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Concurrent Oil & Gas Development Wells: A Smart Well Solution To Thin Oil Rim Presence In Gas Reservoirs

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Abstract

For a number of gas supply projects feeding LNG export schemes, there exists a challenge that key gas reservoirs have associated underlying oil rims. Without due consideration to these oil rims regulator approvals to move ahead with the gas projects may be delayed and can erode project value.

In order to optimize the development of both oil and gas hydrocarbon resources, a novel concurrent oil and gas development concept is proposed. In this concept the gas cap and oil rim are produced simultaneously from the start of production through a single well conduit. As a result significant cost benefits can be realized (i.e. one concurrent smart well can potentially replace two conventional dedicated oil and gas wells).

Reservoir simulation has demonstrated the ability of concurrent wells to enable simultaneous oil and gas production with minimal impact on oil recovery. The proposed concept can significantly impact the portfolio of available gas reservoirs by delivering a cost effective technology solution.

Especially for reservoirs with water drive as the dominant drive mechanism (i.e. reservoirs with a strong aquifer), a concurrent oil and gas development is attractive. The main conclusions for this type of reservoir are:

- A relatively high gas offtake rates (up to 10% GIIP/year) can be achieved with limited reduction in oil recovery.
- Oil rim recovery is a function of how fast the oil rim migrates into the gascap, itself mainly driven by gas offtake rate, reservoir permeability and aquifer strength.
- Placing the horizontal leg close to the GOC is advantageous to maximize the time that the oil section of the well is exposed to the oil rim.
- Given the time dependency, a relatively large tubing size improves oil recovery. This also enables the desired gas offtake rate to be achieved late in field life.
- Active monitoring and surveillance of the oil rim movement is essential to maximize recovery.

For reservoirs with gas cap expansion as the dominant drive mechanism, a concurrent oil and gas development is less attractive. It is however still feasible and should still be considered.

Introduction

With the increased focus on LNG in the world, we are faced with the challenge that some key gas reservoirs that are crucial for the timely LNG supply have underlying oil rims. In some cases, these rims have been logged and samples have been taken, in others cases however, only a gas-down-to (GDT) has been logged so the presence of an oil rim cannot be ruled out. As a result, the size of the oil rim can be a major uncertainty on the timing of the gas availability.

In cases where we have a relatively large gas cap with a relatively small underlying oil rim we are faced with the dilemma that:

- From a pure recovery point of view a phased sequential oil-gas development, i.e. producing the oil first and then the gas, is considered to be best practice;