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The Tordis IOR Project

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Abstract

The idea of separating oil from water on the sea floor has been an engineer's dream for years. Now, with the Tordis IOR (increased oil recovery) project in the North Sea, Statoil and FMC Technologies with partners¹ are making this dream a reality.

The Tordis IOR project realises the first commercial full scale subsea separation installation in the world. Statoil expects to improve the Tordis field's recovery factor from 49 to 55 percent and to extract 35 million barrels of additional oil from the field.

The Tordis field is linked to a Gullfaks C platform via 11 km pipelines. Tordis is a mature field, which produces more and more water and less oil. There is not capacity on the platform to separate the vast amount of water needed to keep Tordis in production. Installation of a subsea separation, boosting and injection (SSBI) system removes the water subsea and enable lowering the well head pressure. This is the main driver for increased oil production even if the reservoir pressures start to drop. This allows Tordis IOR to remain operative an additional 15 -17 years.



Figure 1. Illustration of the subsea separation, boosting and injection (SSBI) station. Separator and desander vessels are illustrated in orange. The

multiphase and water injection pumps and leakage detectors are shown in white. Note: Protection structure has been removed for better visibility. At distance the water injection well (upper left) and Pipeline inline manifold (right) can be seen.

The well stream is routed to the SSBI system, where water, sand and hydrocarbons are separated. Oil and gas are pumped through a 2,3 MW multiphase pump¹ to the Gullfaks C platform.

The ability to handle sand is important in a mature field IOR project. The de-sanding process for Tordis is therefore designed to handle up to 500 kg sand per day. The separated sand is ejected into the water stream, downstream a 2,3 MW water injection pump¹, and injected into the dump reservoir in the Utsira formation through a water injection subsea tree.

Statoil has chosen a contract strategy where the SSBI technology development is handled as a normal delivery project, as opposed to a technology development project.

Background

A majority of Statoil's oil and gas production comes from subsea wells. Statoil has therefore been developing subsea processing equipment for more than 10 years, ranging from small, simple pumps to large compressors that are still under development.

The strategy has been to develop the technology incrementally and test it out thoroughly (topside) prior to installation. In this way, Statoil has gradually increased the power of electric motors, the step-out distance from topside facilities, water depths, and the complexity of processing systems.

The Tordis field at the Norwegian Continental Shelf has been producing since 1994. It is a subsea development at 200m water depth with tie-in of the production to the Gullfaks C platform in the Tampen area.

In 2007 a subsea processing plant will be installed in order to increase the oil recovery by lowering the well head pressure. A reduced wellhead pressure maintains the driving force for the oil production even as the reservoir pressures start to drop.

The installation consist of a separator to remove most of the water from the production, a water pump to inject this water into a disposal well at the Utsira reservoir, and a multiphase pump to transport oil, gas and remaining water towards the production platform Gullfaks C, 11km away. In addition, there is a sand handling system.