



Hydro Oil & Energy

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Value creation through technology – The Ormen Lange example

Capital Markets Day
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Value creation through technology

Birkeland and Eyde: The spirit lives on



*Professor
Birkeland*

- Hydro was founded in 1905 by Birkeland and Eyde, based on an invention by Birkeland
- Still technology and research are important elements in our value creation

Value creation through technology

The Ormen Lange history

- Identified by Hydro in 1989
- Licence awarded in 1996
- Drilled in 1997
- Proved 400 billion Sm³ of gas
- Second largest gas discovery in Norway



The “discovery” section

The Ormen Lange history

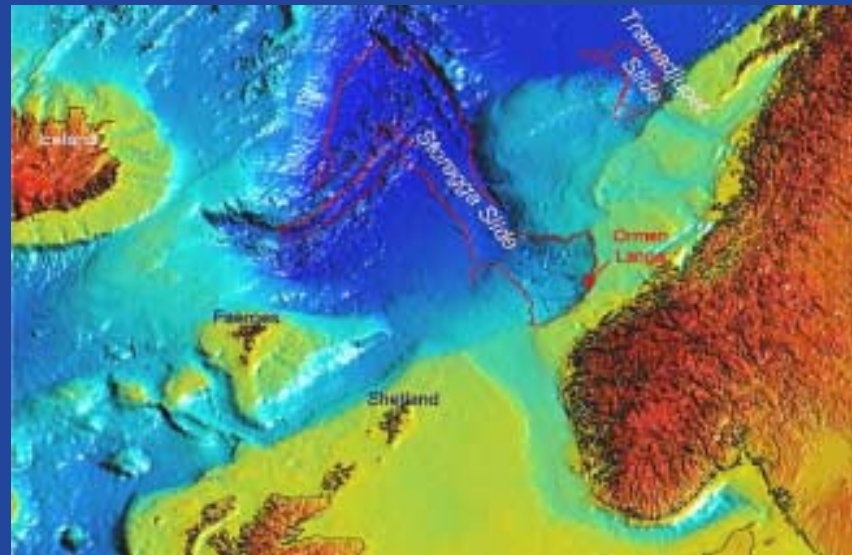
Challenges

Located in a slide area

Storegga slide
one of the largest sub-
marine slides in the world

Slide took place 8 200
years ago

Stability problems had to
be addressed



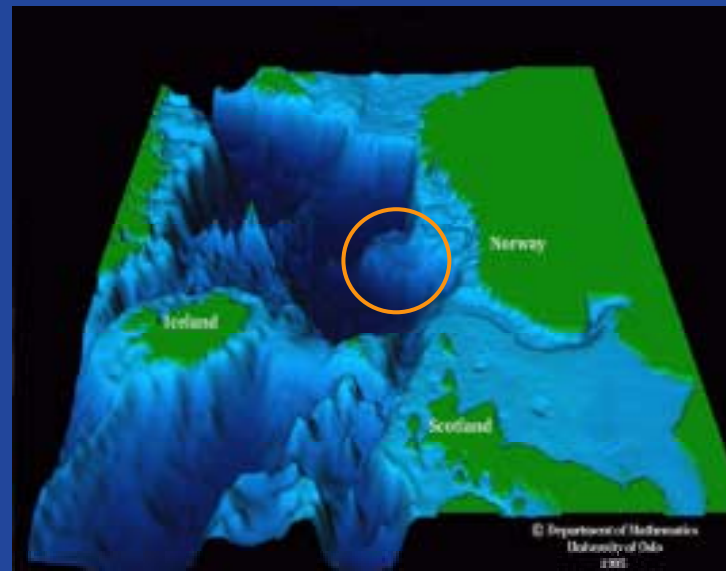
The Ormen Lange history

Challenges

Located in a slide area

Deep water

Situated 800 to 1 200 m
below sea level



The Ormen Lange history

Challenges

Located in a slide area

Deep water

Harsh environment

Extreme waves, up to more than 30 m

Negative temperatures at seabed



The Ormen Lange history

Challenges

Located in a slide area

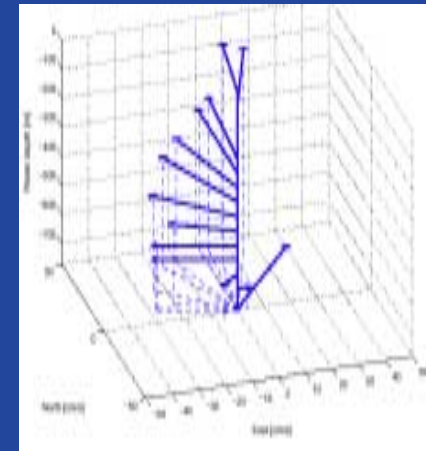
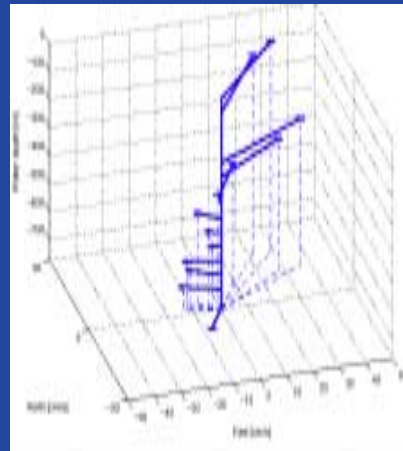
Deep water

Harsh environment

Strong and complicated currents

Currents varies with depth and time during the day

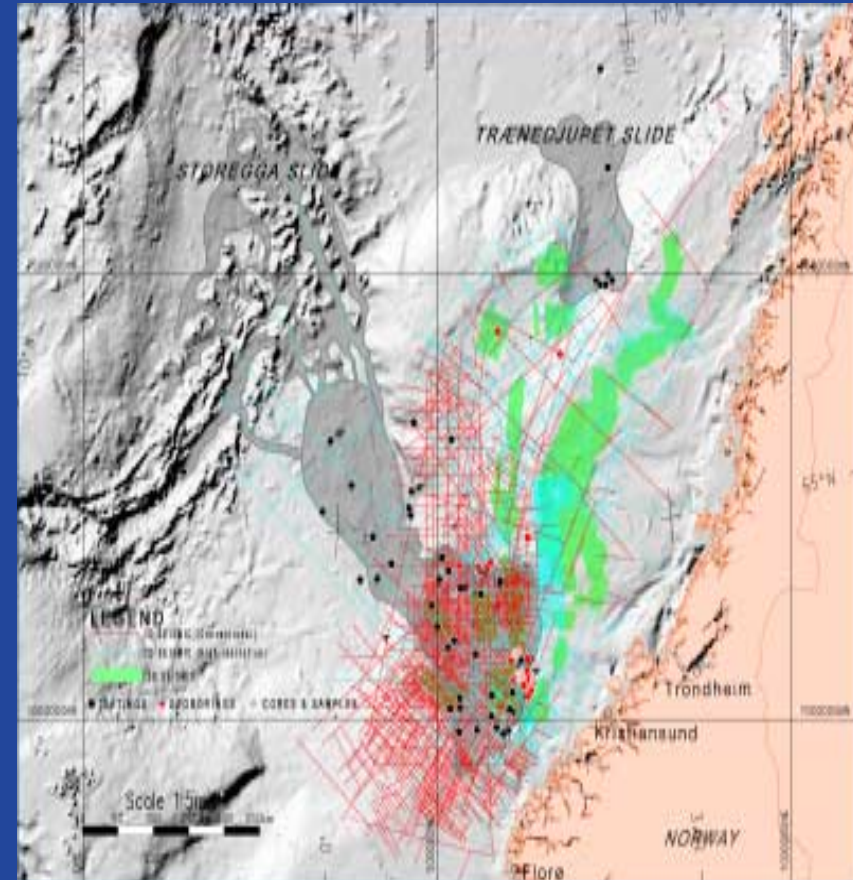
Example:
Current profile with 3 hrs.
time difference



The Ormen Lange history

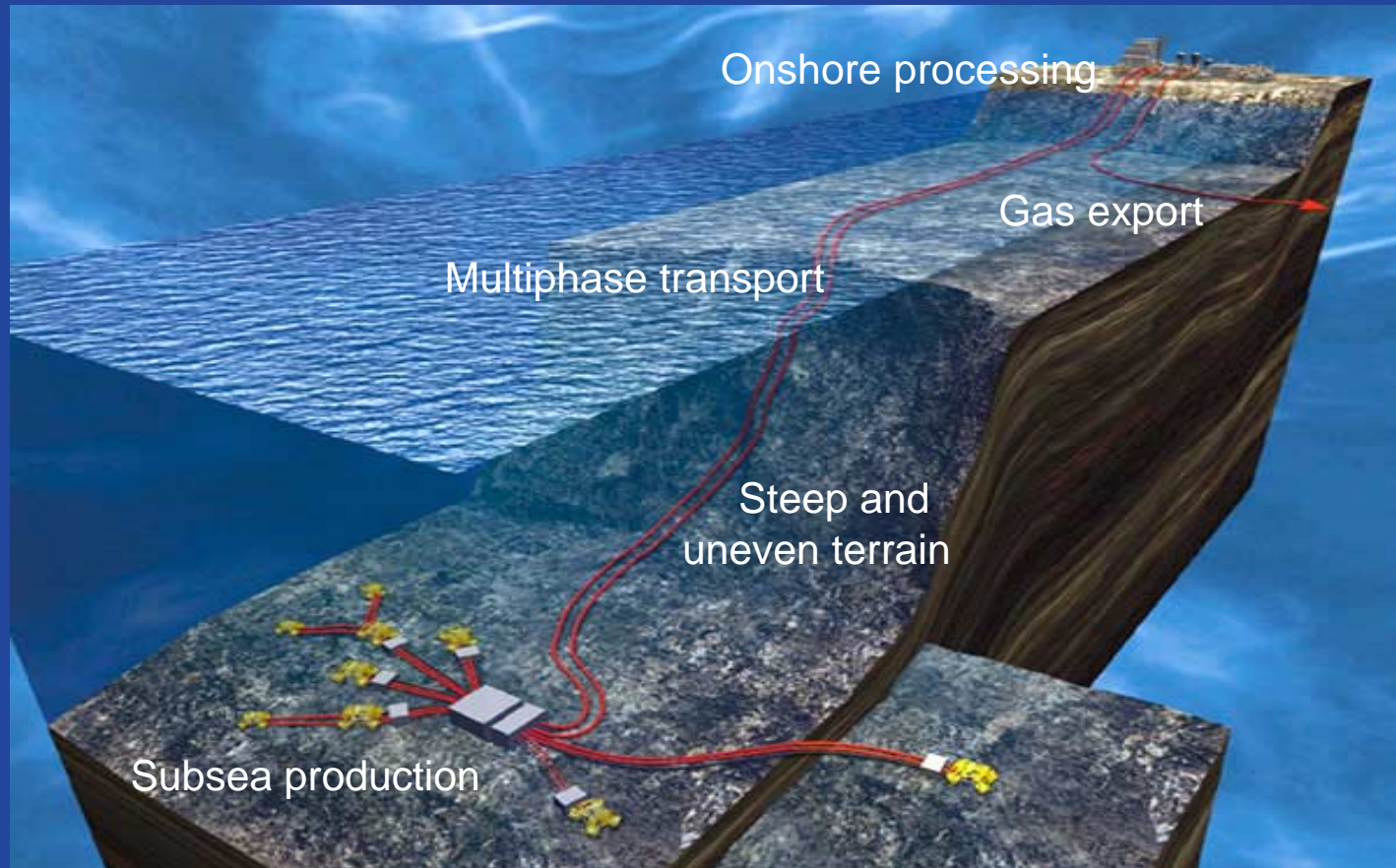
Solutions – slide stability

- No danger for additional slides
- Extensive studies performed by:
 - Hydro
 - EU research
 - Several universities
 - Various research institutes
- A new ice age is a prerequisite for future slides



The Ormen Lange history

The final concept

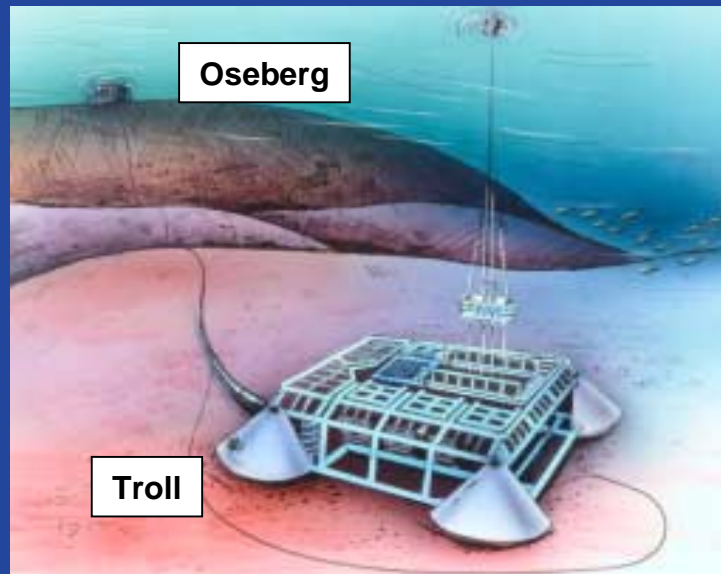


The Ormen Lange history

Building on Hydro's unique subsea experience

TOGI; Troll Oseberg Gas Injection

- Subsea production and multiphase transport system
 - Started gas production from Troll in 1991
 - 48 km transport to Oseberg
 - Increased oil recovery on Oseberg;
20 - 30 million Sm³
 - Perfect production regularity



The Ormen Lange history

Building on Hydro's unique subsea experience

TOGI; Troll Oseberg Gas Injection

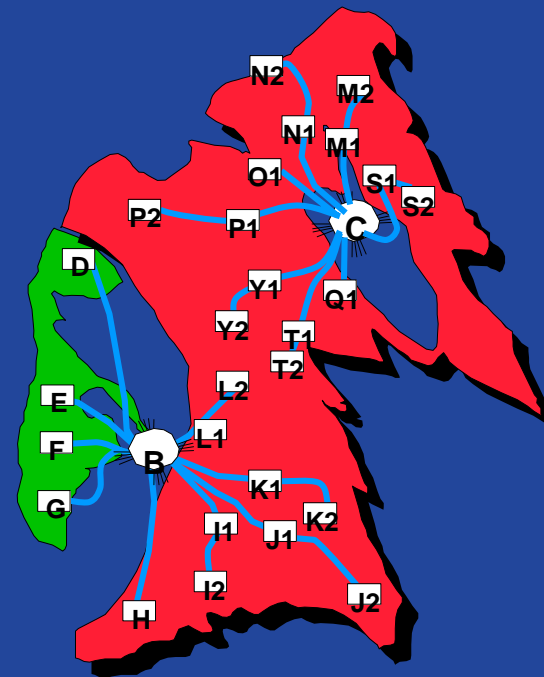
Troll Oil; Extensive use of subsea wells

27 subsea clusters

101 wells in service

16-25+ more wells planned

Advanced system of remote well control



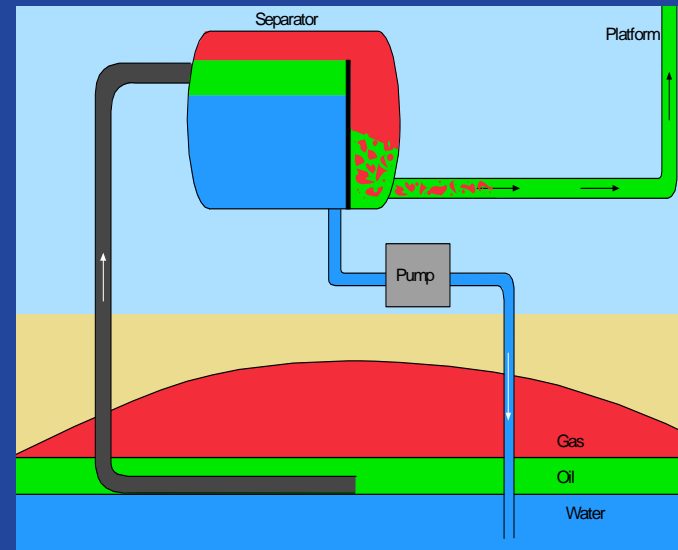
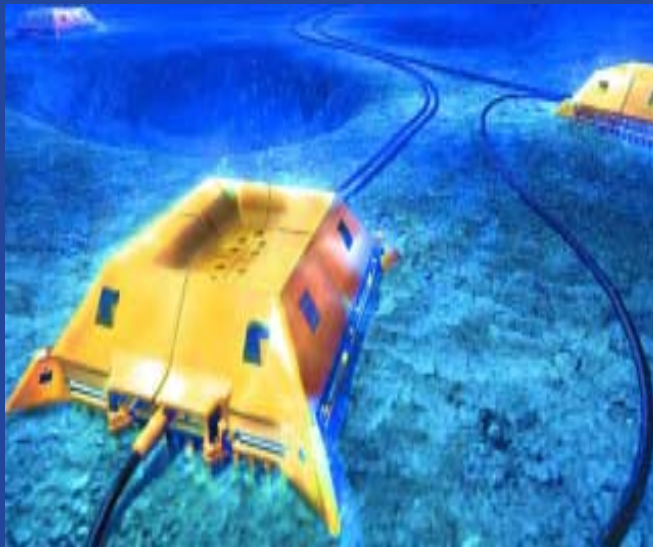
The Ormen Lange history

Building on Hydro's unique subsea experience

TOGI; Troll Oseberg Gas Injection

Troll Oil; Extensive use of subsea wells

Subsea processing; Troll Pilot



First subsea separation unit in the world

The Ormen Lange history

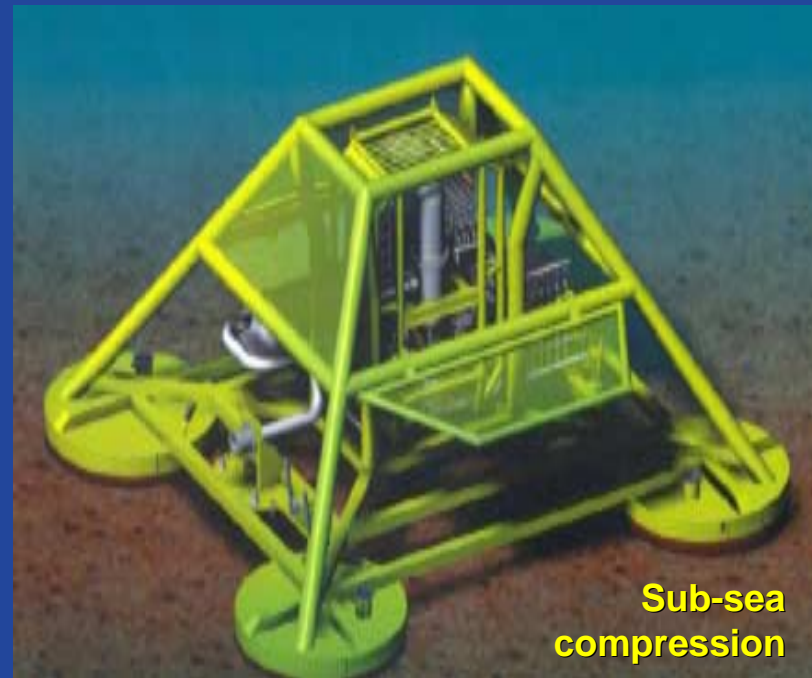
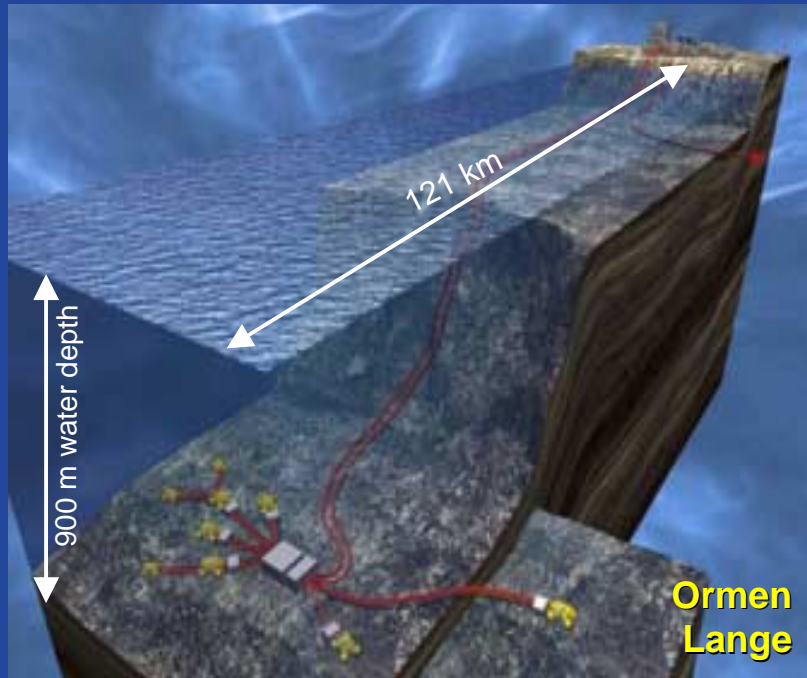
Hydro is pushing subsea technology through our research facilities and in close cooperation with supply industry...



The pipe separator; a new concept for subsea processing

The Ormen Lange historyand we are still pushing the limits...

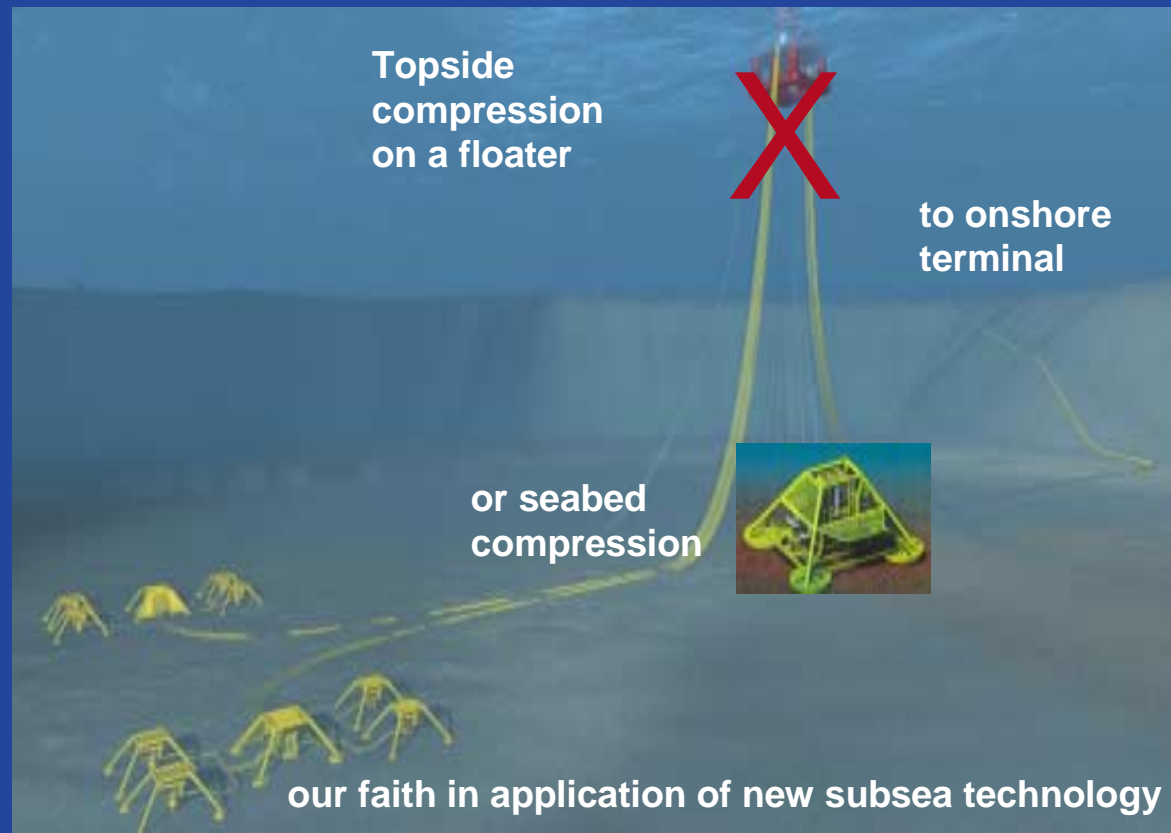
- Subsea production facilities
- Future subsea compression (to be qualified)



The Ormen Lange history

....for application on Ormen Lange phase II development

- Subsea compression can result in significant savings, compared to the planned late stage compression platform

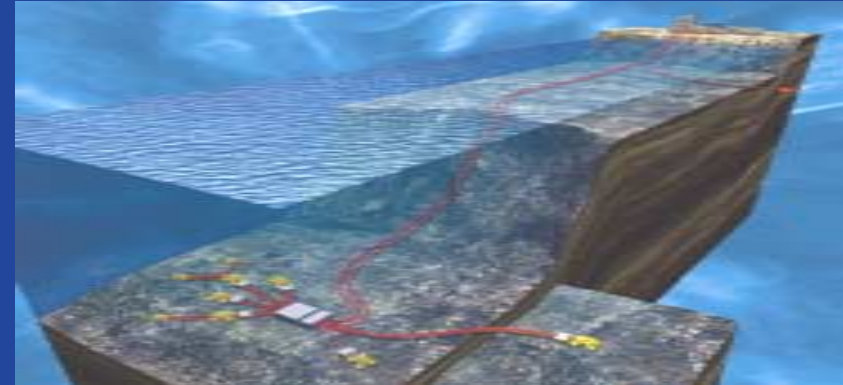


The Ormen Lange history

Flow assurance / Multiphase transport

The challenges:

- Long distance 121 km
- Steep and uneven terrain
- Partly negative sea-bottom temperatures



Hydro has unique testing facilities regarding:

- High pressure
- High temperature
- Real fluids
- Tilted pipes

Hydro's testing facilities in Porsgrunn



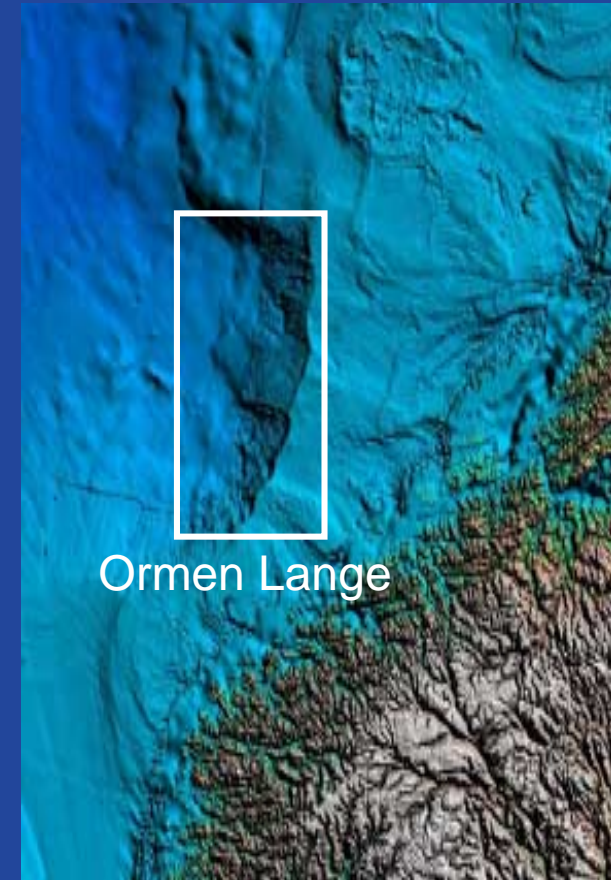
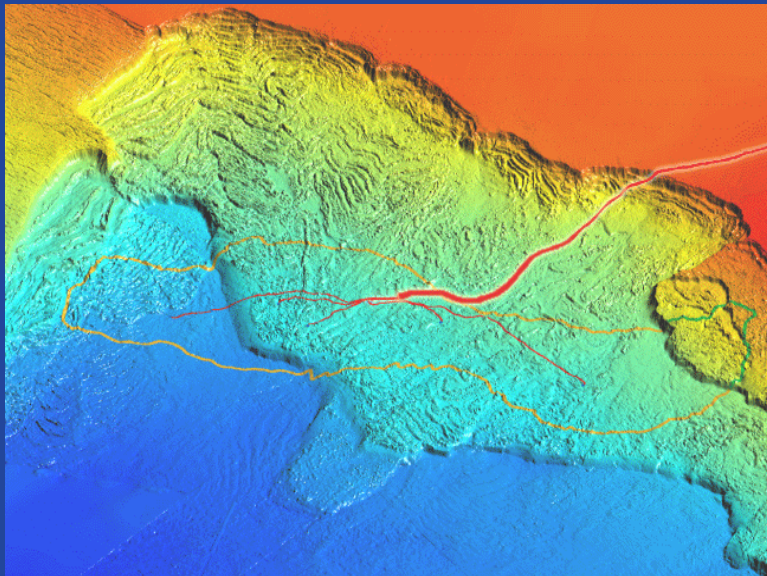
Ormen Lange fluids have been studied here

The Ormen Lange history

Pipe-laying in extremely uneven terrain

Key elements:

- Detailed topography mapping
- Estimate of maximum free span
- Estimate of need for rock dumping
- Development of a simulator



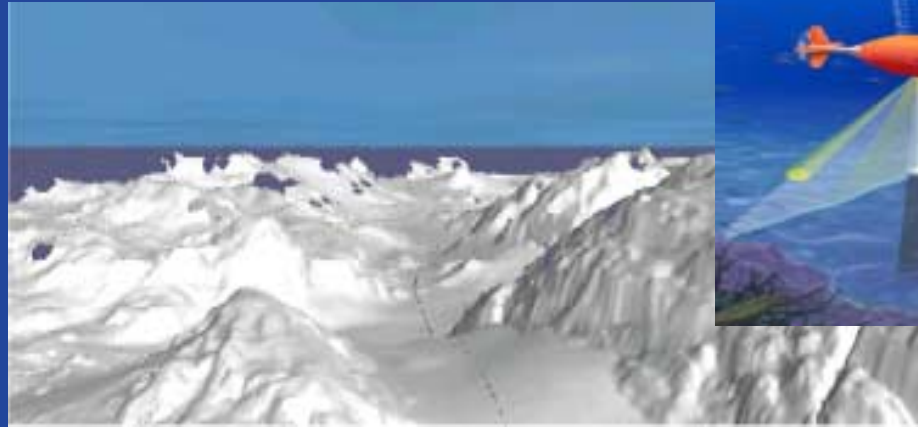
The Ormen Lange history

Pipe-laying in extremely uneven terrain

Topography mapping

Hugin AUV

Extensive use
of AUV for
detailed
topography
mapping



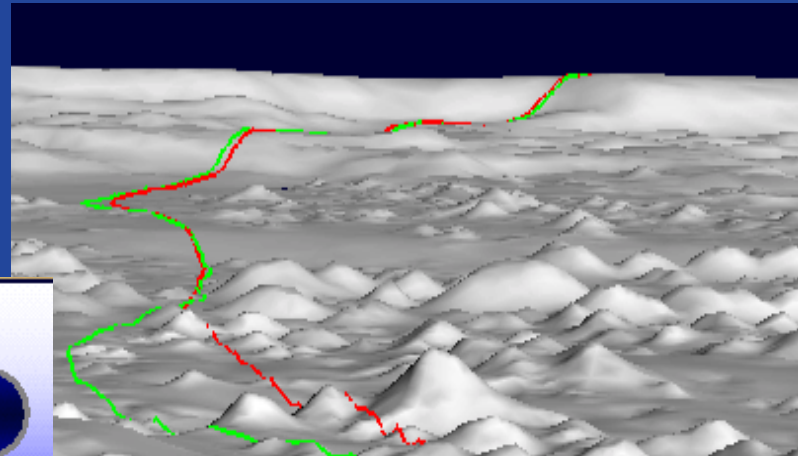
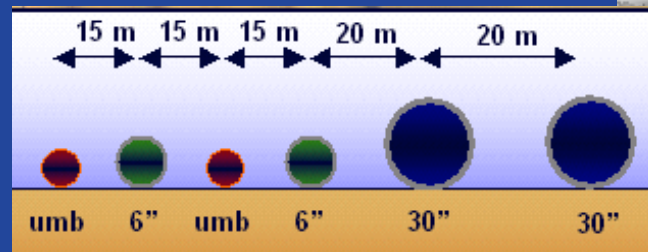
The Ormen Lange history

Pipe-laying in extremely uneven terrain

Topography mapping

Optimal pipeline routing

Huge efforts have been made to identify the most cost effective routing



The Ormen Lange history

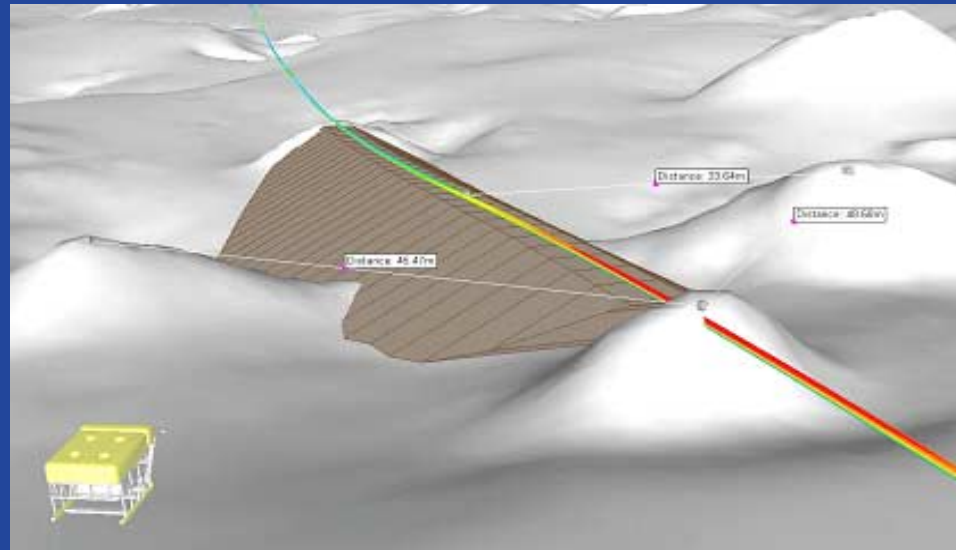
Pipe-laying in extremely uneven terrain

Topography mapping

Optimal pipeline routing

Simulator, rock dumping

First pipeline simulator in the world



The Ormen Lange history

Pipe-laying in extremely uneven terrain

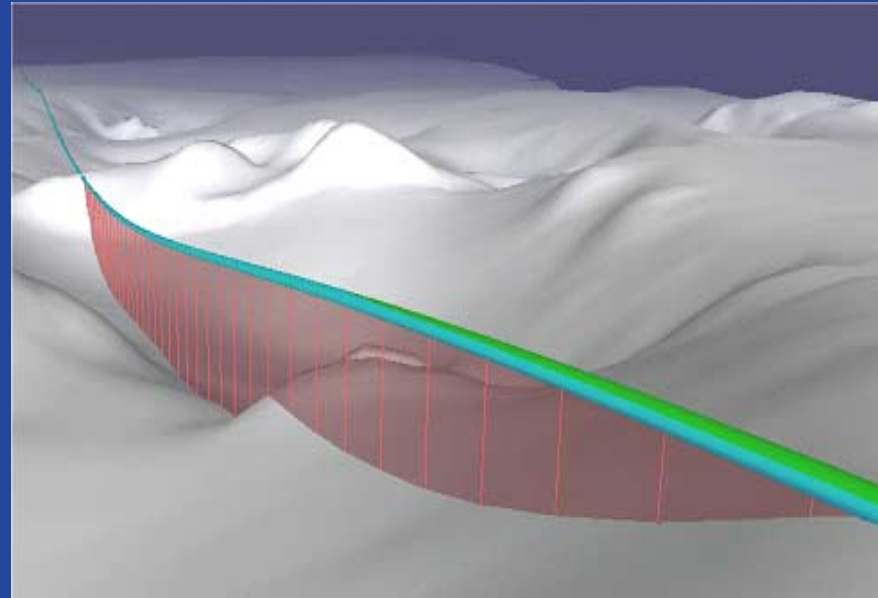
Topography mapping

Optimal pipeline routing

Simulator, rock dumping


Simulator; free span

Leading knowledge
about max. length of
free spans



Value creation through technology

The Ormen Lange history



The production capacity from Ormen Lange is 20 billion Sm³ gas/year,

equivalent to the total Norwegian energy consumption during the next 20 years,

or 20% of the UK gas demand

Forward-Looking Statements/ Use of Non-GAAP Financial Measures

In order to utilize the "safe harbour" provisions of the United States Private Securities Litigation Reform Act of 1995, Hydro is providing the following cautionary statement: This presentation contains certain forward-looking statements with respect to the financial condition, results of operations and business of the Company and certain of the plans and objectives of the Company with respect to these items. By their nature, forward-looking statements involve risk and uncertainty because they relate to events and depend on circumstances that will occur in the future. The actual results and developments may differ materially from those expressed or implied in the forward-looking statements due to any number of different factors. These factors include, but are not limited to, changes in costs and prices, changes in economic conditions, and changes in demand for the Company's products. Additional information, including information on factors which may affect Hydro's business, is contained in the Company's 2002 Annual Report on Form 20-F filed with the U.S. Securities and Exchange Commission.

With respect to each non-GAAP financial measure Hydro uses in connection with its financial reporting and other public communications, Hydro provides a presentation of what Hydro believes to be the most directly comparable GAAP financial measure and a reconciliation between the non-GAAP and GAAP measures. This information can be found in Hydro's earnings press releases, quarterly reports and other written communications, all of which have been posted to Hydro's website (www.hydro.com).