Completion Design Workflow for IOR/EOR Project Cuts Costs and Increases Production

MODELING SOFTWARE SIMULATES INTELLIGENT COMPLETION DESIGNS TO IMPROVE PERFORMANCE FROM COMPLEX AND AGING ASSET FOR PETRONAS
MALAY BASIN, OFFSHORE MALAYSIA

OVERVIEW
Compartmentalization and multilayered structures presented Petronas with multiple challenges when planning improved oil recovery/enhanced oil recovery (IOR/EOR) projects in the Malay Basin offshore Malaysia. Success in the costly projects depended on improving completion performance in the injection and producing wells.

CHALLENGES
Well placement and completion design in the complex, aging assets were complicated by thin oil-rim, stacked, compartmentalized reservoirs. Well designs had to intersect two or more reservoir targets. Crossflow and early water or gas production (or excessive water injection) were key concerns. In addition, the completions had to provide an option for changing to water-alternating-gas (WAG) flooding later in the well’s life.

SOLUTION
The operator used NETool™ software to simulate and compare different completion scenarios to improve production and estimated ultimate recovery (EUR). The process determined zonal flow control requirements for the wells, identified fit-for-purpose flow control equipment for individual well applications, and performed detailed well and reservoir modeling. A quantitative value screening was also performed to assess productivity/injectivity gain and EUR from the fields.

RESULTS
NETool completion design used only two of the six planned injector wells, resulting in significant CAPEX savings.
Reduced injection requirements freed up four wells for production.
Implementation of intelligent design eliminated intervention to control downhole injectivity, thus saving approximately USD 10 million per intervention.

CHALLENGES
» Enhance IOR/ EOR projects in complex, aging reservoirs
» Optimize completions in wells intersecting multiple reservoirs
» Create option to change to WAG injector

SOLUTION
» Using NETool™ software, simulate and compare completion designs for multizone, multilateral production and injection wells

The complexity of the reservoir required a workflow that considered multiple scenarios to produce the optimal solution.

Workflow Design Process

1. BUILD THE CASE
2. CREATE SCENARIOS
3. RUN SIMULATIONS AND CHOOSE BEST SCENARIO
4. APPLY TO RESERVOIR MODEL
RESULTS

The resulting performance improvements achieved with the multizone high-rate injector design illustrates the benefit of performing multiple optimization simulations. The NETool completion design used only two of the six planned injector wells for a significant CAPEX savings.

The reduced injection requirements freed four wells on the spar with significant oil production potential. In addition, implementing the intelligent design eliminated intervention to control downhole injectivity, saving an estimated USD 10 million per intervention based on rig rates at the time. (Source: SPE 174702)