

ABSTRAK

INTEGRATED ASSET MODELLING INJEKSI IMMISCIBLE WATER ALTERNATING GAS SEBAGAI PERENCANAAN PILOT PROJECT LAPANGAN “AJ”

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Perencanaan pengembangan Lapangan “AJ” dilakukan dengan pendekatan *Integrated Asset Modelling* (IAM) untuk mengevaluasi efektivitas metode injeksi *Immiscible Water Alternating Gas* (IWAG) dalam meningkatkan perolehan minyak. Metode ini dipilih karena hasil simulasi basecase menunjukkan *recovery factor* awal sebesar 11,4%, tergolong rendah sehingga diperlukan penerapan *Enhanced Oil Recovery* (EOR). Dibandingkan waterflood yang hanya mencapai *recovery factor* 13,6%, IWAG menawarkan efisiensi penyapuan lebih baik melalui kombinasi keunggulan injeksi air (efisiensi makroskopik) dan gas (efisiensi mikroskopik).

Simulasi dilakukan menggunakan tNavigator, diawali dengan penempatan sumur optimal menggunakan *Assisted History Matching* berbasis *Particle Swarm Optimization*. Dilakukan juga sensitivitas terhadap laju dan siklus injeksi untuk memperoleh skenario terbaik.

Hasil menunjukkan skenario optimal IWAG pada kombinasi laju injeksi air 10.000 bbl/day dan gas 3432 Mscf/day (W2G3), menghasilkan produksi minyak 160,496 MMSTB dan *recovery factor* 15,87%. Skenario dengan siklus injeksi 18 bulan menghasilkan produksi tertinggi 162,179 MMSTB, *remaining reserve* 849,761 MMSTB, dan *recovery factor* 16%. Dengan IAM, distribusi fluida injeksi dapat dimonitor melalui *streamline* dan VRR yang menunjukkan efisiensi penyapuan berjalan optimal. IWAG dengan pendekatan IAM dapat dijadikan rencana awal *pilot project* untuk peningkatan perolehan minyak di Lapangan “AJ”.

Kata kunci: *Enhanced Oil Recovery, Immiscible Water Alternating Gas, Integrated Asset Modelling, Simulasi Reservoir, Water-Gas Injection.*

ABSTRACT

INTEGRATED ASSET MODELLING OF IMMISCIBLE WATER ALTERNATING GAS INJECTION AS A PILOT DEVELOPMENT PLAN FOR "AJ" FIELD

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The development planning of the "AJ" Field was carried out using an Integrated Asset Modelling (IAM) approach to evaluate the effectiveness of Immiscible Water Alternating Gas (IWAG) injection in enhancing oil recovery. This method was selected because basecase simulation results showed an initial recovery factor of 11.4%, which is considered low, thus requiring the implementation of Enhanced Oil Recovery (EOR). Compared to waterflooding, which only achieved a recovery factor of 13.6%, IWAG offers better sweep efficiency by combining the advantages of water injection (macroscopic efficiency) and gas injection (microscopic efficiency).

The simulation was conducted using tNavigator, starting with optimal well placement using Assisted History Matching based on the Particle Swarm Optimization algorithm. Sensitivity analysis was also performed on injection rates and cycle durations to determine the most effective scenario.

Results show that the optimal IWAG scenario was achieved with a water injection rate of 10,000 bbl/day and gas injection of 3432 Mscf/day (W2G3), resulting in total oil production of 160.496 MMSTB and a recovery factor of 15.87%. The scenario with an 18-month injection cycle produced the highest cumulative oil production of 162.179 MMSTB, with a remaining reserve of 849.761 MMSTB and a recovery factor of 16%. With IAM, fluid distribution can be monitored through streamlines and VRR, indicating optimal sweep efficiency. Therefore, IWAG with an IAM approach can serve as an initial pilot project plan for improving oil recovery in the "AJ" Field.

Keywords: Enhanced Oil Recovery, Immiscible Water Alternating Gas, Integrated Asset Modelling, Reservoir Simulation, Water-Gas Injection.