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Energy & Environmental Research Center (EERC)

CLARIFYING THE RELATIONSHIP OF ENHANCED OIL RECOVERY WITH ASSOCIATED STORAGE OF CO_2

2019 Carbon Management Technology Conference
Houston, Texas
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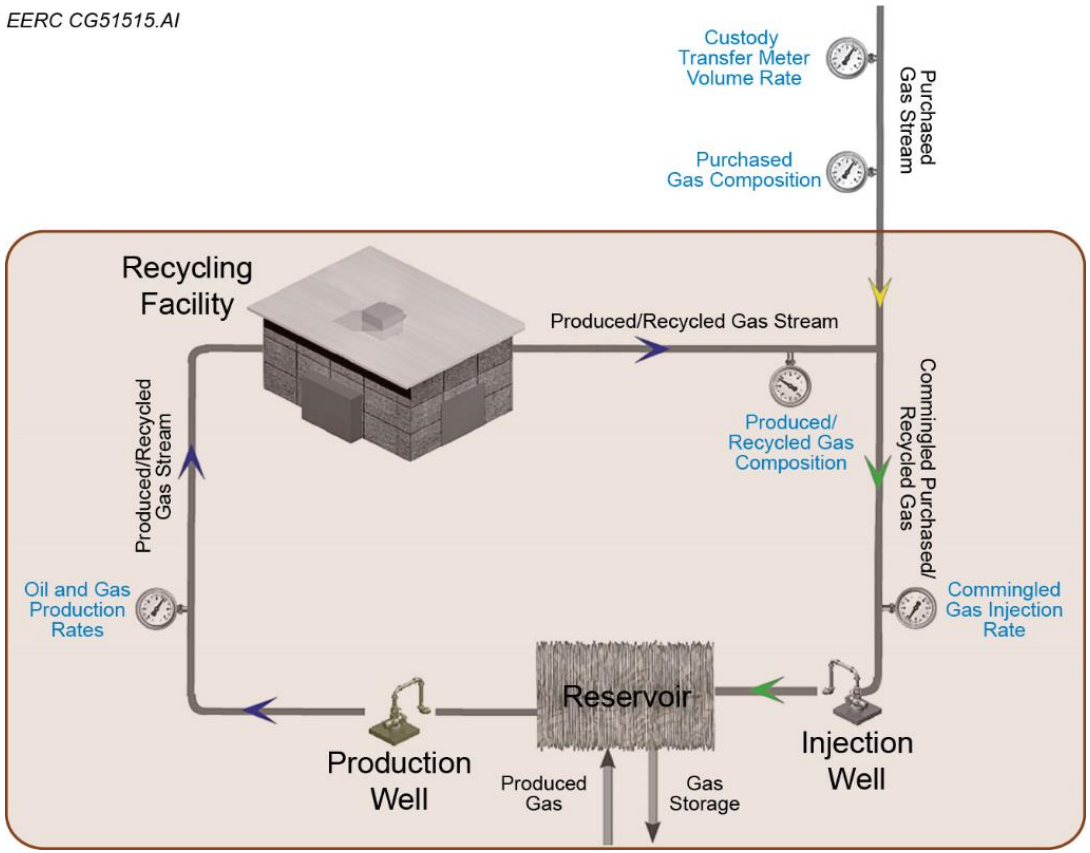
ENHANCED OIL RECOVERY (EOR) PROCESS

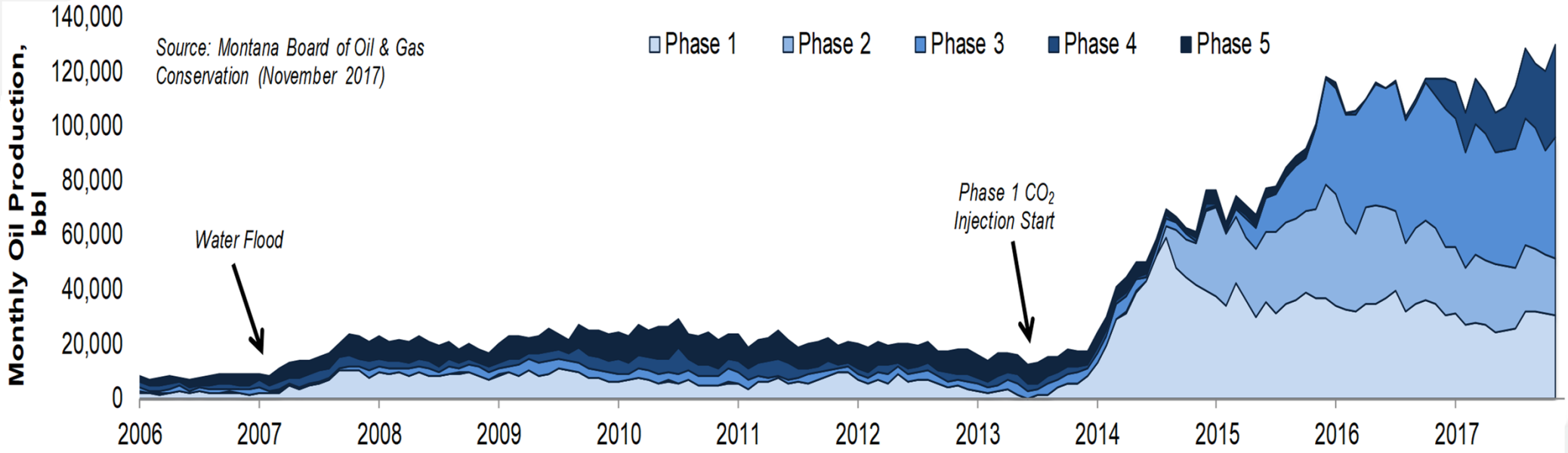


Associated CO_2 Storage, Incidental to the Bell Creek CO_2 EOR Project

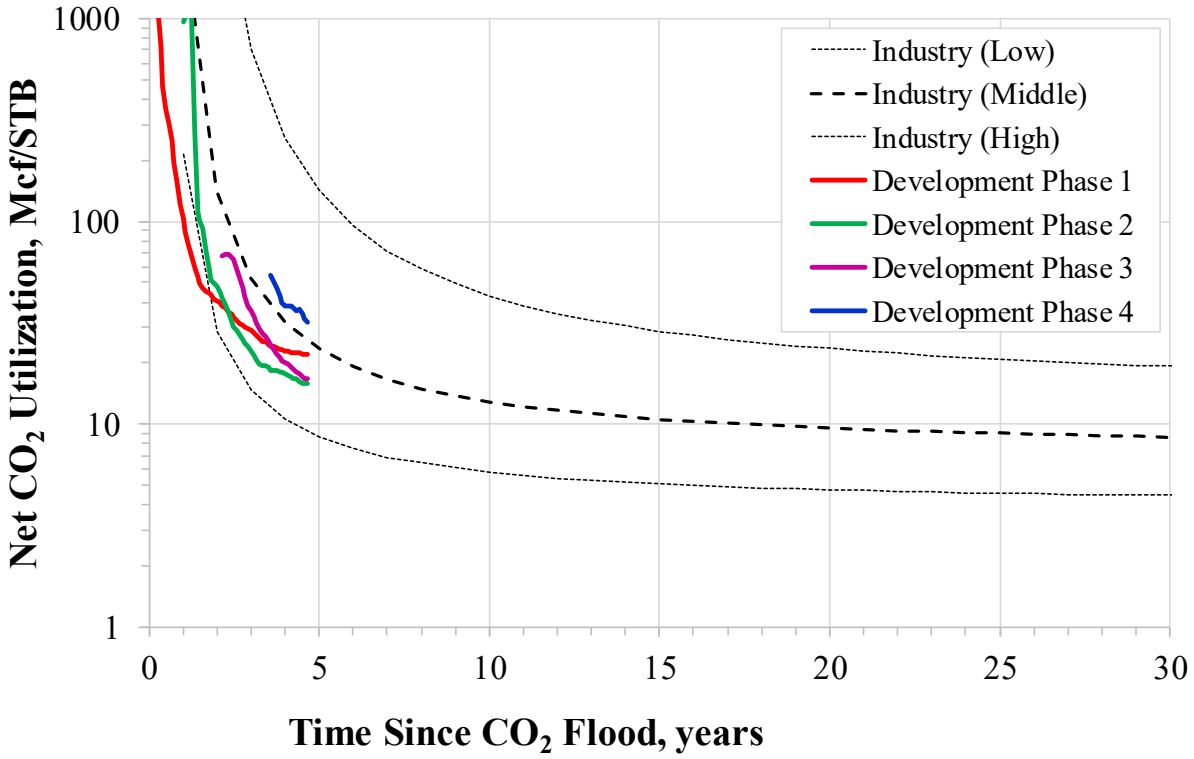
- The PCOR Partnership has worked with Denbury Resources to study EOR and associated CO_2 storage
- OOIP was estimated to be ~350 MMbbl; one of the most significant oil fields in Montana
- CO_2 flooding was selected to recover an estimated 20 to 40 MMbbl of incremental oil

[1] *J.P. Morgan 2018 Energy Conference – estimated proved plus potential tertiary reserves.*

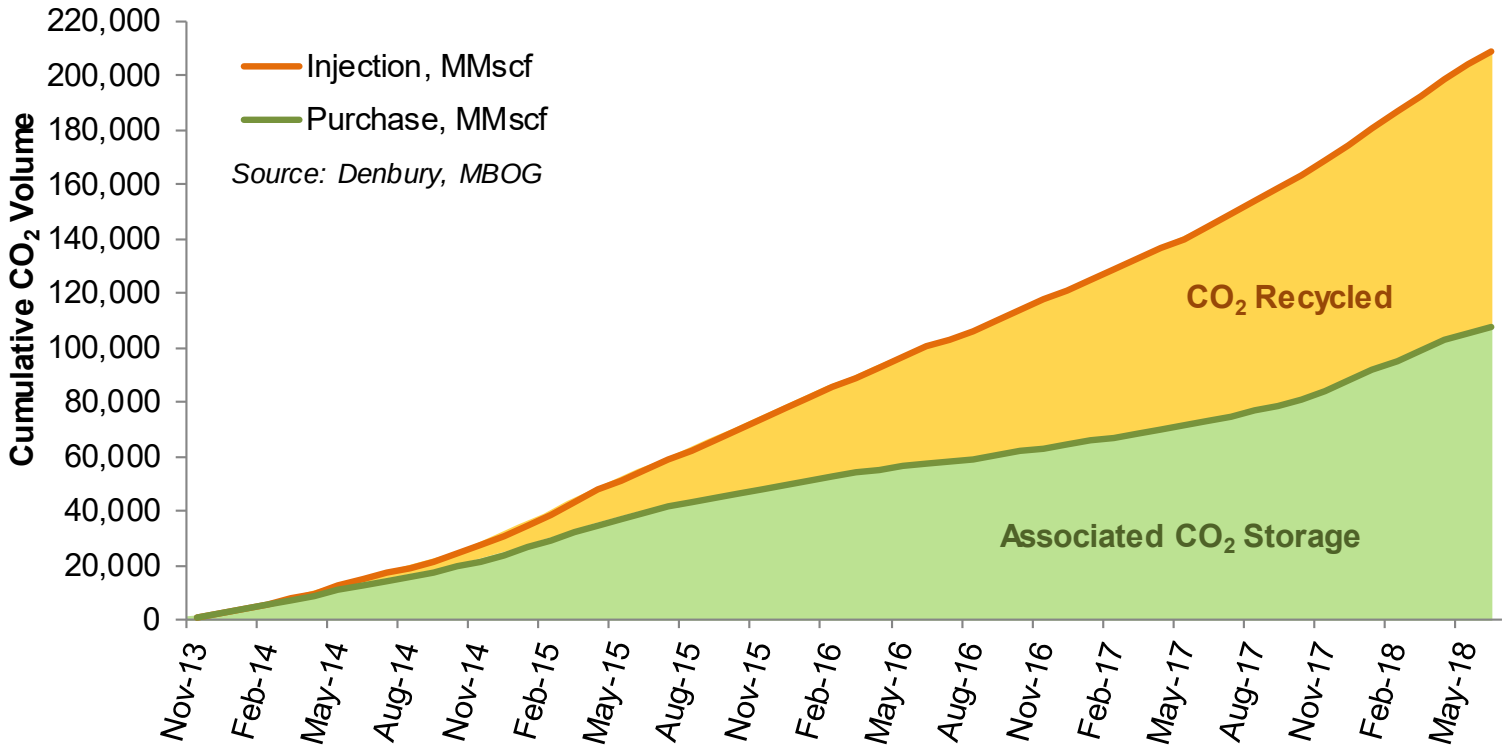
BELL CREEK INCREMENTAL OIL PRODUCTION



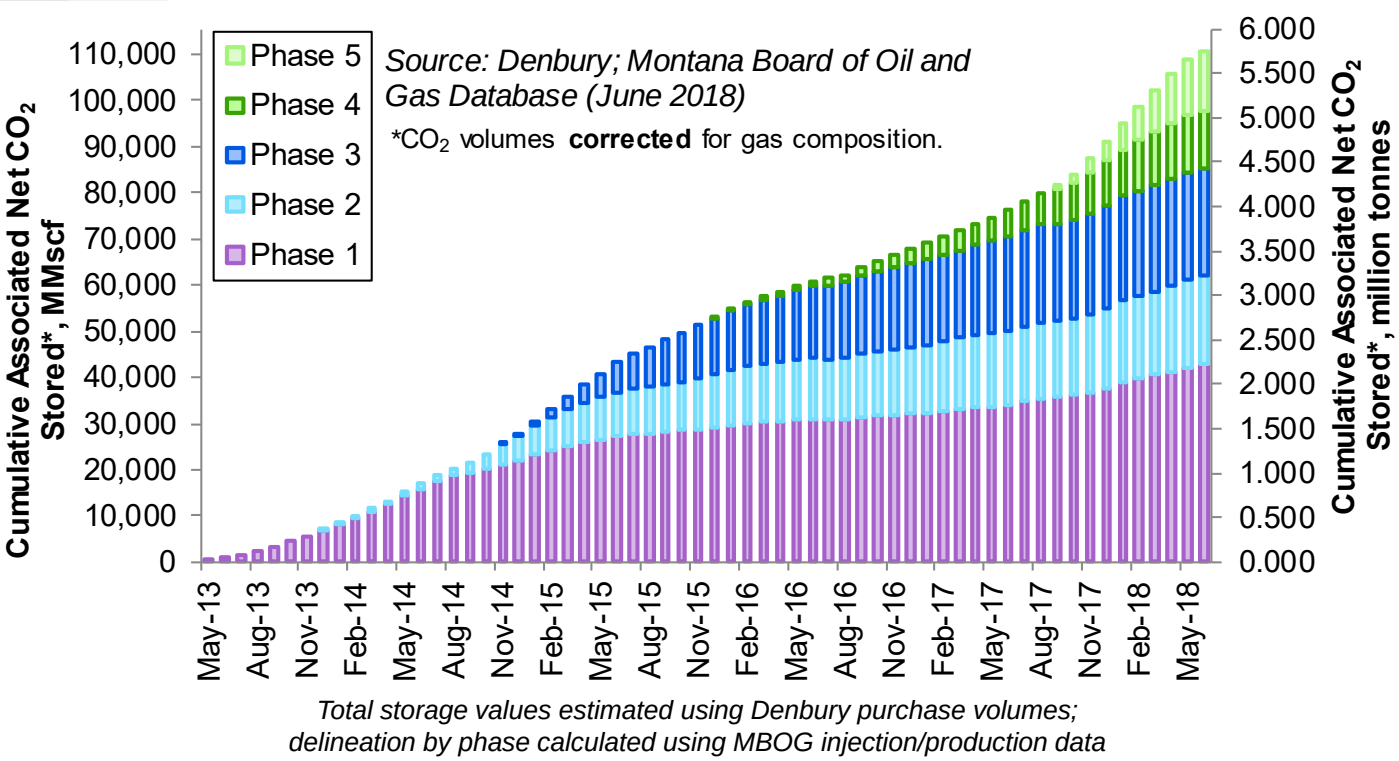
BELL CREEK NET UTILIZATION RATES ARE CONSISTENT WITH INDUSTRY RANGES



INJECTED AND RECYCLED CO_2 QUANTITIES



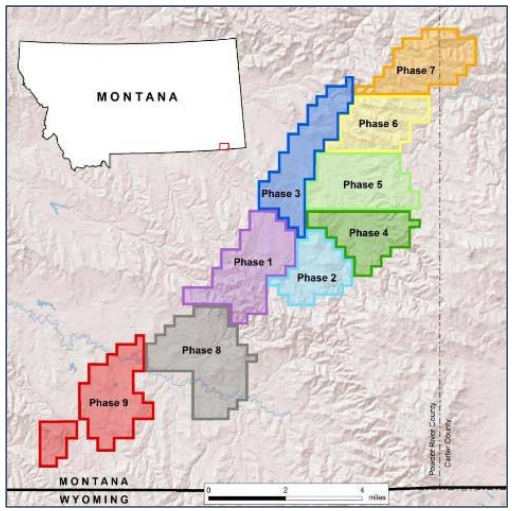
ASSOCIATED CO_2 STORAGE AT BELL CREEK BY DEVELOPMENT PHASE



Total storage values estimated using Denbury purchase volumes; delineation by phase calculated using MBOG injection/production data

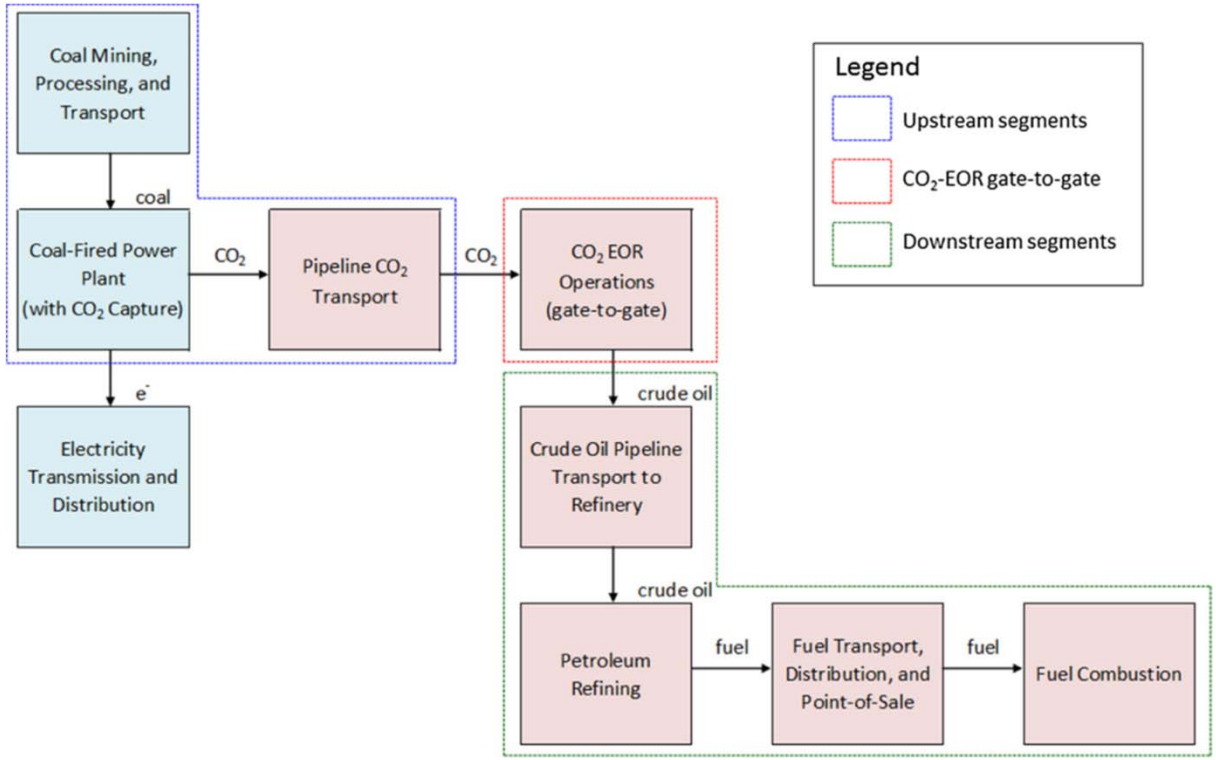
Development Phase	Injection Start*
1	May 2013
2	December 2013
3	November 2014
4	December 2015
5	September 2017

**Estimated start date for commercial EOR operations by development phase.*

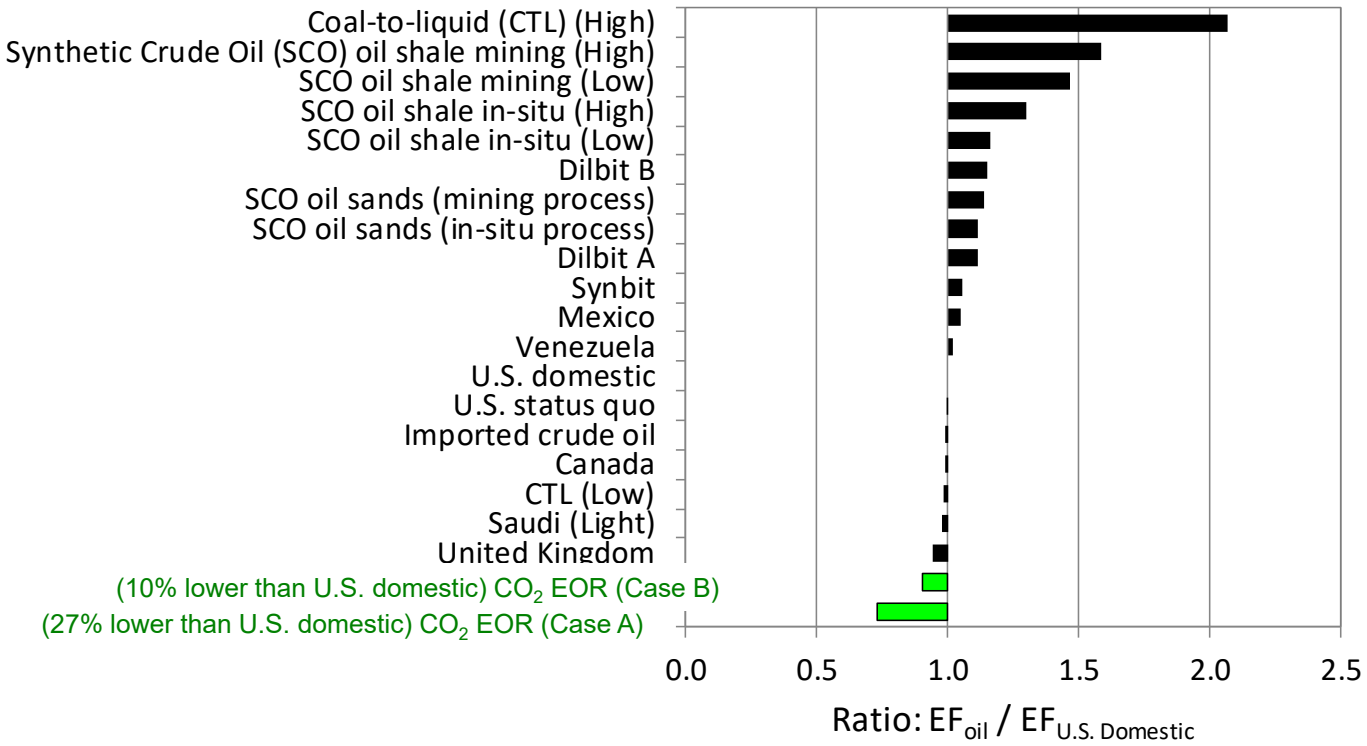


As of July 2018: Associated CO_2 storage incidental to EOR is about 5.9 million metric tons.

LCA SYSTEM BOUNDARIES INCLUDE UPSTREAM, GATE-TO-GATE, AND DOWNSTREAM SEGMENTS



LIFE CYCLE ANALYSIS SHOWS THAT EOR WITH CAPTURED CO_2 RESULTS IN LOWER-CARBON-INTENSITY OIL

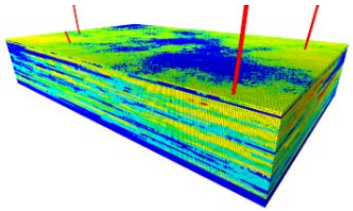


Adapted from:

Mangmeechai, A. (2009) *Life Cycle Greenhouse Gas Emissions, Consumptive Water Use and Levelized Costs of Unconventional Oil in N. America*. Dissertation, Carnegie Mellon University: Pittsburgh, PA.

Azzolina, N.A.; Peck, W.D.; Hamling, J.A.; Gorecki, C.D.; Ayash, S.C.; Doll, T.E.; Nakles, D.V.; and Melzer, L.S. (2016) How green is my oil? A detailed look at greenhouse gas accounting for CO_2-enhanced oil recovery (CO_2-EOR) sites. *International Journal of Greenhouse Gas Control*, 51:369–379.

BAKKEN CO_2 STORAGE AND ENHANCED RECOVERY PROGRAM – 2017 FIELD INJECTION TEST



XTO ENERGY

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THOUGHTS ON THE FUTURE OF BAKKEN EOR

- The potential size of the prize for EOR is enormous!
- Lessons learned from rich gas EOR can be directly applied to CO_2 EOR
- Widespread deployment may be a decade away

- Rich gas is available, CO_2 capture has traction
- Industry partners highly engaged

ACKNOWLEDGMENT

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Disclaimer

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