

Optimizing Oil Development of a Super K Compartmentalized Reservoir with Large Gas Cap and Bottom Water Aquifer “Case Study”

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Abstract

This paper presents a case study of developing a significant volume of super K compartmentalized oil reservoir with a large gas cap and bottom water aquifer in Abu Dhabi-UAE. The reservoir is a low relief heterogeneous carbonate, located in a complex environment represented by natural and artificial islands in the surface, shallow and medium water marine areas with subsurface lateral, and vertical heterogeneities as well as variation in reservoir fluid properties.

The static and dynamic data were utilized to construct representative geological and dynamic models for the reservoir. The field development objective focused on maximizing the oil production and achieving 70% RF while minimizing the gas cusping, water conning and early breakthrough via super K interval.

Nine years production dynamic data were available from 6 oil producers in addition to well testing “14 wells”, core “11 wells”, MDT “17 wells” data during the appraisal phase. These data were used to quality control the initialization and history match phases. In preparation to the development options, the team included pressure support using water injection, lean gas injection, miscible gas injection, miscible WAG injection. The predicted reservoir performance of the super K oil reservoir indicated considerable gas production and high water production from the bottom water aquifer through super K interval in all the development options.

It was a big challenge to reduce the amount of gas production, water production, and early breakthrough for all development options. A new development option was introduced to perform peripheral miscible Hydrocarbon WAG injection accompanied with optimization of the wells and completion intervals locations for producers and injectors, as wells as WAG cycle to minimize the gas production from the gas cap, water production from the aquifer, and early breakthrough. This resulted in significant enhancement to plateau length, sweep efficiency, and recovery factor.

This paper provides the methodology followed to guide the development plan to fill in the uncertainty gap along with a detailed data acquisition and monitoring programs to better understand the reservoir behavior.