

OIL AND GAS FIELDS IN NORWAY

INDUSTRIAL HERITAGE PLAN



NORSK OLJEMUSEUM

ORMEN LANGE

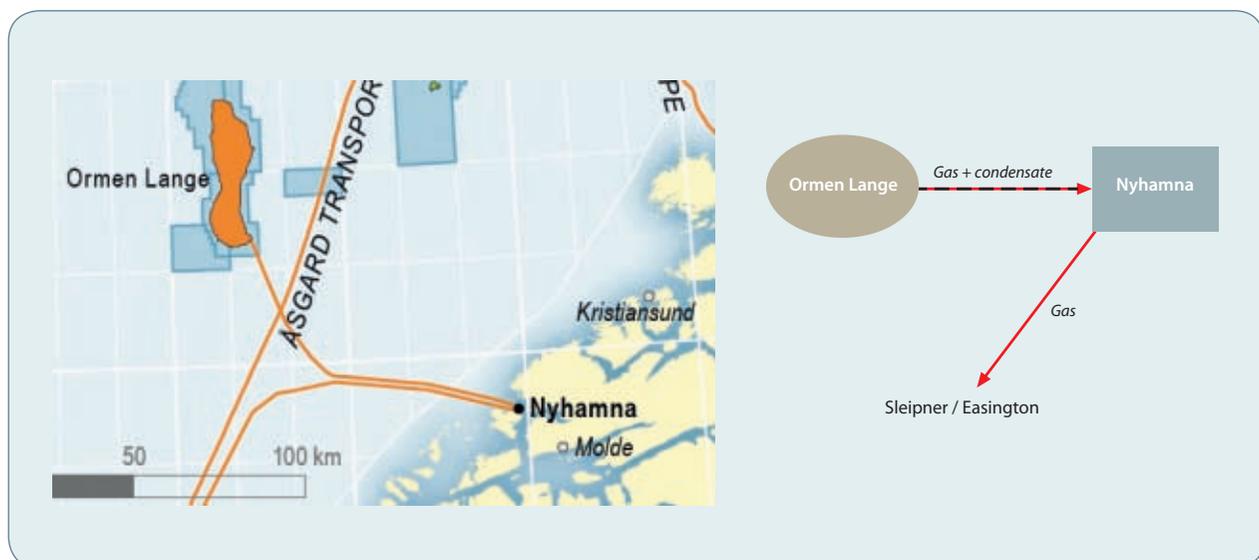
This gas field is located at the southern end of the Norwegian Sea, about 130 kilometres north-west of Molde. The gas is brought ashore at Nyhamna in Møre og Romsdal county.

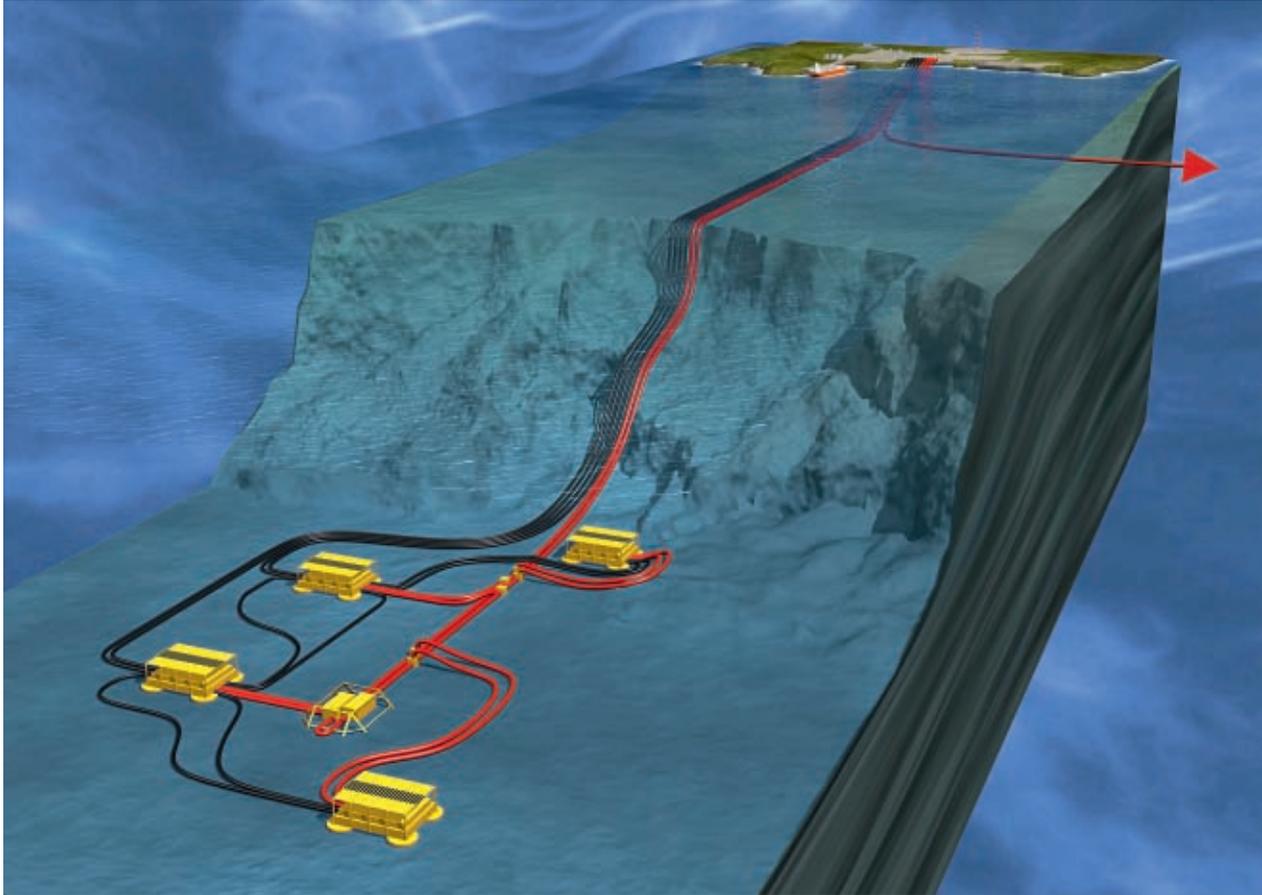
Ormen Lange lies in an area where the climatic and oceanographic conditions made its development one of the most demanding in the world. With water depths of 850-1 100 metres, it also ranks as Norway's first deepwater project. The deep water made work complicated and demanded the development of new technology. Pipelines and installations had to be placed on a very irregular seabed. They must also be able to cope with the currents which characterise this part of Norwegian Sea, an ambient seabed temperature below freezing point and demanding wind and wave conditions. Multiphase flow transport takes place up the steep Egga Slope, a relic of the Storegga submarine landslide.

Norsk Hydro served as development operator



until 1 December 2007, when Norske Shell took over the operatorship for the production phase. Most of the gas is sold to the UK.





Ormen Lange. Illustration: Norsk Hydro

Storegga slide

One of the world's largest submarine clay landslides occurred about 8 000 years ago in the Norwegian Sea, 100 kilometres north-west of Norway's Møre coast. Involving an area the size of Iceland, this event occurred in 300-2 500 metres of water and generated a tsunami 10-20 metres high which reached the Norwegian coast. The back edge of the slide is 300 kilometres long and as steep as the landing slope on a ski jump, and the slide moved some 800 kilometres out into the deep ocean. Ormen Lange lies centrally in the depression left by the slide, close to the steep back slope which rises 200-300 metres up to the continental shelf.

The seabed in the area is very irregular as a result of the slide, with heights rising to 30-60 metres. Located in 800-1 100 metres of water, the reservoir itself is 2 000 metres beneath the seabed.

Reservoir and development strategy

Ormen Lange's main reservoir comprises early Tertiary sandstones at a depth of 2 700-2 900 metres, and covers an area about 40 kilometres long by eight

to 10 wide. With gas-bearing strata 50 metres thick, the reservoir is defined as partly segmented.

At about 0.2 per cent, the carbon dioxide content of the gas is low by comparison with other fields. The water cut in the wellstream is modest, and mainly accompanies the condensate. Production is based on pressure reduction followed by gas compression.



Constructing templates for Ormen Lange.

Photo: Norsk Hydro



The Ormen Lange processing plant at Nyhamna, photographed in 2005. Photo: Øyvind Leren/Norske Shell

Development solution

The field development comprises three components – subsea installations in 860 metres of water, two 120-kilometre multiphase flow pipelines to land and the processing plant at Nyhamna.

Plans call for Ormen Lange to be developed with 24 wells drilled through four subsea templates. The first two of these structures were installed in August 2005. Measuring 44 metres long, 33 wide and 15 tall, the templates stand 3.6 kilometres apart. Each has slots for eight wells tied back to a manifold.

Nyhamna

Comprising gas, condensate and water, Ormen Lange's unprocessed wellstream is carried through two 30-inch multiphase flow lines to Nyhamna. The special seabed conditions over the reservoir yield water temperatures as low as -1°C . Such extremes, combined with high pressure, could cause the formation of hydrates (hydrocarbon ice) which in turn may plug the pipelines should production be shut down. Antifreeze has to be piped from land in two six-inch lines and injected continuously into the transport pipelines out on the field to inhibit this problem. The antifreeze returns in the wellstream to Nyhamna, where it is separated out and recycled.

On arrival at the receiving terminal, the wellstream first enters a slug catcher to deal with possible liquid accumulations (slugs) which could otherwise damage the processing plant. Gas, condensate, water and antifreeze are then separated in various



Langeled. Illustration: Norsk Hydro/Norske Shell

processes. The gas passes subsequently through a dewatering and drying plant before being compressed for export, while stabilised condensate is stored in a 150 000-cubic-metre rock cavern for shipment by sea. Produced water is treated before being discharged to the sea.

At plateau, Ormen Lange's processing facilities will be able to handle about 20 billion scm of gas per year, which corresponds to total Norwegian energy requirements for a 12-month period.

Ormen Lange

Blocks:	6305/4, 5, 7 and 8
Production licences	208, 209 and 250
Awarded	1996 and 1999

Total recoverable reserves	393.7 bn scm gas 28.5 mill scm condensate
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Discovery year	1997
Approved for development	2 Apr 2004
On stream	13 Sep 2007
Operator (1 Dec 2007-)	Norske Shell
Operator (1996-2007)	Norsk Hydro
Operations organisation	Nyhamna

Licensees

Petoro	36.48%
Statoil	28.91%
Norske Shell	17.04%
Dong E&P Norway	10.34%
ExxonMobil	7.23%

Transport

After the gas has been dewatered and compressed, it is carried through the 1 200-kilometre Langeled pipeline via Sleipner East to Easington near Hull in the UK. A diameter of 44 inches on the Sleipner East-UK leg makes this the largest underwater pipeline in the North Sea. The Nyhamna-Sleipner East leg is 42 inches in diameter. Via the riser platform on Sleipner East, the gas can also be transported to customers in continental Europe. Langeled crosses the Norwegian Trench at a depth of 360 metres, and is dimensioned to cope with an internal pressure of 250 bar – equivalent to the ambient pressure in 2 500 metres of water. This is the highest level for any North Sea pipeline.