North East England

Regional Development Agency

The North Sea Oil and Gas Market

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INTRODUCTION

Measurements

Below is a brief description of the measurement and their abbreviations listed in this document:

Barrel per day, abbreviated as BPD, bbl/d, bpd – unit of oil production rate. 1 barrel = 158.98 litres or 42 US gallons.

Trillion cubic feet, abbreviated as Tcf, tcf, TCF – commonly used measurement to describe volumes of natural gas.

Billion cubic feet, abbreviated Bcf, bcf, BCF – measurement to describe volumes of natural gas.

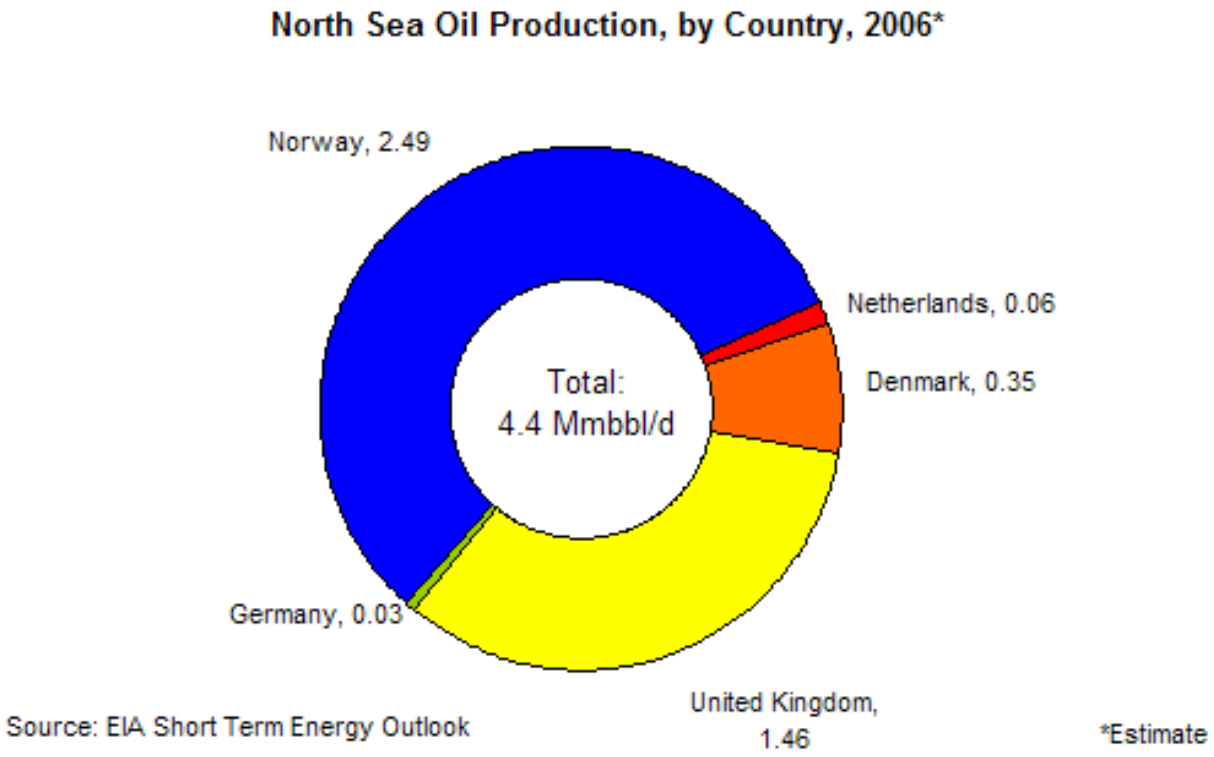
THE NORTH SEA

The North Sea Oil fields are one of the world's most important non-OPEC production sites. The North Sea is situated to the east of Britain and to the west of continental Europe. It extends to about 625,000 km2. To the north, it is bounded by the continental shelf edge marking the limits of the Norwegian Sea. There is a relatively deep (600 m) trench off the coast of Norway, otherwise it is generally less than 200m in depth, becoming shallower to the south. The seafloor is comprised mostly of mixed sediments with mud in some more northerly areas, and coarser sands in the shallower tidally active south. Areas close to Scottish and Norwegian coasts are rocky.

North Sea location map

BACKGROUND

Significant North Sea oil and natural gas reserves were discovered in the 1970s. However, the North Sea did not emerge as a key, non-OPEC oil producing area until the 1980s and 1990s, when major projects began coming onstream. Oil and natural gas extraction in the North Sea's inhospitable climate and great depths requires sophisticated offshore technology. Consequently, the region is a relatively high-cost producer, but its political stability and proximity to major European consumer markets have allowed it to play a major role in world oil and natural gas markets. Five countries operate crude oil and natural gas production facilities in the North Sea: Denmark, Germany, the Netherlands, Norway, and the United Kingdom.

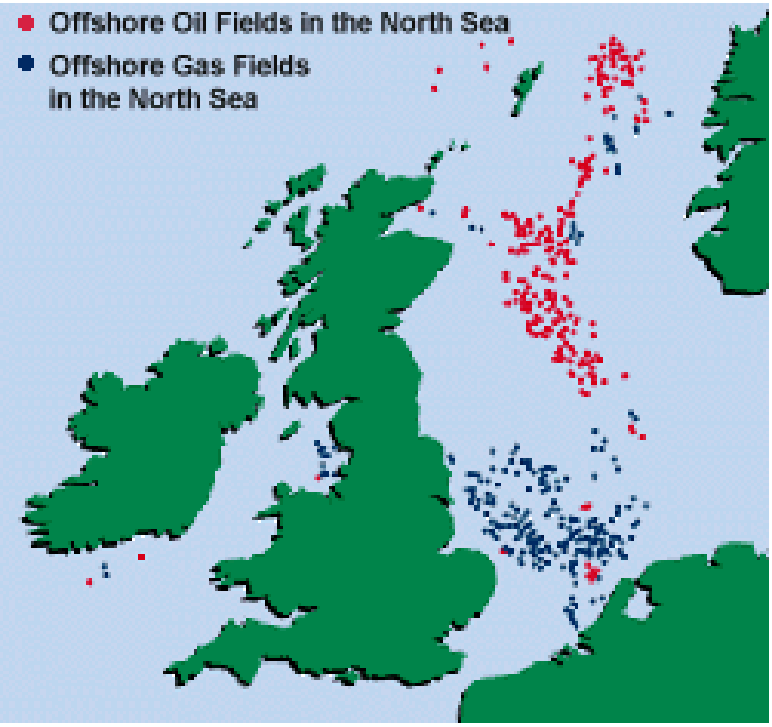


There are over 300 oil and gas fields and over 100 offshore pipelines in the North Sea (a list of some of the major pipelines can be found at the end of this document).
Most of the crude oil produced in the North Sea is pumped by pipeline to the major offshore receipts terminals at Sullom Voe (Shetlands), Flotta (Orkney's), Grangemouth (Nr Edinburgh) and Teesside. Crude ships load the crude oil at these terminals and ship it all over the world. Much of the oil goes to America which favours the North Sea's low sulphur and high potential petrol content over local consumers. UK refineries, which are some of the most sophisticated in the world, are able to run on heavier (and cheaper) high sulphur crudes from Russia and the Middle East.

Although the North Sea region will continue to be a sizable crude oil producer, output from its largest producers - the UK and Norway - has peaked and entered a period of long term decline. In the near term, improved oil recovery technologies, continued high oil prices and new projects coming online could temporarily delay declines in North Sea crude oil output. Nonetheless, only new discoveries of sizable volumes could reverse the current downward trend of oil production from the North Sea.

In regards to natural gas, the North Sea is also seen as a mature region. Only Norway has seen an increase in natural gas production in recent years, while the UK will likely become a net gas importer in the midterm. Nevertheless, the North Sea's importance as a key supplier of natural gas will continue, as natural gas consumption in Europe will increase significantly in the future. Imports from outside sources, such as Africa, the Middle East and Russia, will have to increase to compensate for the North Sea decline.

Because five countries control different parts of the North Sea, transnational cooperation is necessary for the development of oil and gas fields straddling boundaries. In April 2005, Norway and the UK signed a bilateral treaty detailing the handling of such resources. The treaty was the first step toward a general framework for inter-boundary oil projects, as previous projects have been governed by separate treaties and negotiations. Talisman Energy planned to bring the Enoch and Blane fields onstream by the end of 2006, which straddle the border between Norway and the UK.



Location of North Sea oil and gas fields

Location of UK Oil Refineries

There are nine major refineries, as mapped out below, all of which are located on coastal sites around the country as follows:

Location	Company	Refining capacity (million tonnes pa)
Grangemouth, Scotland	INEOS	>10
North Tees, Teesside	Petroplus	5.5
Killingholme, Lincolnshire	TOTAL	11
Humber, Lincolnshire	Conoco	11.5
Coryton, Thames	BP (sale agreed to Petrolplus)	10
Fawley, near Southampton	Esso	16
Pembroke, South Wales	ChevronTexaco	10.5
Milford Haven, South Wales	70% TOTAL & 30% Murco	6
Stanlow, Cheshire	Shell	12

INVESTMENT

Conditions in the North Sea are very harsh, and the oil fields are small compared to those in other parts of the world resulting in oil production that is relatively expensive. UK oil companies therefore, need to be inventive and have to invest heavily in safe and efficient techniques to remain competitive in the world market. Currently a fifth of all industrial investment in the UK, £4 billion per annum, comes from the oil and gas industry.

As a result of this investment, the UK has moved in one generation, from reliance on other countries for much of its specialist knowledge, to being globally acknowledged experts, particularly in areas such as deep water technology. The UK has been very successful in developing techniques for extracting a higher proportion of oil from each field than was possible before. Expertise of this kind means that UK specialists are in high demand all over the world, and their own contribution to the economy is enormous.

Twenty years ago, it was confidently predicted that North Sea oil would run out by the year 2000, but UK oil production continues to increase. In fact, UK reserves of oil currently stand at around two billion tonnes - as much as has been produced in the last 25 years. Some oil fields, in particular those to the west of the Shetland Islands, have been discovered relatively recently and are at an early stage of their productive life. Long term investment in new technology remains a priority, both to increase productivity and to find new sources of oil. Recent and future fields are expected to remain productive at least until 2020.

Many of the world's unexplored oil fields lie under very deep water. UK expertise in extracting oil from deep water wells is therefore likely to grow in importance and make British technology an increasingly valuable export.

WORKFORCE

It is estimated that approximately 380,000 people in the UK are employed directly and indirectly in over 6,000 companies by the oil industry. About 35,000 of these are employed by oil companies in offshore jobs. It is estimated that there are approximately 75,000 people in Norway employed in the offshore sector.

Examples of employment generated by the North Sea oil and gas industry

Exploration and production:

- Divers
- Drillers
- Engineers
- Geologists
- Geophysicists
- Analysts and planners
- Welders
- Safety officers

Transporting oil and support services:

- Construction workers
- Crews for standby vessels and other marine support
- Helicopter crews
- Lorry drivers
- Tanker crews

Oil companies' offices:

- Accountants and administrative support
- IT and communications specialists
- Lawyers
- Printers, publishers and stationery suppliers
- Telephone operators and receptionists
- Planners and project managers

Back-up staff on offshore platforms:

- Administrators and managers
- Catering and cleaning staff
- Computer specialists
- Nurses and paramedics
- Environmental specialists

EXPLORATION AND PRODUCTION

Oil

The five countries in the North Sea region had 4.8 billion barrels of proven oil reserves in 2005. Norway contains the bulk of these reserves (57 percent), followed by the UK (30 percent). Total oil production for the North Sea region, including on- and offshore, was 5.9 million barrels per day (bbl/d), down 5.6 percent from peak production in 1999. Norway and the UK are the largest producers, though Denmark is also a net exporter.

Norway

The bulk of Norway's oil production occurs in the North Sea, with smaller amounts in the Norwegian Sea. Norwegian oil production rose dramatically from 1980 until the mid-1990s, but has since remained flat.

The largest oil field in Norway is the Troll complex, operated by Norsk Hydro, which produced 306,000 bbl/d in 2004. Other important fields include Ecofisk (ConocoPhillips), Snorre (Statoil), Oseberg (Norsk Hydro), and Draugen (Shell). There is a great emphasis on increasing production from existing projects, including the incorporation of smaller satellite fields.

Industry analysts consider the Norway Continental Shelf (NCS) a mature oil producing region. Most of the country’s flagship oil fields have peaked, with production remaining flat or declining slightly. For example, the Oseberg complex produced 503,000 bbl/d in 1993, but only 229,000 bbl/d during the first five months of 2005. Companies are still discovering oil in the NCS, but none of the recent finds have been significant. In 2003, the Norwegian Ministry of Petroleum and Energy (MPE) reported that oil companies made eleven new discoveries, potentially holding 189-566 million barrels of oil, far less than what the country produced for the year.

There are about 60 oil and natural gas discoveries that are still undeveloped, representing about 4.4 billion barrels of liquids and 16 trillion cubic feet (Tcf) of natural gas. Drilling activity on the NCS in 2004 was the lowest it has been in a decade. At the time, many blamed the low drilling rate on a four-month rig strike; however, during the first half of 2005, the rate of exploratory drilling was similar to that of 2004.

Because Norway shares the North Sea region with the United Kingdom, the two must coordinate efforts when dealing with reserves that straddle the division of each country’s respective zone. In April 2005, the two countries signed a bilateral treaty detailing the handling of such resources. The treaty was the first step toward a general framework for inter-boundary oil projects, as previous projects have been governed by separate, one-time treaties and negotiations.

United Kingdom

Total oil production (including condensates, natural gas liquids, and refinery gain) in the UK was 2.08 million bbl/d in 2004, a 13 percent decrease from 2003 and 30 percent below the peak of production in 1999. The UK Continental Shelf (UKCS), located in the North Sea off the eastern coast of the UK, contains the bulk of the country's oil reserves.

The UK government expects oil production in the country to continue to decline, reaching 1.38 million bbl/d by 2009. Reasons for this decline include: 1) the overall maturity of the country's oil fields; 2) the application of new crude oil extraction technologies that lead to field exhaustion at a quicker rate; and 3) increasing costs as production shifts to more remote and inhospitable regions

Denmark

Many new fields have come onstream in the past six years, including Halfdan, Siri, and Syd Anre, Nina, Cecilie and Nif, developments which have helped to bolster Denmark's crude oil production. In July 2004, Danish Oil and Gas Company (DONG) announced that, after completing the CA-3 appraisal well in the Cecilie field, the company found commercial volumes of oil and will proceed with the wells development. Other fields under development include Adda and Boje.

The Netherlands

The Netherlands produced 94,900 bbl/d in 2004. Overall, the Netherlands' oil production has been in decline since 1986, when it peaked at 123,400 bbl/d.

Germany

In 2004, Germany produced 161,500 bbl/d. Most of Germany's oil production is onshore; however, the country does operate a single offshore oil field, Mittelplate, located in the North Sea.

Crude Oil Exports

Norway and the United Kingdom are significant oil exporters, though Denmark is also a small net exporter. Because Norway only consumes a relatively small amount of oil each year, the country is able to export the vast majority of its oil production. In 2003, Norway was the third-largest net oil exporter in the world, behind Saudi Arabia and Russia. The largest single recipient of Norway's exports is the United Kingdom, which imported 814,500 bbl/d from Norway, or 34 percent of Norway's total exports. Other significant destinations included the Netherlands (14 percent), the United States (11 percent), and Germany (9 percent).

The UK has been a net exporter of crude oil since 1981, though the country does import large quantities of oil from Norway. In 2004, the UK exported 235,000 bbl/d of crude oil and 134,000 bbl/d of petroleum products to the U.S., contributing 2.3 percent and 4.7 percent to total U.S. crude oil and petroleum product imports, respectively.

NATURAL GAS

The five countries in the North Sea region had combined, proven natural gas reserves of 169.8 trillion cubic feet (Tcf). Two countries, Norway and the Netherlands, account for over three-fourths of these reserves. On the other hand, the United Kingdom is the largest producer. The North Sea region is an important source of natural gas for Europe, second only to Russia in total exports to the European Union (EU). Natural gas production in the region has increased dramatically since the early 1980s, with a 2003 production level of 9.9 Tcf that was 56 percent above the 1980 level. However, regional natural gas production has begun to flatten, with only Norway adding any significant new capacity in recent years.

Norway

The North Sea holds the majority of Norway's natural gas reserves, but there are also significant quantities in the Norwegian and Barents Seas. Norway is the eighth-largest natural gas producer in the world, producing 2.59 Tcf in 2003. However, because of the country's low domestic consumption, Norway was the world's third-largest net exporter of natural gas in 2003, behind Russia and Canada.

A small group of fields account for the bulk of Norway's total natural gas production. The single largest field is Troll, which produced 930 billion cubic feet (Bcf) in 2004 and represents about one-third of Norway's total natural gas production. Other important fields include Sleipner Ost (450 Bcf), Asgard (360 Bcf), and Oseberg (250 Bcf). These four fields compose over 70 percent of Norway's total gas production.

Despite the maturation of its major natural gas fields in the North Sea, Norway has been able to sustain annual increases in total natural gas production by incorporating new fields. In October 2004, the Kvitebjorn field came onstream with a production level of 710 million cubic feet per day (Mmcf/d). Over the long-term, Norway is counting on non-North Sea projects to provide significant natural gas production, such as Ormen Lange (Norwegian Sea) and Snohvit (Barents Sea).

United Kingdom

Most UK natural gas reserves occur in three distinct areas: 1) associated fields in the UK Continental Shelf (UKCS); 2) non-associated fields in the Southern Gas Basin, located adjacent to the Dutch sector of the North Sea; and 3) non-associated fields in the Irish Sea. Since 1997, the UK has been a net exporter of natural gas. However, as is the case with the country's oil reserves, most natural gas fields have already reached a high degree of maturity, and the UK government estimates that the country will again become a net importer of natural gas by the end of the decade. Indicative of this trend, the operators of the Interconnector natural gas pipeline linking the UK and Belgium announced in August 2005 that they would change the flow of the system, exporting gas from the Continent to the UK, rather than importing gas from the UK. In addition, the UK received in 2005 its first shipment of liquefied natural gas (LNG) in three decades.

The UK is the fourth-largest producer of natural gas in the world, behind Russia, the United States, and Canada. The largest concentration of natural gas production in the UK is the Shearwater-Elgin area of the Southern Gas Basin. The area contains five non-associated gas fields—Elgin (Total), Franklin (Total), Halley (Talisman), Scoter (Shell), and Shearwater (Shell). The UK also produces significant amounts of associated natural gas from its oil fields in the UKCS. Like the oil industry, smaller independents have been able to acquire some maturing assets from larger operators, who find it difficult to profitably operate these older, declining fields.

Denmark

Danish natural gas production has steadily increased over the last three decades, reaching 280 Bcf in 2003. More than a quarter of the country's production is re-injected to boost oil production, according to the Danish Energy Authority (DEA).

The Netherlands

In 2003, natural gas production in the Netherlands was 2.6 Tcf. Natural gas production in the country has declined, not due to natural factors, but rather government policy. The Netherlands has passed the Natural Gas Law, which caps natural gas production at 2.68 Tcf per year between 2003-2007, with this ceiling dropping to 2.47 Tcf between 2008-2013. The government made this policy decision to cut back production in order to maintain reserves for future use. According to the Dutch Ministry of Economic Affairs, Dutch natural gas production will continue to remain steady or slightly decline through 2014.

The onshore Groningen field, located in the north-east of the country, accounts for about one-half of total Dutch natural gas production, with remaining production spread across small fields both onshore and in the North Sea. The largest offshore field is K15. Nederlandse Aarodolie Maatschappij (NAM), a consortium of ExxonMobil and Royal Dutch Shell, operates both K15 and the Groningen field.

Germany

Germany produced 785 Bcf of natural gas in 2003. Nearly all of Germany's natural gas production is located onshore. The country does have one offshore natural gas field, A6-B4, located in the German sector of North Sea, which began production in 2000. The largest natural gas producer in Germany is BEB, a consortium of Royal Dutch Shell and ExxonMobil, which controls half of the country's domestic natural gas production.

Liquefied Natural Gas (LNG)

Norway has a small liquefied natural gas (LNG) terminal located in Tjeldbergodden, with a capacity of only 12,000 tonnes per year (t/y). In 2004, all output from this plant went to Sweden.

The UK has a single LNG import terminal, though there are several in various planning stages. NGT operates the Isle of Grain LNG terminal, a converted natural gas storage facility in southern England.

The terminal has a natural gas processing capacity of 470 Mmcf/d, with plans to eventually increase capacity to 1.5 Bcf/d. The terminal received its first delivery of LNG in July 2005 from Algeria.

ExxonMobil and Qatar Petroleum have received regulatory approval for the South Hook LNG receiving terminal in Milton Haven, Wales. The terminal will be dedicated to receiving LNG from the Qatargas II liquefaction project in Ras Laffin, Qatar, which is also a joint project between the two companies.

APPENDIX

North Sea – Major Pipelines

Europipe I - The Europipe I gas pipeline runs from the Draupner E riser platform in the North Sea to a receiving terminal at Dornum on the German coast. With an internal diameter of 40 inches, it is 716 kilometres long.

Operator: Gassco, Location: Europe(North), North Sea

Europipe II - The Europipe II pipeline is 658 kilometres long and has an internal diameter of 42 inches. It transports gas from the Kårstø processing complex north of Stavanger to the receiving facilities at Dornum in northern Germany.

Operator: Gassco, Location: Europe(North), North Sea

Forties Pipeline System - in the North Sea carrying some 30% of the UK's oil. It is fully owned and operated by BP, who retained the asset after selling off the Forties oilfield to Apache Corp. in 2003. Some 50 assets tie their export lines into the FPS either directly or through intermediate hubs, eventually joining at either Forties Charlie or Forties Unity.
FPS consists of a 36" pipeline originating at Apache Corp.'s Forties Charlie platform. The pipeline then carries crude 169km, routing through the Forties Unity riser platform, to the terminal at Cruden Bay. From there, unstabilised crude is carried to the processing facility at Kinneil, Grangemouth.

Operator: BP, Location: Europe(North), North Sea

Franpipe - The Franpipe system runs for 840 kilometres from the Draupner E riser platform in the North Sea to the receiving terminal at Port Ouest in Dunkerque on the French coast. It has an internal diameter of 42 inches.

Operator: Gassco, Location: Europe(North), North Sea

Frostpipe - This 16-inch line carries oil from the Lille-Frigg and Frøy fields in the Frigg area to Oseberg. Measuring 82 kilometres long, it began operating in 1994. From Oseberg, the oil flows through the Oseberg Transport System to Sture near Bergen.

Operator: TotalFinaElf, Location: Europe(North), North Sea

Haltenpipe - The Haltenpipe line is 250 kilometres long and carries gas from the Heidrun field in the Norwegian Sea to Tjeldbergodden in mid-Norway. With an internal diameter of 16 inches, it became operational in December 1996.

Operator: Gassco, Location: Europe(North), North Sea

Langeled - The world's longest export pipeline. The gas will be transported by the world's longest subsea export pipeline approximately 1200 kilometres from Nyhamna at the west coast of Norway via Sleipner in the North Sea to Easington in UK.

Operator: Norsk Hydro, Location: Europe(North), North Sea

Norne Gas Transport System - The Norne Gas Transport System (NGTS) runs for 126 kilometres to tie the Norne field in the Norwegian Sea into the Åsgard Transport pipeline.

Operator: Gassco, Location: Europe(north), North Sea

Norpipe Oil - A 34-inch oil pipeline which runs for 335 kilometres from Ekofisk to the Teesside export port in Britain. On line in 1975.

Operator: Phillips, Location: Europe(North), North Sea

Oseberg Transport System (OTS) - This was the first pipeline to bring oil ashore in Norway when it began operating in 1988. Crude from Oseberg, Veslefrikk, Brage, Frøy and Lille-Frigg is piped for 115 kilometres through the 28-inch line to Sture near Bergen.

Operator: Norsk Hydro, Location: Europe(North), North Sea

Sleipner Condensate - Condensate from the Sleipner fields is piped for 245 kilometres through a 20-inch line to Kårstø north of Stavanger for processing. Began operating in 1993.

Operator: Statoil, Location: Europe(North), North Sea

Troll Oil I - This 16-inch line carries oil for 86 kilometres from Troll B to Mongstad near Bergen, reaching a depth of more than 500 metres in the Hjelte Fjord. Began operating in 1995.

Operator: Statoil, Location: Europe(North), North Sea

Troll Oil II - This 20-inch line carries oil for 82 kilometres from Troll C to Mongstad. Began operating with a daily capacity of 315,000 barrels in November 1999.

Operator: Statoil, Location: Europe(North), North Sea

Ula Transport - Oil from Ula and Gyda is piped through two 20-inch lines to Ekofisk, and on through Norpipe Oil. The Ula line began operating in 1986, with the Gyda section following in 1990.

Operator: Statoil, Location: Europe(North), North Sea

Vesterled - The Vesterled system runs from the Heimdal Riser platform in the North Sea to St Fergus in the UK, is 361 kilometres long overall and has an internal diameter of 32 inches.

Operator: Gassco, Location: Europe(North), North Sea

Zeepipe - From the Troll Gas processing plant at Kollsnes near Bergen to the Sleipner area, a pipeline with an internal diameter of 40 inches, running for 814 kilometres from the Sleipner area of the North Sea to a receiving terminal at Zeebrugge in Belgium.

Operator: Gassco, Location: Europe(North), North Sea

Åsgard Transport - Gas production from the Åsgard field formed the basis for the pipeline system. Flexible risers from the floating Åsgard B gas platform tie into an export riser base on the seabed, which forms the starting point for the 42-inch Åsgard Transport line.

Operator: Gassco, Location: Europe(North), North Sea