

OIL AND GAS FIELDS IN NORWAY

INDUSTRIAL HERITAGE PLAN



NORSK OLJEMUSEUM

THE GULLFAKS AREA

Together with the Snorre and Statfjord areas, the Gullfaks area lies in the Tampen region of the northern North Sea and embraces the Gullfaks, Gullfaks South, Gimle and Tordis fields. Gullfaks South also embraces the Rimfaks, Skinfaks, Gullveig and Gulltopp deposits. Installations on Gullfaks represent an important part of the infrastructure in the Tampen region. While the Tordis wellstream is transferred to and processed on the Gullfaks C platform, stabilised crude from Vigdis and Visund are stored on and shipped from Gullfaks A.

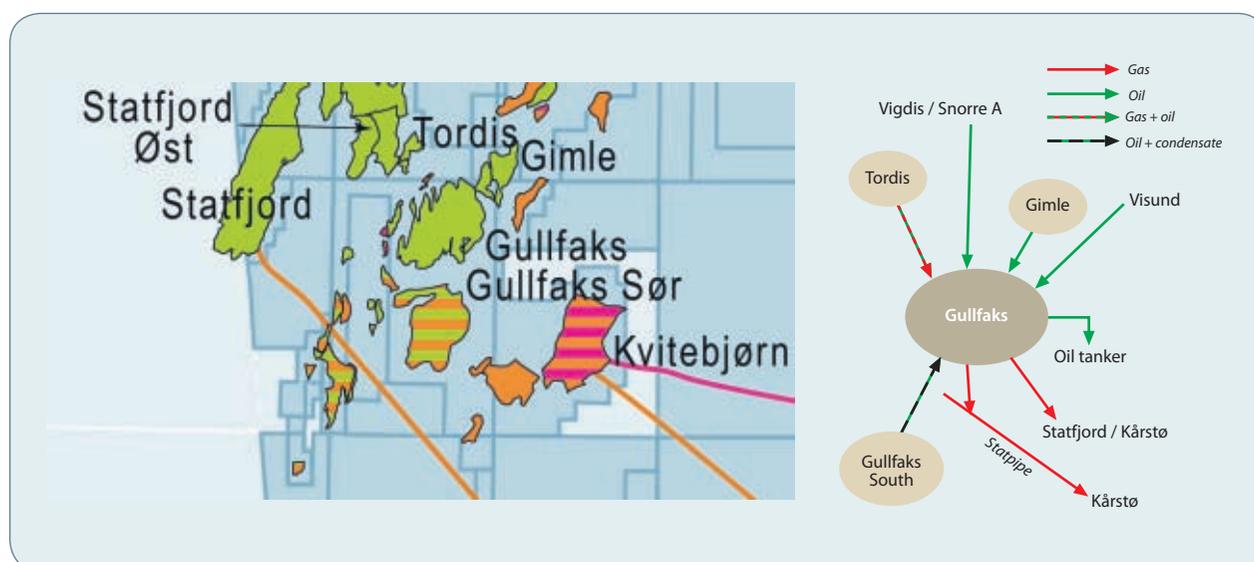
Gullfaks was the first wholly Norwegian offshore development project. Norway's Statoil, Norsk Hydro and Saga Petroleum companies were awarded block 34/10 – known as the Golden Block (Gullblokken) – in 1978. As on Statfjord, Gullfaks was developed with three Condeep concrete platforms. This project was particularly important for operator Statoil, which initially had an 85 per cent interest. As the first large field where a Norwegian company held the operatorship from the start, Gullfaks was important for Statoil's growth as an operational oil company. The company could also build on experience from the Statfjord development. Esso served as technical

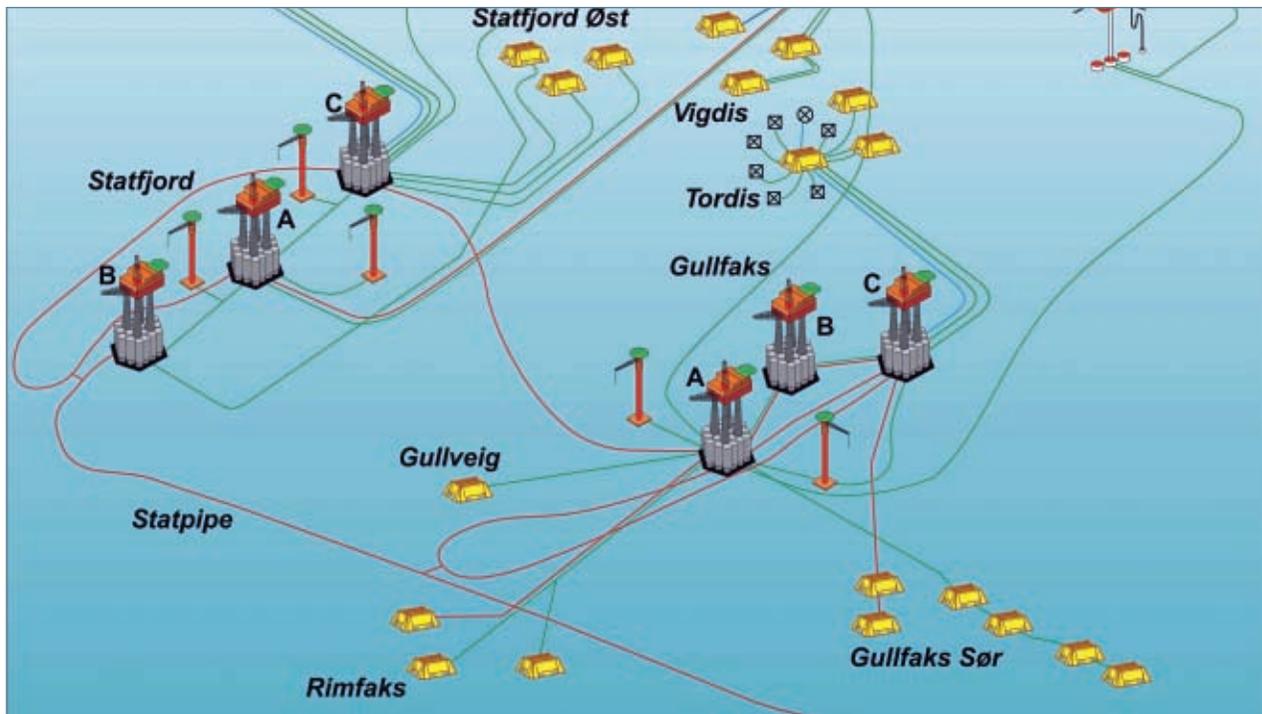


assistant in the exploration phase, but this agreement terminated in December 1981. A technical assistance deal was later concluded with Conoco Norway.

Locating the operations organisation for Gullfaks in Bergen was important for building up an oil community in that city.

The world's first full-scale subsea separation facility became operational on Tordis in 2007.





The Gullfaks area with neighbouring fields in the Tampen region. Installations and pipelines. Illustration: Statoil

Gullfaks

This oil field lies in 130-220 metres of water in the northern North Sea. Ranked as a giant by world standards, Gullfaks is one of the largest discoveries on the north-west European continental shelf.

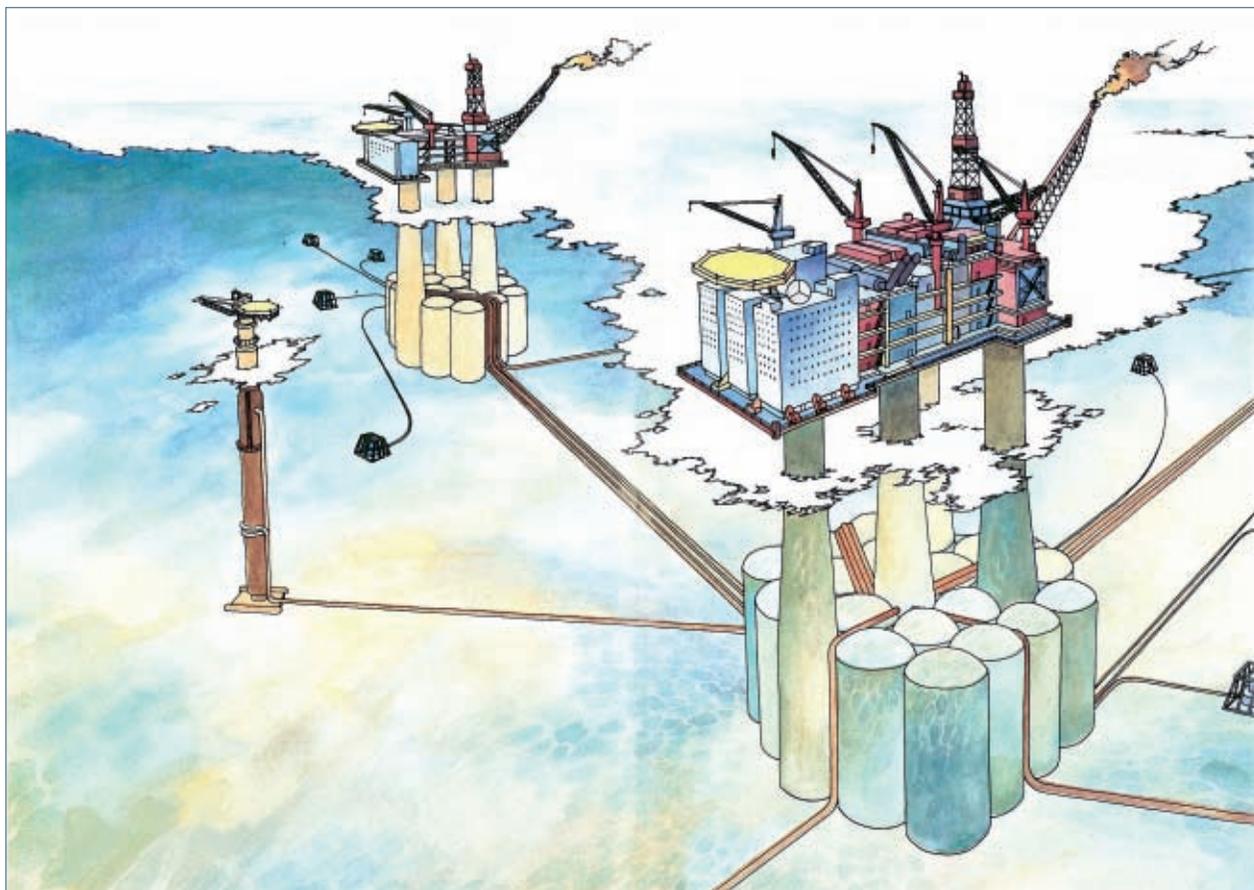
Reservoir and recovery strategy

Several separate geological structures containing oil and gas are found in the Gullfaks block, which lies on the western flank of the Viking Graben. The main reservoir comprises sandstones in the Brent group of middle Jurassic age. Oil-bearing sandstones are also found in the deeper Cook, Statfjord and Lunde formations of early Jurassic and late Triassic age. These strata were deposited 140-150 million years ago. Source rocks are the Draupne and Heather formations deposited during the Jurassic rift phase.

Located at depths of 1 700-2 000 metres, the Gullfaks reservoirs are built up from a series of small tilted and rotated fault blocks to the west and a structural horst on the east, with a strongly faulted area in between. Because they lie at a fairly shallow depth, the Gullfaks structures are poorly cemented

Gullfaks

Block	34/10
Production licences	050 and 050 B
Awarded	1978 and 1995
Total recoverable reserves	2 265 mill bbl oil 24.2 bn scm gas 3 mill tonnes NGL
Remaining at 31 Dec 2008	126.4 mill bbl oil 1.5 bn scm gas 0.2 mill tonnes NGL
Discovery year	1978
Approved for development	9 Oct 1981
On stream	22 Dec 1986
Operator	Statoil
Operations organisation	Bergen
Main supply bases	Sotra and Florø
Licensees	
Statoil	70%
Petoro	30%



Gullfaks A with loading buoy (foreground), Gullfaks B and subsea installations. Illustration: Statoil

and relatively unconsolidated. This means that sand can easily be produced together with the oil. The geology is complex and has required extensive mapping. More than 200 wells and a number of seismic surveys provide the database for plotting the structures and stratigraphy in the area.

Oil is produced through pressure support from water, gas and water alternating gas (WAG) injection. Although the drive mechanism varies between the various drainage sections of the field, waterflooding represents the main strategy. Some small fault blocks are produced through pressure reduction.

Transport

Oil ships from Gullfaks A and C via loading buoys to shuttle tankers. Rich gas not injected into the reservoir is carried in an export pipeline tied into Statpipe.

Development solution

The field has been developed with three integrated production, drilling and quarters platforms, each with a concrete GBS and a steel module support frame. Gullfaks A and C receive and process oil and

gas from Gullfaks South, Gimle and Tordis. These platforms are also used to transport oil from Vigdis and Visund. Tordis output is processed in a separate facility on Gullfaks C. Gullfaks B has a simplified processing plant confined to first-stage separation.



The Gullfaks B loading buoy with the Polytraveller shuttle tanker. Photo: Øyvind Hagen/Statoil



Gullfaks A. Photo: Øyvind Hagen/Statoil



Gullfaks B in 1996. Photo: Øyvind Hagen/Statoil



Gullfaks C. Photo: Øyvind Hagen/Statoil

Gulfaks South

Incorporating the separate Rimfaks, Gullveig, Gulltopp and Skinfaks structures, Gulfaks South is a satellite to Gulfaks. These reservoirs lie in the same water depth as the main field, from 130 to 220 metres. The licensees have pursued a phased development.

Phase I comprised a total of eight subsea installations tied back to Gulfaks A for processing, storage and loading of oil and condensate.

The second phase covered the production and export of gas resources and associated liquids, which began in the autumn of 2001. Gas is processed to rich gas and carried via a pipeline tied into Statpipe to Kårstø. After NGL separation, the dry gas is piped on to continental Europe. Oil and condensate are stabilised, stored and loading from existing facilities on the platforms. In connection with phase II, Gulfaks C has been upgraded to increase its gas processing and export capacity. A corresponding upgrade has been carried out on the A platform. Skinfaks is incorporated in Gulfaks South, and came on stream in January 2007. Gulltopp is produced through an extended-reach well from Gulfaks A, drilled in April 2008.

Reservoir and recovery strategy

Permeability in the Gulfaks South reservoirs is poor, but reservoir properties in the Rimfaks, Gullveig, Gulltopp and Skinfaks structures are fairly good.

Oil and condensate from Gulfaks South are partly produced with pressure support in the form of gas injection and partly through pressure reduction. Rimfaks Brent produces through full pressure maintenance with the aid of injected gas, while Gulfaks South and the Statfjord formation in Rimfaks have limited gas injection. Gullveig is produced through pressure reduction, with its output also influenced by production from Tordis and Gulfaks. Gulltopp and Skinfaks are produced with the aid of gas lift.

Transport

Oil is piped to Gulfaks A for processing, storage and onward transport in tankers. After processing on Gulfaks C, rich gas gets exported via Statpipe to Kårstø for further processing and transmission as dry gas to continental Europe.

Development solution

Gulfaks South has been developed with a total of 10 subsea templates tied back to Gulfaks A and C.

Gulfaks South

Blocks	32/12, 33/12 and 34/10
Production licences	037 B, 037 E, 050, 050 B and 152
Awarded	1978, 1988, 1995, 1998 and 2004

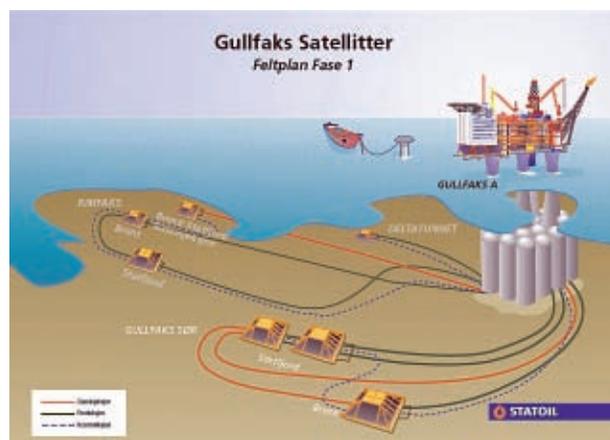
Total recoverable reserves	301.3 mill bbl oil 45.7 bn scm gas 6.1 mill tonnes NGL
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Remaining at 31 Dec 2008	90 mill bbl oil 21.7 bn scm gas 3.2 mill tonnes NGL
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Discovery year	1978
Approved for development	29 Mar 1996
On stream	10 Oct 1998
Operator	Statoil
Operations organisation	Bergen
Main supply bases	Sotra and Florø

Licensees

Statoil	70%
Petoro	30%



Gulfaks satellites, with Gulfaks South in the foreground.
Illustration: Statoil

Gimle

This small oil field lies in 220 metres of water due north of Gullfaks, and was proven in 2004 with well 34/10-48 S drilled from Gullfaks C. Following test output in 2005, Gimle was carved out into a separate production licence in 2006. It produces via Gullfaks C.

Reservoir and recovery strategy

The Gimle reservoir comprises middle Jurassic sandstones in a down-faulted structure on the north-eastern side of Gullfaks. Its properties are very good.

Production is based on water injection to support pressure in the reservoir.

Transport

Gimle production is processed on Gullfaks C and exported together with oil and gas from Gullfaks.

Gimle

Block 34/10	
Production licence	050 DS
Awarded	2006
Total recoverable reserves	25.2 mill bbl oil 1.1 bn scm gas 0.2 mill tonnes NGL
Remaining at 31 Dec 2008	14.5 mill bbl oil 1 bn scm gas 0.2 mill tonnes NGL
Discovery year	2004
Approved for development	18 May 2006
On stream	19 May 2006
Operator	Statoil
Operations organisation	Bergen
Licensees	
Statoil	65.13%
Petoro	24.18%
ConocoPhillips	5.79%
Total E&P Norge	4.90%

Tordis

The Tordis oil field lies in 200 metres of water between Snorre and Gullfaks in the northern North Sea. Proven in 1987, it came on stream in June 1994. Production from the Tordis East, Borg and Tordis South-East deposits began in December 1998, July 1999 and December 2001 respectively.

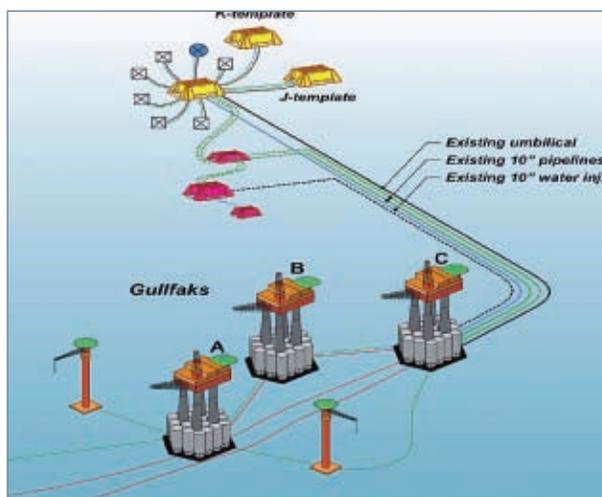
Reservoir and recovery strategy

Located 2 000-2 500 metres down, the reservoir sandstones are middle Jurassic in Tordis and Tordis East, late Jurassic in Borg, and both middle and late Jurassic in Tordis South-East.

Tordis and Tordis South-East are produced through pressure maintenance with the aid of water injection and through natural water drive. Production utilises full pressure maintenance with water injection from Borg, and pressure support from natural water drive on Tordis.

Transport

The wellstream from Tordis is transported to Gullfaks C for processing and export.



Gullfaks with the Tordis subsea installations in the background. Illustration: FMC Technologies

Development solution

Tordis has been developed with a central subsea manifold for seven separate satellite wells and two seabed templates. Two pipelines tie the field back to Gullfaks C, 10 kilometres away, for processing the wellstream. Most of the output is oil, but gas and condensate are also produced. The world's first full-scale facility for subsea separation of water and sand from a wellstream became operational on the field in 2007. Tordis East, Borg and Tordis South-East have been developed with subsea-completed wells tied back to the Tordis production installation.

Tordis

Block	34/7
Production licence	089
Awarded	1984
Total recoverable reserves	375.5 mill bbl oil 5.3 bn scm gas 1.7 mill tonnes NGL
Remaining at 31 Dec 2008	44.6 mill bbl oil 1.5 bn scm gas 0.3 mill tonnes NGL
Discovery year	1987
Approved for development	29 Mar 1996
On stream	21 Apr 1999
Operator	Statoil
Operations organisation	Bergen
Main supply base	Florø
Licensees	
Statoil	41.5%
Petoro	30.0%
ExxonMobil	10.5%
Idemitsu Petroleum Norge	9.6%
Total E&P Norge	5.6%
RWE Dea Norge	2.8%



Tordis subsea installations. Illustration: FMC Kongsberg Subsea