



OTC 18963

## Ormen Lange—Challenges in Offshore Project Execution

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### Abstract

Ormen Lange is the second-largest Norwegian gas field and was discovered by Hydro in 1997. The Ormen Lange field comprises an offshore subsea solution approximately 125 km off the west coast of Norway, an onshore gas processing and export facility at Nyhamna, a gas export transportation system between Norway and the UK, and the Easington gas reception terminal in the UK. The Ormen Lange development is divided into three main sub-projects: Onshore, Offshore, and Langed.

This paper gives a summary of the Ormen Lange Offshore development, including descriptions of project execution and contract strategy, and how Hydro's competence and systematic work processes have been utilized in order to secure efficient progress. The Offshore project will be further described - including the technical challenges of the project - in three OTC 2007 papers:

- OTC 18965 Ormen Lange subsea production system
- OTC 18967 Ormen Lange pipelines installation and seabed preparation
- OTC 18969 Ormen Lange subsea compression pilot as a supplement to the summary provided here.

### Introduction

Ormen Lange is Norway's second largest gas field, with expected gas export equivalent to the total energy demand in Norway.

The Ormen Lange gas field was proven by drilling in 1997, and Hydro was selected as operator for the development of the field in December 1999.

After an intensive period of studies, Hydro decided in 2003 to develop the field without any platforms. The subsea solutions on Ormen Lange will take the technological developments on the Norwegian continental shelf a significant step forward.

**Project Description** The Ormen Lange development is an innovative subsea to shore concept, comprising 24 large bore wells drilled from four subsea templates, with the following key challenges:

- Extreme seabed topography
- Main production area located in an avalanche / slide area
- Low temperatures, minus 1°C at seabed
- Strong currents, waves and winds
- 850 –1,000 m water depth
- High flow production wells 10MSm<sup>3</sup>/d

The two first subsea production stations will be located 120km from shore, at a water depth of 850 m. Each of the subsea production stations weighs more than one thousand tonnes, and will produce 80 MSm<sup>3</sup>/day from large bore wells. The stations will be remotely controlled from the shore.

From the subsea production stations, two 30" pipelines will transport the well stream to the onshore plant for processing. The pipelines are laid across an extremely irregular seabed, with boulders and slide blocks up to 60 m tall in the Storegga slide area. Furthermore, the pipelines cross the slide at an inclination of up to 40 degrees. The Storegga slide created a tsunami 8100 years ago which hit the west coast of Norway and the coasts of the UK. NOK 700 million has been spent to make sure that the slide area is stable, and that development and gas production will not change its stability. In order to make the pipeline concept feasible we have drawn on all relevant expertise worldwide, and stretched the technology to its limits.

The special water current conditions give water temperatures as low as minus 1°C. Such extreme temperature conditions, combined with high pressure, can cause gas and water to form hydrates and ice, which again can form plugs in the pipelines. The subsea system has been designed to avoid hydrate formation, and a production simulator will be built to control the entire system so as to avoid hydrate and ice problems.

A possible further development of the Ormen Lange field is being planned. The development scenario foreseen for the future extension of the field comprises two additional eight-slot production templates (C & D). Each production template will produce gas through dual 12" manifold headers and flowlines tied back to the 30" pipelines.

Two new infield 6" MEG injection lines will be connected to templates C and D respectively, as extensions from the initial templates A and B. Furthermore, a new infield control umbilical will connect template C and D to the initial production templates A and B.