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Applicability of SAGD in Eastern Venezuela Reservoirs

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This paper describes the evaluation of the SAGD recovery process using a sector model from a field and oil and reservoir characteristics representative of an eastern Venezuela formation. The goal was to understand the impact of key variables and to understand the effects on the recovery factor in these reservoirs, which have previously been produced with cold primary recovery mechanisms.

The parameters analyzed were vertical well spacing, injection steam rate, well flowing pressure, and horizontal length of the well pair. The effect on the oil recovery from the angle of dip in the reservoir and the orientation of the well pair with regard to the direction of dip were also briefly analyzed.

A PVT adjustment process was performed to generate the parameters of the equation of state (EOS) to replicate the fluid properties in the simulator. The main PVT properties used in the adjustment process were oil relative volumes, bubble point pressure, oil densities, solution gas-oil ratios (SOR), and liquid viscosities versus pressure. The adjustment of the parameters of the EOS reproduced the fluid characterization from laboratory tests with a maximum error below 8%. This depiction was achieved in spite of the initial SOR of 150 scf/STB.

The study concluded that SAGD technology has potential to increase recovery factors from eastern Venezuela heavy oil reservoirs to more than 20%. 70-ft vertical well spacing generated an appropriate balance between steam production at bottom conditions and heat losses. A steam injection rate of 450 tons/d provided the optimum cumulative SOR for the cases analyzed. A relatively low differential pressure of about 300 psi (flowing bottomhole pressure of 800 psi) improved the oil recovered and decreased the SOR. Best oil production performance was obtained with horizontal lengths of 2,000 ft. Proper well placement, accounting for dip in reservoir, has an impact on recovery.

It is recommended that economic analyses should accompany technical considerations in the selection of a SAGD design. Geomechanical models for the SAGD process should help to account for the effects in the reservoir of changing rock properties with temperature and pressure stresses. Incorporation of heat losses in the surface piping, facilities, and the wellbores of the producer and injector will complement the design. This analysis should be performed to estimate the steam quality, pressure, and temperature of the injection stream that reaches sandface.

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