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## **St Joseph Field Waterflood Project: Fractured Water Injection Using Smart Well Technology**

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### **Abstract**

St Joseph is a mature oil field offshore Sabah, Malaysia. It has been on production since 1981, gas injection started in 1996. A large re-development project is planned to install water flooding and restore offshore living quarters. First water will be injected in 2010.

The total project scope entails installation of a new platform for offshore living quarters and seawater treatment & injection facilities plus drilling of six horizontal water injector wells and five infill wells. Treated seawater will be used as injection fluid at a total rate of 60,000 bwpd.

A high degree of zonal control is required in the water injectors, because of the laminated nature of the reservoir and historical problems with controlling water and gas breakthrough through high permeability streaks. The selected concept for the water injector wells is a horizontal well injecting under fracturing conditions, completed on five zones. It is intended that injection will be into two zones simultaneously, alternating between zones several times a year. This concept is not feasible without the use of smart technology: Each zone will be fitted with a flow control valve and dual downhole pressure gauge to allow remote control. There are significant challenges and benefits associated with a five-zone smart completion. This approach is expected to provide the necessary control to allow the optimisation of the water injection flood front for maximising oil recovery.

The selected well concept provides substantial modelling challenges: Within the industry there is limited experience with fracture models, so initial dynamic modeling was done assuming matrix injection but with ongoing research work to account for fractured injection. Eventually, the dynamic model output is required to determine the operational strategy for the injection wells during the producing life: to determine when zone change needs to take place and which zones get priority.