The effect of high oil prices on EOR project economics

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Abstract

This paper examines two questions: (1) in a high oil price (and operating cost) environment what are typical breakeven prices for CO\textsubscript{2}? and, (2) are these prices sufficient to incentivize development of large-scale CCS projects? To address these questions we have developed an engineering-economic model for geological storage of CO\textsubscript{2} through EOR. In this paper we briefly describe the performance and cost models for CO\textsubscript{2}-flood EOR, and use them to estimate the breakeven price for CO\textsubscript{2} as a function of significant variables. In particular, the relationship between breakeven CO\textsubscript{2} price and oil price is developed for four illustrative cases, all of which are, or were, operating EOR projects in North America. The sensitivity of the breakeven CO\textsubscript{2} price to variability and uncertainty in reservoir characteristics and other model input parameters is also examined in detail for one of the cases.

1. Introduction

There are numerous options for geologic sequestration of carbon dioxide (CO\textsubscript{2}) [1] and, while there is considerable uncertainty over the total capacity available for sequestration [2], it is clear that saline aquifers offer the largest potential for long term storage. However, in many countries the regulatory framework for aquifer sequestration is non-existent or under development [3, 4]. Consequently, even in jurisdictions that have adopted emissions reduction goals the economics and commercial feasibility of aquifer sequestration are unclear. Conversely, sequestration through CO\textsubscript{2}-flood Enhanced Oil Recovery (EOR) is very attractive because there is considerable commercial experience with CO\textsubscript{2}-flooding; it can slow declining domestic oil production from mature basins; the regulations surrounding CO\textsubscript{2}-flooding are clear in most jurisdictions; and, with forethought, the infrastructure built today for CO\textsubscript{2}-flooding will compliment the development of saline aquifer sequestration in future.

The objective of this paper is to briefly describe and then apply a semi-analytical model to estimate the cost of geological storage of CO\textsubscript{2} via miscible CO\textsubscript{2}-flood EOR\textsuperscript{2} under the economic conditions of relatively high oil prices.

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\textsuperscript{2} Herein the term CO\textsubscript{2}-flooding will refer to the miscible process; while the immiscible process is also commercially practiced, it operates via different mechanisms that do not offer the same potential for increasing oil recovery.