THE EFFECT OF METHANE AND FLUID GEOMETRY ON CO_2 ENHANCED OIL RECOVERY

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ABSTRACT

CO_2 Enhanced Oil Recovery (EOR) is a process that involves injecting large volumes of carbon dioxide as a supercritical fluid into hydrocarbon reservoirs in order to recover hydrocarbons that are not mobilized during primary or secondary production. Some of the injected CO_2 is produced with the hydrocarbons and then recycled by reinjection into the reservoir. For a typical oil field, miscible floods (fluids mix without interface) are more efficient in recovering oil than immiscible floods. When recycled CO_2 includes a high percentage of methane, miscibility is reduced. Calculations from produced fluid databases shows that at 18 mole percent methane, 28 percent of offshore oil reservoirs became immiscible.

In this study, I assessed the fluid distribution in a study area to determine if methane production can be avoided by strategic completion of wells to avoid high methane areas. High Island 10L, High Island 24L and ST TR 60S were selected due to availability of structural data. Using seismic, well log interpretation, and production data from well-characterized near shore fields, I found that 94 percent of the wells evaluated had solution gas drive, therefore co-production of methane with CO_2 cannot be avoided. Methane separation facility, changes to CO_2 recycling, cutting CO_2 with another gas and accepting immiscible flood conditions are options considered to manage produced methane. A method to estimate the increase of cost for miscible CO_2 enhanced oil recovery (figure 1) was used to show how the economic solutions might affect the cost of CO2 enhanced oil recovery.

$$\begin{aligned} &General\ Additional\ Costs\ of\ CO2\ Enhanced\ Oil\ Recovery \\ &= (Cost\ of\ CO2\ Recycling\ Plant + Cost\ of\ Pipelines \\ &+ Cost\ of\ CO2\ to\ Offset\ Methane\ Immiscibility + Transportation\ costs \\ &+ O\&M\ costs + Pipeline\ Operation\ Costs) \\ &- (Value\ of\ Storage\ Tax\ Credit) \end{aligned}$$

Where:

$$Cost\ of\ CO2\ to\ Offset\ Methane\ Immiscibility = \left(cost\ of\ \frac{CO2}{ton} * tons\ of\ CO2\ needed\ to\ offset\ Methane\right)$$

$$Cost\ of\ Pipelines = (cost\ of\ pipeline\ construction\ per\ mile * number\ of\ miles)$$

$$Value\ of\ Storage\ Tax\ Credit = \left(\frac{\$35}{ton} of\ CO2\ stored\ Tax\ Crdit * tons\ of\ stored\ CO2\right)$$

Figure 1 Equation to calculate additional cost of CO_2 enhanced oil recovery

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