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EOR: The New Frontier in the Malay Basin Development

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Abstract

Tapis is one of the largest oil fields in the Malay Basin with almost thirty years of production. It is also the oldest pattern waterflood field in Malaysia. The field has undergone continuous implementation of improved oil recovery (IOR) strategies that include major workover campaigns, step-out drilling, and infill drilling programs. Application of IOR has increased the recoverable reserves and production capacity for economic operation of the field.

To further improve the field recovery, in 2003, ExxonMobil and PETRONAS embarked on a joint study to evaluate the potential for implementing enhanced oil recovery (EOR) processes at Tapis. The high complexity and cost of EOR projects requires a disciplined work process during evaluation, design, and implementation.

This paper will describe the recently concluded joint study leading to the targeted implementation of a full-field EOR project in the Tapis Field. This work illustrates ExxonMobil's disciplined EOR assessment process, starting with initial screening of candidate fields and identification of appropriate EOR processes, followed by detailed reservoir simulation evaluation of EOR process options supported by comprehensive laboratory work, and scoping cost estimating of full-field facilities development. The work resulted in selection of an immiscible Water Alternating Gas (WAG) process using readily available hydrocarbon gas as the most feasible EOR process for full-field implementation in the mature waterflood reservoirs of the Tapis field. Use of a disciplined process helped the project team to focus on the most promising EOR technologies and enabled efficient resolution of key technical issues and uncertainties.

Introduction

EOR projects typically require a large amount of capital investment and operating expense, besides having low incremental production over a long period of time. In addition, uncertainties in technical data could impact the EOR process assessment. It is imperative that a disciplined process is used for EOR evaluation to ensure technical uncertainties and risks are appropriately identified and managed to support investment decisions. The assessment process requires a full spectrum of technology including specialized laboratory data acquisition and mechanistic reservoir simulation.

The EOR evaluation workflow used by ExxonMobil is shown in Figure 1. This disciplined approach begins with screening for suitable EOR processes and the identification of target fields. It is followed by further in-depth technical evaluation of the most promising EOR processes for the short-listed fields. The technical evaluation often requires a combination of laboratory work, geological and reservoir simulation modeling, and additional field data gathering. If the in-depth evaluation indicates EOR has potential for field implementation, field tests or pilots may be carried out to address the key uncertainties identified. Results from field tests form a feed-back loop to fine tune the technical assessment. A comprehensive commercial project plan for implementing the selected EOR process is then developed, followed by execution of reservoir surveillance and management programs. Note that it is essential to secure stakeholders review and approvals in each key step of the EOR evaluation to ensure all interested parties are aligned with respect to the technical assessments, project progress, and expectations.