Unlocking Hydrocarbon Potential of Natih-B in Block-5, Case Study

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Abstract

In Block-5, late Cenomanian Natih-B has been under investigation for its resource and production potential since 2014. An intensive study has led into dividing Natih-B into three main areas: On structure; where Natih-A is present and above oil water contact (OWC), off structure; where Natih-A is present but below OWC, and truncation of Natih-B; where Natih-B is Natih top and Natih-A is completely eroded. Each area has a unique character and properties when development is the main challenge.

Within Natih-B reservoir, zones of low total organic content (TOC) and high TOC are defined. The lab measurements of TOC were modelled by Neural-Network and estimated in non-cored wells. Both are referred to as Natih-B unconventional outside the truncation area of Natih-B. By lab measurement, high TOC layers are not mature, hence oil cannot be generated from within these layers. Whereas, Natih-B at truncation area is referred to as conventional type of reservoir where rock has good porosity, permeability and oil saturation as observed from cores, logs and mud log data. This distinguished approach is evidence from log trends when correlating Natih-B from deepest areas to shallowest area when the reservoir is below the Santonian-Campanian Fiqa unconformity.

Details of appraisal activities, rig operation, hoist workover, lab experiments and results for Natih-B are explained throughout the paper up to 2023 within block-5.

Vertical wells can be considered for Natih-B appraisal when meeting certain conditions. The first condition for vertical wells is that they should be placed on a structure or truncation area. All off-structure area trials so far prove production from Natih-B is not feasible, as maturity is the main challenge. The water contact is the same for both Natih-A and Natih-B. Second, vertical wells should have sufficient oil leg across Natih-B. The contact should be clear and can be mapped. Third, vertical wells should be placed away from injection or production areas. There is very good communication between Natih-A, Natih-B and Natih-C units. Water coning and encroachment through open faults or fractures are main reasons for high water cut production seen in Natih-B trials.

Natih-B is very challenging for production potential. The main risks are reservoir quality, kerogen maturity and water production. The deep and tight Natih-B did require fracking, while in the case of shallower potential with better quality, flow was possible without fracking. Initially, because of the extensive Natih-B area, this potential has being evaluated and explored with a range of different approaches. The focus was to lower the cost of developing this potential while being able to extract oil out of the high TOC layers or low TOC layers.

It is proven that high TOC has no potential on conventional development. However, ISC (in-situ combustion; a thermal recovery technique) technology has potential application at lab scale. But for field scale, this technology showed low recovery with high cost, as per the simulation result.

The off-structure area has not been explored intensively. It could be an attractive potential if proven successfully. However, recent appraisals at the truncation area has proven the potential of Natih-B production. However, the issue of high water cut is a concern and more evaluation should be carried out. Low permeability results in a low production rate. In total, the Natih-B formation has produced over 27.6k bbl of oil until August 2023.