

# OIL AND GAS FIELDS IN NORWAY

## INDUSTRIAL HERITAGE PLAN

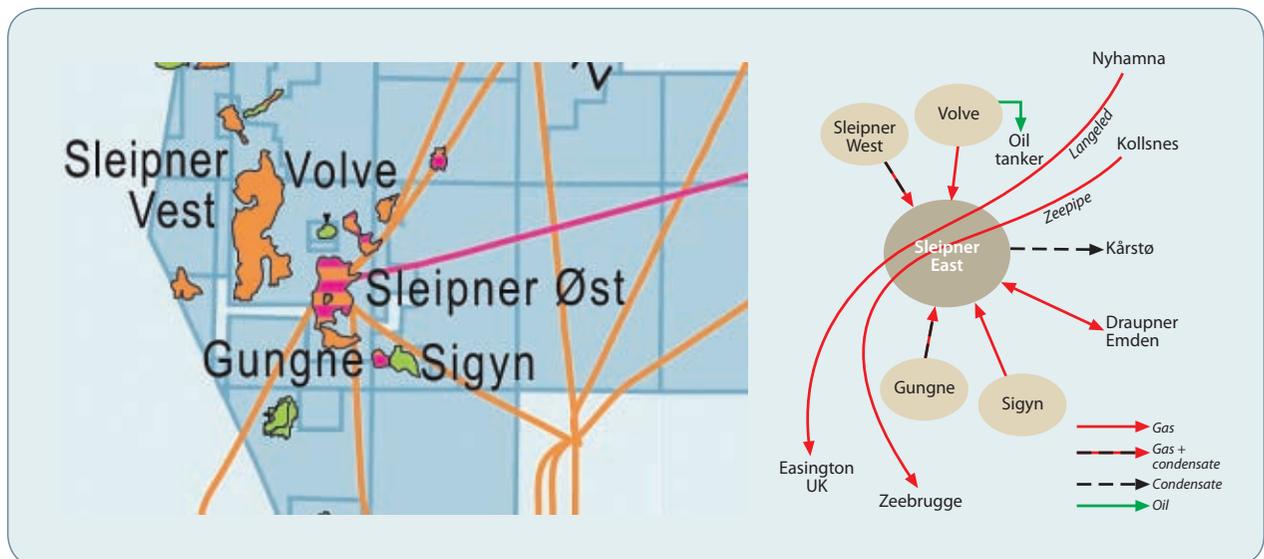


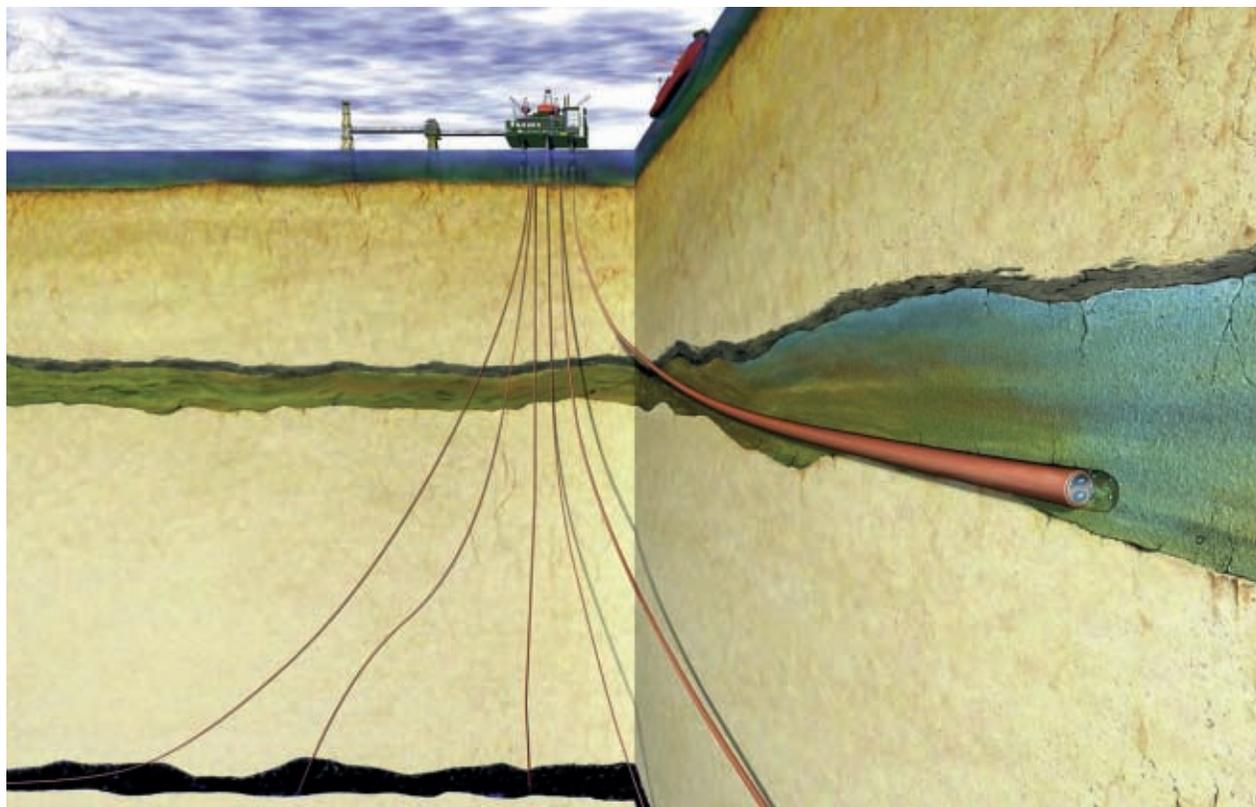
NORSK OLJEMUSEUM

# THE SLEIPNER AREA

The Sleipner area embraces the Sleipner East, Sleipner West, Sigyn, Volve and Gungne fields. It represents an important hub for gas from Troll, which is exported through Zeepipe to Belgium, and from Ormen Lange, carried via Langeled to the UK.

Sleipner East came on stream in 1993 and Sleipner West in August 1996. Gas from the latter contains about nine per cent carbon dioxide, which exceeds the delivery specification. Most of this greenhouse gas is accordingly captured in an amine plant on the Sleipner T platform and stored in the Utsira formation, a 200-metre-thick waterfilled sandstone structure which covers 26 000 square kilometres at a depth of 800-1 000 metres. Roughly a million tonnes of carbon dioxide have been stored there annually since 1996, and research is still being conducted on how the injected volumes behave in the formation.





Carbon injection in the Utsira formation. Illustration: Statoil

## Sleipner East

This gas and condensate field lies in 82 metres of water at the southern end of the NCS. The Loke discovery forms part of Sleipner East and has been developed with a simple subsea well tied back to the Sleipner A platform on the latter field. Sigyn, Gungne, Volve and Sleipner West are also tied back to the same installation. Statoil is operator for Sleipner East.

### Reservoir and recovery strategy

The resources in Sleipner East and Loke are located in sandstones of Palaeocene, middle Jurassic and Triassic age, located at a depth of roughly 2 300 metres. No pressure communication exists between the reservoir zones.

Production is based on gas injection and pressure reduction.

### Transport

Gas for Sleipner East is sold under the terms of the Troll agreement. The wellstream from the field is processed on Sleipner A together with production from Gungne and Sigyn. Unstabilised condensate from Sleipner East and West are blended and piped to Kårstø for processing to stabilised condensate and NGL products. Processed gas is mixed with output

from Troll and exported to Zeebrugge via Zeepipe or Emden via Statpipe. Since 2007, gas from Ormen Lange has been exported in the Langede pipeline from Nyhamna via Sleipner R to the UK.

### Sleipner East

Block	15/9
Production licence	046
Awarded	1976
<b>Total recoverable reserves</b>	67.4 bn scm gas 26.9 mill scm condensate 13.4 mill tonnes NGL
<b>Remaining at 31 Dec 2008</b>	36.8 bn scm gas 3 mill tonnes NGL
Discovery year	1981
Approved for development	15 Dec 1986
On stream	24 Aug 1993
Operator	Statoil
Operations organisation	Stavanger
Main supply base	Dusavik
<b>Licensees</b>	
Statoil	59.6%
ExxonMobil	30.4%
Total E&P Norge	10.0%



Laying Langed during 2005. From left: Sleipner A, R, T and the flare stack. Pipelay barge Acergy Piper is on the right. Photo: Kim Laland/Statoil



Sleipner A. Illustration: Norwegian Contractors

### Development solution

Sleipner East has been developed with Sleipner A, a concrete integrated production, drilling and quarters platform, two templates for subsea wells, the Sleipner R riser platform, the Sleipner T treatment platform and a flare stack.

### Sleipner A

This platform rests on a Condeep-type concrete GBS with four shafts, 24 cells and a total concrete volume of roughly 80 000 cubic metres. The original GBS sank in the Gands Fjord outside Stavanger on 23 August 1991. Sleipner A2 was built as a replacement and installed in 1993.

### Sleipner R

A riser platform.

### Sleipner T

Sleipner T is a steel gas treatment platform, which was modified for low pressure production in 2002. It processes natural gas and gas condensate from both



Sleipner R. Photo: Harald Pettersen/Statoil

Sleipner West and East. Carbon dioxide is separated from the Sleipner West wellstream for injection in the Utsira formation.



Sleipner T. Photo: Harald Pettersen/Statoil

## Sleipner West

This gas field lies in 110 metres of water. Tied back to Sleipner East, it has been developed with the Sleipner B wellhead platform. Statoil is the operator.

### Reservoir and recovery strategy

Sleipner West produces from middle Jurassic sandstones located at a depth of 3 450 metres. It is divided into five segments – Epsilon, Delta, Beta, Alpha South and Alpha North. The first four came on stream in 1996, followed by Alpha North in 2004. Faults in the field do not normally form seals, and communication between the sandstones is good.

The field produces through pressure reduction.

### Transport

Gas and condensate from Sleipner West are processed on Sleipner T, and carbon dioxide removed. Processed gas goes to Sleipner A for export, with carbon injection in the Utsira formation via a dedicated well from the A platform. Unstabilised condensate from

### Sleipner West

Blocks	15/6 and 15/9
Production licences	029 and 046
Awarded	1969 and 1976
Total recoverable reserves	117.7 bn scm gas 29.2 mill scm condensate 8.3 mill tonnes NGL
Remaining at 31 Dec 2008	36.8 bn scm gas 3 mill tonnes NGL
Discover year	1974
Approved for development	14 Dec 1992
On stream	29 Aug 1996
Operator	Statoil
Operations organisation	Stavanger
Main supply base	Dusavik

### Licensees

Statoil	58.35%
ExxonMobil	32.24%
Total E&P Norge	9.41%



Sleipner B. Photo: Dag Tore Anfinsen/Statoil

Sleipner West and East are blended on Sleipner A and piped to Kårstø for processing into stabilised condensate and NGL products.

**Development solution**

Sleipner B is a steel wellhead platform without processing equipment. The unprocessed wellstream from this installation is piped 12 kilometres to Sleipner T on Sleipner East, which is linked by a bridge with Sleipner A. Without permanent staffing, Sleipner B is remotely operated from the A platform.

**Sleipner West Alpha North**

This Sleipner West satellite was brought on stream in 2004. An 18-kilometre flowline carries gas and condensate to Sleipner T, where the high carbon content is removed and transmitted to Sleipner A for injection in the Utsira formation. Statoil is the operator.

The field is produced through a subsea template with four wells and a 16-inch flowline.

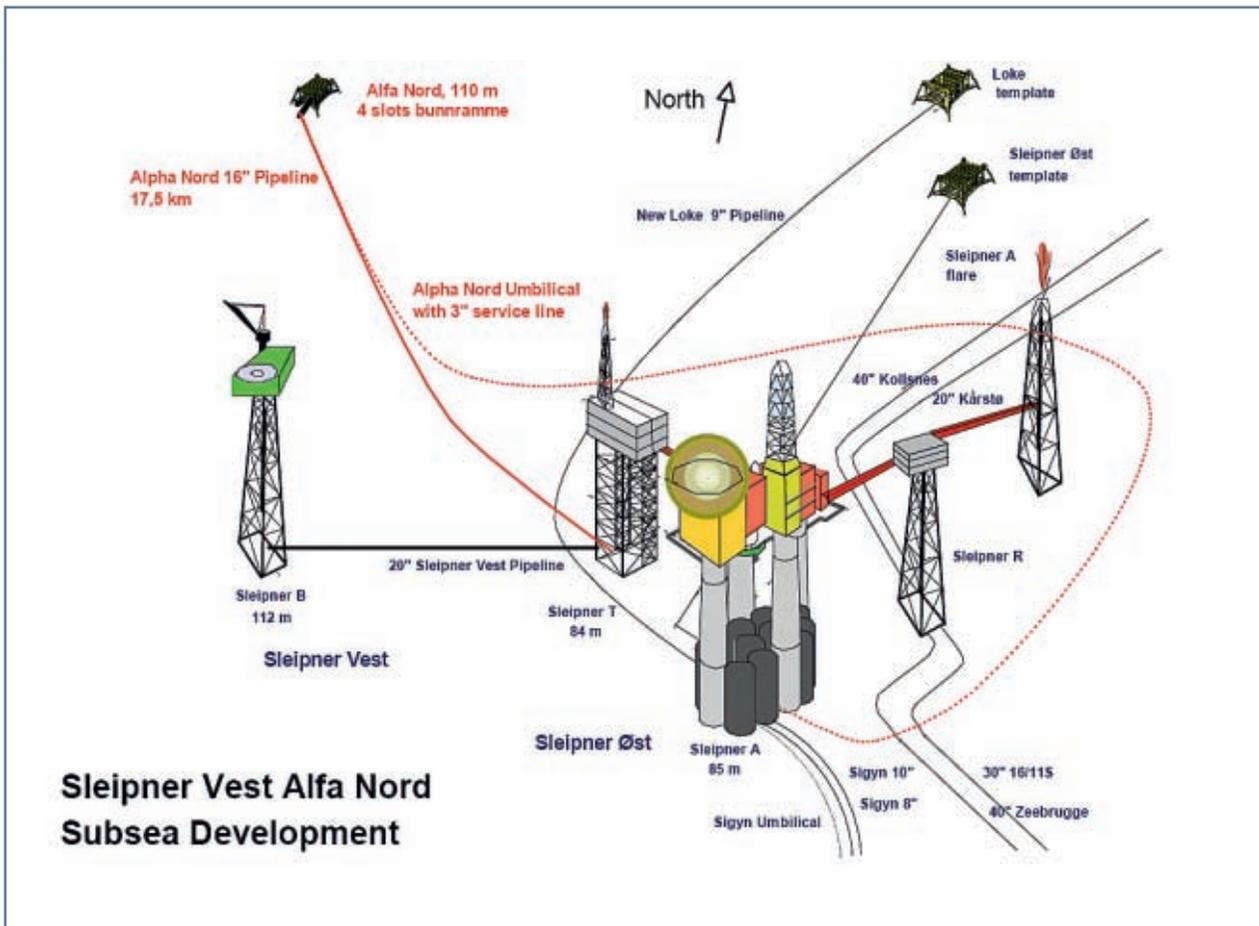


Illustration: Statoil

## Gungne

This gas and condensate field is a satellite to Sleipner East. Lying in 83 metres of water, it came on stream in 1996 with Statoil as operator.

### Reservoir and recovery strategy

Gungne produces primarily from a Triassic sandstone reservoir about 2 800 metres down. Reservoir properties are good.

The field produces through pressure reduction.

### Transport

Gas and condensate from Gungne are processed on Sleipner A, with processed gas blended with output from Troll and exported through Zeepipe to Zeebrugge.

### Development solution

Gungne produces via three wells drilled from Sleipner A.

### Gungne

Block	15/9
Production licence	046
Awarded	1976
<b>Total recoverable reserves</b>	14.1 bn scm gas 4 mill scm condensate 1.9 mill tonnes NGL
<b>Remaining at 31 Dec 2008</b>	2.4 bn scm gas 0.3 mill tonnes NGL
Discovery year	1982
Approved for development	29 Aug 1995
On stream	21 Apr 1996
Operator	Statoil
Operations organisation	Stavanger
Main supply base	Dusavik
<b>Licensees</b>	
Statoil	62%
ExxonMobil	28%
Total E&P Norge	10%

## Sigyn

Located south of Sleipner East in roughly 70 metres of water, Sigyn is tied back to Sleipner A as a satellite field. The operator is ExxonMobil E&P Norway.

### Reservoir and recovery strategy

The field embraces Sigyn West, a gas and condensate deposit, and Sigyn East, which contains light oil. Located about 2 700 metres down, the main reservoir is of Triassic age.

Sigyn produces through pressure reduction.

### Transport

The wellstream travels through two 12-kilometre pipelines to Sleipner A for gas export via the dry gas system. Condensate is piped from the A platform to Kårstø.

### Development solution

Sigyn has been developed with a subsea template for three production wells.

### Sigyn

Block	16/7
Production licence	072
Awarded	1981
<b>Total recoverable reserves</b>	6.6 bn scm gas 3.9 mill scm condensate 2.9 mill tonnes NGL
<b>Remaining at 31 Dec 2008</b>	2.1 bn scm gas 1.1 mill tonnes NGL
Discovery year	1982
Approved for development	31 Aug 2001
On stream	22 Dec 2002
Operator	ExxonMobil
Operations organisation	Stavanger
Main supply base	Dusavik
<b>Licensees</b>	
Statoil	60%
ExxonMobil	40%

## Volve

This oil field lies eight kilometres north of the A platform on Sleipner East and three west of Loke. Statoil is the operator.

### Reservoir and recovery strategy

The reservoir contains oil in Jurassic and Triassic rocks.

Volve is produced with water injection as the drive mechanism.

### Transport

Rich gas is piped to Sleipner A and exported from there, with oil stored in a tanker for onward transport.

### Development solution

Volve's infrastructure comprises Maersk Inspirer, a jack-up processing and drilling platform, and the Navion Saga tanker for storing stabilised crude.

The submerged turret loading system (STL) was originally used by Statoil on the Yme field along with the same storage vessel, then under the name m/v Polysaga.

### Volve

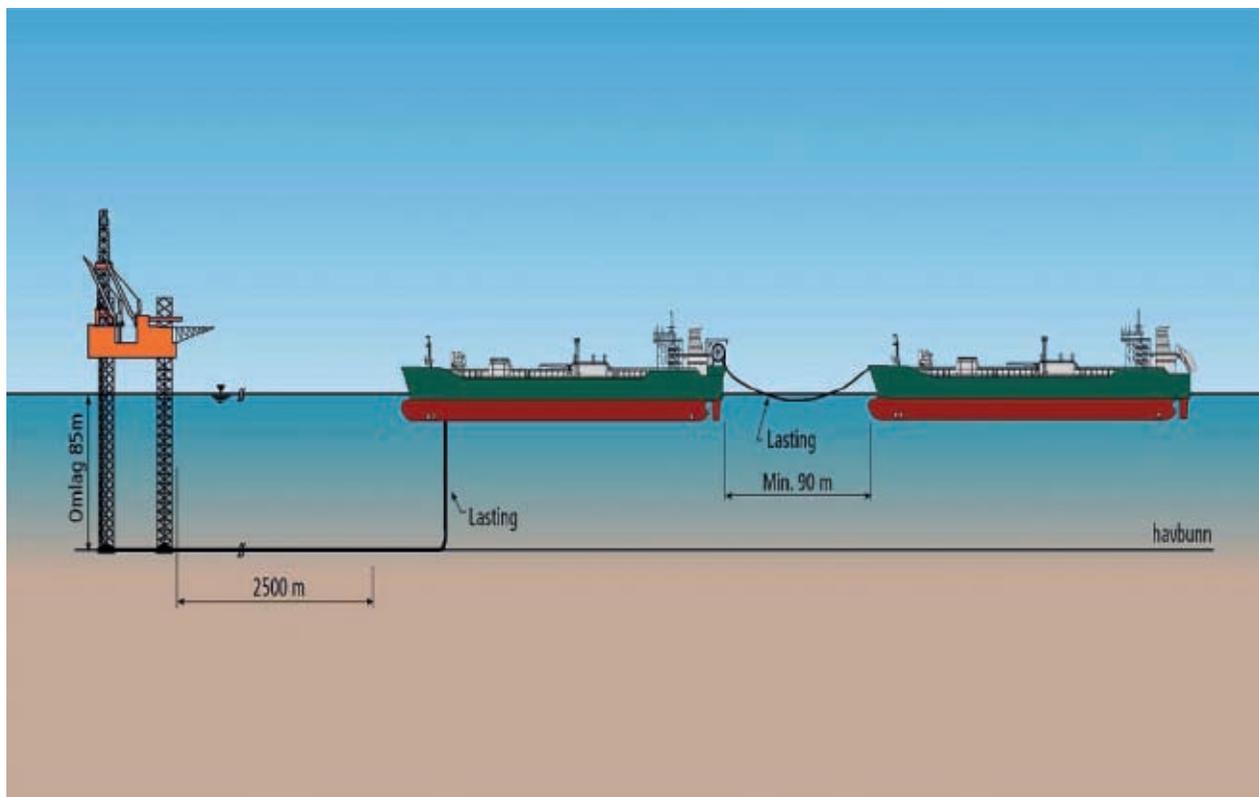
Block	15/9
Production licence	046 BS
Awarded	2006
<b>Total recoverable reserves</b>	85.6 mill bbl oil 1.1 bn scm gas 0.1 mill scm condensate 0.2 mill tonnes NGL
<b>Remaining at 31 Dec 2008</b>	74.2 mill bbl oil 1 bn scm gas 0.1 mill scm condensate 0.2 mill tonnes NGL
Discovery year	1993
Approved for development	22 Apr 2005
On stream	12 Feb 2008
Operator	Statoil
Operations organisation	Stavanger
Main supply base	Dusavik
<b>Licensees</b>	
Statoil	59.6%
ExxonMobil	30.4%
PA Resources Norway	10.0%



Volve's Maersk Inspirer platform outside Haugesund. Photo: Kim G Poulsen/Statoil



The Navion Saga tanker Photo: Øyvind Hagen/Statoil



The Volve development solution. Illustration: Statoil