

EOR for Canadian Tight Oil Reservoirs - Opportunities and Challenges

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Abstract

In the Western Canadian Sedimentary Basin (WCSB), abundant light and tight oil resources are locked in formations such as the Bakken/Exshaw, Cardium, Viking, and Lower Shaunavon. Breakthrough well stimulation techniques, including horizontal well drilling and multi-stage hydraulic fracturing, have allowed tight light oil production to reverse a decade-long decline in overall WCSB conventional crude oil recovery.

While new tight oil wells are highly productive, this output declines rapidly from its initial peak, at rates sometimes in excess of 85% per year and with ultimate primary recovery of only 3 to 10% of the original oil in place. This poses a huge opportunity for enhanced oil recovery (EOR) technologies. Classic EOR theories for conventional oil reservoirs need to be re-evaluated for tight oil reservoirs, mainly due to the rather different multi-phase flow mechanisms in low permeability and low porosity porous media. Furthermore, with a wide variety of permeability, lithology, and mineralogy for tight oil reservoirs, an effective EOR process for one reservoir may not work for another. In general, (enhanced) waterflooding and gas injection are the two most technically viable EOR methods for tight oil reservoirs; however, each of them has its own set of opportunities and challenges. It is of vital importance to screen, evaluate and tailor EOR techniques for specific tight reservoirs.

This presentation reviews current activities in WCSB tight oil reservoirs and discusses important technical factors in designing particular EOR processes for unlocking such resources. The importance of the understanding the reservoir characteristics and fluid flow in tight porous media for maximizing recovery performance from the EOR process is emphasized. Advantages and challenges associated with various gas and chemical based EOR techniques are discussed based on the results of physical and numerical modeling experiments conducted at the Saskatchewan Research Council.

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