Oil production enhancement strategy by using integrated simulation and well log data, Norne Field, Norway

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The Norne Field, a mature hydrocarbon reservoir is located on a 9 km × 3 km horst block with an overall depth of roughly 380 m on the continental shelf of the Norwegian Sea. This honors project focuses on developing a strategy that will contribute to efficiently allow the remaining hydrocarbons in the Norne Field to be recovered. This will be achieved by running computer simulations based on a variety of new injector and producer well configurations. The data have been released by Statoil as part of the "Norne Field Benchmark Case" and include both the petrophysical/geological well reports and original DATA file that describes the current wells in the field, that will be used as background information for this thesis. The DATA file is carried out

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through simulation software such as Petrel, Eclipse and S3GRAF. The geology of the reservoir is classified into four formations from top to base: Garn, Not, Ile, Tofte, and Tilje (which are further subdivided). These Mid to Late Jurassic rocks are dominantly sandstone, generally buried 2500–2700 m deep. The average porosity is 25–30% and permeability ranges from 20 to 2500 mD. Horizontal permeability is mostly favorable, although vertically it is highly affected by the 7.5 m. thick Not Shale, as well as limestone, claystone and siltstone stringers, likely to have originated from depositional environments and/or diagenetic processes. In fact, mechanical compaction is responsible for most porosity reduction. One of the issues to be addressed by this thesis is the correlation of the information contained in the petrophysical/geological well reports with that contained in the simulation grid blocks (controlled by DATA files). This will allow for verification of the continuity of the Not Shale throughout the entire reservoir, and thus, modify the production plan accordingly. Currently, 49 wells (3 exploration, 46 production and injection) have been drilled and as of December 2007, 86% of recoverable reserves were produced. From April of 2008 to March of 2010 water production showed an overall increase. However, both oil and gas production has decreased within the same time frame. The degree of success achieved will be measured by comparing the new injection strategy with the already existing ones, while analyzing parameters such as oil, gas and water production rates during the simulated time periods and fluid/rock interactions.