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

The installation plays a key role in the transportation and treatment of gas and condensate (light oil) from important areas on the Norwegian continental shelf. Twentyeight fields are linked to Kårstø via pipelines. Every day millions of cubic metres of gas and non-stabilised condensate flow into the plant, where the heavier components are removed by separation. The remainder, known as dry gas or sales gas, is exported by pipeline to the Continent.

The heavier components are known collectively as natural gas liquids (NGL) or wet gas. 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 treat 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 Åsgard and other fields in the Norwegian sea through the Åsgard Transport pipeline. On 1 October 2005, Kårstø was ready to receive gas from yet another large field, the Kristin Field on the Haltenbank.

The latest expansions have entailed a large increase in the plant’s capacity to receive and process gas. Just under 90 million standard cubic metres of rich gas can flow through the plant every 24 hours.

Added value
Kårstø is an important link in the value chain from the 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 percent of the natural gas delivered from Norway to European customers each year will be exported via Kårstø.

The site
Out of an area of approximately 208 hectares the actual installation occupies 108 hectares. It originally consisted of the Statpipe gas treatment plant.

Kårstø Gas Processing  The Transport Network

<table>
<thead>
<tr>
<th>Ethane</th>
<th>LPG</th>
<th>Naphtha</th>
<th>Condensate</th>
</tr>
</thead>
<tbody>
<tr>
<td>- propane</td>
<td>- iso-butane</td>
<td>(natural gasoline)</td>
<td></td>
</tr>
<tr>
<td>Rich gas/condensate</td>
<td>Dry gas/sales gas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Transport Network

- From the Norwegian Sea
  - Åsgard 42 inches
    - Capacity: approx. 69 MSm³/day
    - Rich gas
  - Statpipe 30 inches
    - Capacity: approx. 25 MSm³/day
    - Rich gas
  - Sleipner condensate
    - 20 inches
    - 200,000 barrels/day
    - Non-stabilised condensate
Kårstø’s Capacity

Production capacity is a good 10 million tonnes of NGL and condensate per annum

<table>
<thead>
<tr>
<th>Component</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethane</td>
<td>112 tonnes/hour</td>
</tr>
<tr>
<td>Propane</td>
<td>385 tonnes/hour</td>
</tr>
<tr>
<td>n-Butane</td>
<td>76 tonnes/hour</td>
</tr>
<tr>
<td>i-Butane</td>
<td>145 tonnes/hour</td>
</tr>
<tr>
<td>n-Butane</td>
<td>106 tonnes/hour</td>
</tr>
<tr>
<td>Condensate</td>
<td>351 tonnes/hour</td>
</tr>
</tbody>
</table>

Kårstø also receives condensate (light oil) in a separate pipeline from the Sleipner area. It is stabilised and fractionated in a dedicated plant. During this process ethane, propane, normal butane and iso-butane are distilled out. The remainder is called stabilised condensate and is transported from Kårstø by ship.

Storage tanks and caverns

Propane is stored in two large rock caverns with a combined capacity of 250,000 m³. Ethane, normal butane, iso-butane, naphtha and stabilised condensate 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 qualification of equipment and processes for the production and transport of hydrocarbons.

K-lab is owned by Statoil, but it carries out assignments for suppliers to the oil industry and other oil companies, as well as for internal customers. K-lab carries out tasks such as the 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 large production of ethane, LPG and stabilised condensate leads to approximately 700 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 described as the largest of its type in Europe. A dedicated harbour office handles shipping traffic and three tugs are permanently stationed at Kårstø so that the necessary assistance can be provided.

Health, safety and the environment

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

All who work at the installation, or who need to enter the site for any reason, are also required to comply with 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 and onshore process facilities and gas terminals abroad. The system is used by all parties needed to transport Norwegian gas. The receiving terminals for Norwegian gas in Germany, Belgium, France and the UK are wholly or partially owned by Gassled. Gassled is organised in different access zones with different tariff levels.
Facts

Kårstø Site:
Caverns: propane: 250,000 m³
Tanks: normal butane: 1 x 35,000 m³ and 2 x 20,000 m³
iso-butane: 1 x 35,000 m³ and 2 x 8,000 m³
Naptha: 2 x 17,000 m³
Ethane: 1 x 25,000 m³
Stabilised condensate: 2 x 60,000 m³
Site:
Area: 520 acres
Installation: 270 acres

Milestones:
10.06.1981: The Norwegian Storting resolved to build the Statpipe transport system and the Kårstø gas treatment plant.
25.07.1985: Kårstø plant put into operation. First gas to the plant.
01.05.1988: K-Lab ready for operation
01.10.1993: Sleipner condensate plant put into operation.
01.09.2000: Ethane plant put into operation.
01.10.2000: Åsgard Transport ready for operation
01.10.2000: Åsgard plant put into operation.
01.10.2003: Mikkel plant (KEP 1) in operation
01.10.2005: Kristin plant (KEP 2005) in operation

Words and Expressions:
GSm³: Giga standard cubic metre = 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.

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

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