

divert waterfloods away from production wells. Knowing how the fractures were oriented allowed new wells to be properly placed. A magnetic resonance imaging logging tool helped locate oil-bearing zones in sections of the reservoir previously thought to be barren. Sophisticated computer models tied the fracture and magnetic resonance imaging data together and gave operators a production strategy to boost oil flow. Production increased from 45 to 330 barrels per day.

The success of the initial field test created a resurgence of drilling in the region. Neighboring companies initiated 11 new waterfloods involving more than 300 wells. These wells are expected to produce 31 million barrels of additional oil. Because the operations are taking place on federal lands, the direct return to the U.S. Treasury in royalty revenues will likely exceed \$160 million, more than enough to offset DOE's entire investment in all its jointly-sponsored projects in its oil recovery field demonstration program.

A DOE co-sponsored field project has brought new life to the Crystal Field...The new well was completed successfully and began producing 100 barrels of oil per day - 20 times better than the best conventional well in the field.

Moreover, since these 11 projects cover only 13 percent of the area, widespread application of waterfloods could double or triple the region's producible reserves and increase federal revenues to \$500 million, a huge payoff from reservoirs that once were almost abandoned.

Using Horizontal Drilling to Give a Michigan Oil Field New Life

As much as 85 percent of the oil known to exist in the Dundee Formation in the Michigan Basin has been bypassed. Early production techniques in the 137 fields were poor, and so today, Michigan's leading oil-producing formation was at risk of being abandoned, leaving millions of barrels of oil behind. A prime example of a "worn out" field is Crystal Field, a once prolific producer which had been reduced to a handful of wells, the best of which produced only 5 barrels per day.

A DOE co-sponsored field project, however, has brought new life to the Crystal Field. Horizontal drilling is one of the most promising technologies available for oil production. A team, led by Michigan Technological University, used new computer modeling and analysis methods to pinpoint the location for a horizontal well to drain more of the remaining oil than a vertical well could. The new well was completed