

Enhanced Oil Recovery in Unconventional Reservoirs: From lab to field

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Abstract:

Unconventional reservoirs rely on primary depletion, using initial energy to produce hydrocarbons through complex fractures. Production starts with high fluid rates that quickly decline and stabilize. Enhanced Oil Recovery (EOR) can improve well recovery, reduce decline, and extend field life.

This lecture contrasts conventional and unconventional EOR applications and describes lab observations, recovery mechanisms, workflows, surveillance, and results for developing and field-testing two EOR technologies in unconventional reservoirs. The first field case involves the use of surfactants as stimulation additives in existing horizontal wells. Chemical EOR is a technique that boosts oil recovery by injecting chemicals that alter the interactions between fluids and rocks. It has been widely used in conventional reservoirs but applying it in unconventional reservoirs presents challenges and requires careful design and execution. The second field case involves a hydrocarbon gas EOR application under a huff and puff scheme in horizontal wells. Gas EOR recharges the unconventional reservoir by decreasing oil viscosity and promoting oil swelling, though it is dependent on pressure increase and fluid mixing. In both field cases, various analysis techniques, including analytical methods and tracer responses, are combined with production and productivity index to provide an integrated interpretation. Lab and field results confirmed the primary recovery mechanisms with measurable EOR responses. In summary, while EOR technologies can increase recovery factors in unconventional reservoirs, they differ from those in conventional reservoirs in terms of methods, application, and timing due to the complex petrophysical characteristics and recovery mechanisms of unconventional reservoirs.