Natural gas: Petroleum that mainly contains light hydrocarbons. It can be divided into dry gas and wet gas. Dry gas consists mainly of methane, but often contains some ethane and smaller quantities of heavier hydrocarbons. Also called sales gas. Wet gas consists mainly of ethane, propane and butane, and smaller quantities of heavier hydrocarbons.

Condensate: Consists of the heavier components in natural gas, i.e. pentane, hexane, heptane etc. Condensate (natural petrol) is in liquid form at atmospheric pressure and temperature.

Naphtha: A volatile condensate that contains less of the heaviest components.

NGL: Natural gas liquids - wet gas consists of the heavier gases ethane, propane, butane and smaller quantities of pentane, hexane and heptane.

Nm^3: Normal cubic meter at reference conditions 0°C and 1.01325 bar.

o.e.: Oil units or oil equivalents. Oil and gas are often referred to in the form of oil equivalents. Rule of thumb: 1 tonne o.e. = 1 tonne of oil = 1,100 Sm3 of sales gas.

Sm^3: Standard cubic meter at reference conditions 15 °C and 1.01325 bar.

Petroleum: Collective term for hydrocarbons, whether in the solid, liquid or gaseous state.

The Kårstø plant is owned by Gassled, Gassco is operator and Equinor is technical service provider
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