DEEP WATER

CASE STUDY

Integrated Asset Model and Risk Analysis Enable Further Development of Deepwater, Pre-Salt Field

ACCURATE MODELING AND ANALYSIS HELP IDENTIFY INITIATIVES THAT SIGNIFICANTLY IMPROVE RESERVOIR RECOVERY AND INCREASE PROFITS

OFFSHORE BRAZIL

CHALLENGES

- Determine reserve estimations and risk assessments for a deepwater, pre-salt reservoir within a greenfield project
- Help identify initiatives to increase profit and improve reservoir recovery
- Provide a detailed integrated oil production system that could be rapidly generated in less than two months, thereby meeting the client's urgent deadlines

SOLUTIONS

- Provide stochastic reserve evaluation modeling, based on risk and opportunity management, to meet short-term goals with maximum reserves and minimum capital expenditure investment
- Create multiple FDP scenarios, using an optimization-under-uncertainties approach to identify the highest values by risk level
- Offer progressive scale modeling and simulations to enable managing details more efficiently from analytics to numerical models

RESULTS

- Enabled a potential 40% increase in incremental reserves, based on an improved oil recovery (IOR) process, along with new well architecture, a pilot project, and fracture-well technology
- Identified multiple solutions based on the IOR process, primary recovery, and hybrid cases (primary, plus IOR) – and, via hybrid cases, found opportunities to maximize recovery factors
- Provided more rigorous analysis than originally requested, with the deliverables performed in the time allotted by the client

OVERVIEW

An operator offshore Brazil needed solutions for its deepwater, pre-salt reservoir, which had several challenges to overcome in the exploratory phase due to uncertainties in the reservoir's characteristics. The main objective of the project was to perform a stochastic reservoir study of the discovery to ascertain the key drivers for further field development. Halliburton Consulting performed a workflow to integrate all reservoir characteristics, surface facilities, and economic models with strategic decisions and uncertainty variables. The project was completed in the established time frame, providing even more rigorous analysis than was originally requested. Consequently, the client benefited from a better understanding of potential development strategies, along with the associated recoverable hydrocarbon volumes and economic metrics in terms of a probabilistic cut-off threshold curve.

CHALLENGE

An international oil company (IOC) operating in South America requested the development of an integrated exploitation plan for an offshore, pre-salt reservoir, considering an integrated subsurface-to-surface approach with economic analysis. The Halliburton team developed a field development plan (FDP) for the operator's deepwater, pre-salt reservoir and identified the key uncertainties in the system. This FDP considered strategies to mitigate the high cost of the operator's facilities and wells. In addition, the Halliburton team provided an economic analysis, developed and optimized subsurface development strategies, and maximized the project's net present value (NPV) to optimize performance and increase the asset life cycle.

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SOLUTION

The Halliburton Consulting team's front-end loading (FEL) methodology was used to develop an exploitation plan that would help identify maximum profit opportunities for the field. Uncertainties for this offshore field located in a pre-salt geological region were evaluated, using a decision-scenario-optimization (DSO) process. The project delivered an engineering design, a pilot project on well architecture that incorporated new stimulation technology, and an accelerated plan to incorporate new resources from an exploratory prospect.

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World-class modeling, using key subsurface workflows

The project also developed a new oil transportation solution with an accelerated execution plan. The Halliburton team provided progressive scale simulation (from analytics to numerical models and analysis), along with stochastic analysis of the original oil in place (OOIP), reserves, and production system (including well production and facilities). The team also provided development scenarios by using an optimization approach under uncertainties, which generated subsurface development scenarios based on water injection. Halliburton also generated design production facility cases for optimization and provided probabilistic correlations between the number of wells versus the number of reserves acquired. Finally, the Halliburton team employed relative risk analysis to identify critical values of the economic indicators and the parameters that cause high sensitivity on the expected asset performance.

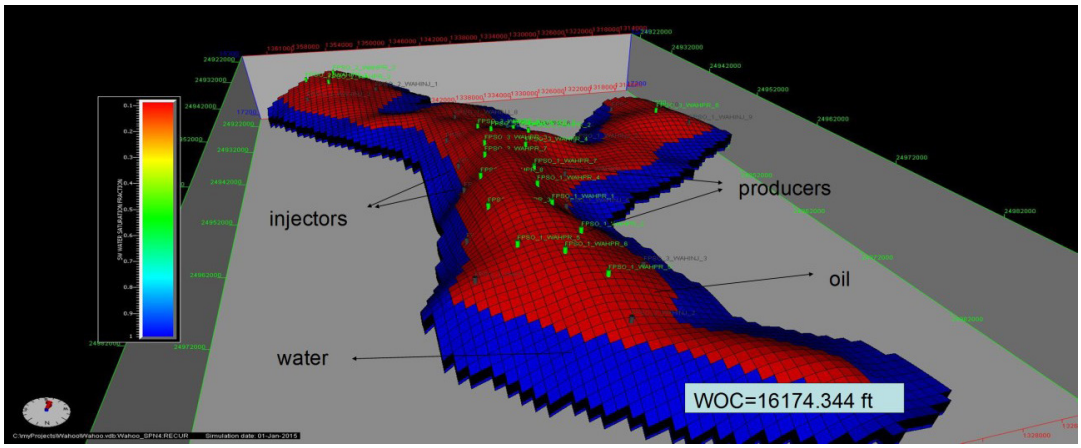

Figure 1: Reservoir numerical model: Scenario selection

RESULT

The Halliburton project generated the opportunity for the operator to increase its reserves by about 40%. Stochastic analysis established the minimum probable expectation of production and NPV. Finally, the Halliburton team determined the optimal number of positions in which to locate floating production storage and offloading (FPSO) vessels for drilling slanted-producer and vertical-injector wells.

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