POTENTIAL USE OF GEOTHERMAL FLUIDS FOR THERMALLY ENHANCED RECOVERY OF HEAVY OIL IN SOUTH TEXAS

Steven J. Seni and Douglas S. Hamilton
Bureau of Economic Geology
The University of Texas at Austin, Texas

ABSTRACT

In a five-county area of South Texas, geopressured-geothermal reservoirs in the Eocene Wilcox Group occur below heavy-oil reservoirs in the Eocene Jackson Group. This co-location warrants consideration of the use of geothermal fluids for a thermally enhanced water flood. Geothermal fairways comprise thick deltaic sandstone within growth-fault-bounded compartments containing geopressured water in excess of 250° F. Geothermal reservoirs occur at depths of 11,000 to 15,000 ft in continuous sandstones 100 to 200 ft thick. Permeability ranges from 1 to 150 md, and porosity from 12 to 24 percent.

Updip pinchout of shallowly buried (200 to 2,000 ft) barrier-bar/strandplain sandstones largely controls the distribution of heavy-oil reservoirs. Subtle structure, small faults, and sandbody pinchouts form lateral barriers of the reservoirs. Structural, depositional, and diagenetic variations affect reservoir compartmentalization. The heavy-oil reservoirs are typically porous (25 to 35 percent) and permeable (100 to 1,000 md), slightly clayey, fine to medium sand. Calcite-cemented zones of low porosity (>5 percent) and permeability (0.01md) compartmentalize reservoirs.

Injection of hot (300° F) moderately fresh to saline brines will improve oil recovery by lowering viscosity and decreasing residual oil saturation. Matrix clays are smectites, which could swell and clog pore throats if injected waters were fresh. The high temperature of injected fluids will collapse some of the interlayer clays, thus increasing porosity and permeability. Reservoir heterogeneity resulting from facies variation and diagenesis must be considered when siting production and injection wells within the heavy-oil reservoir. The suitability of abandoned gas wells as geothermal production wells and their long-term well productivity also affect the economics of geothermally enhanced hot-water flooding.