Design and Optimization of a Greenhouse Gas Mitigation Approach: From Capture to Utilization in Northminster field

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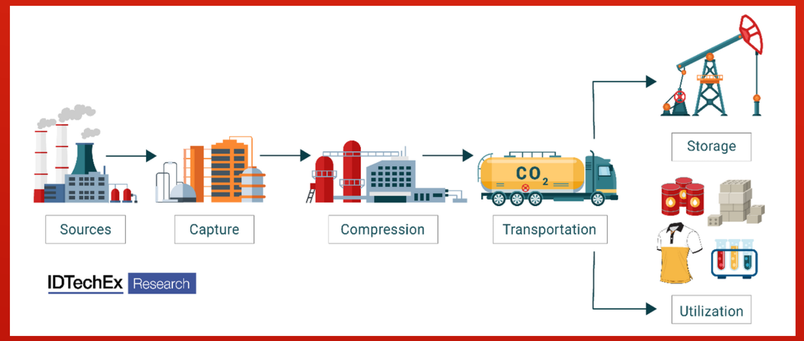
Introduction

Currently, there is an ongoing initiative in Canada and many other countries to reduce carbon emissions by capturing Carbon Dioxide that would otherwise enter the atmosphere, such as emissions from power or chemical plants. The Carbon Dioxide is then condensed, shipped and utilized for Enhanced Oil Recovery (EOR) purposes and permanent storage. The objective of this project is to perform a feasibility analysis on a CO2 based EOR process applied to a depleted oil reservoir accounting for CO2 sequestration.



Source: Dr. Michael Dent, IDTechEx Research

Methods

Stage 1: Gathering/Sourcing data from the Northminster Field in Saskatchewan via AccuMap.

Stage 2: Designed a geological model for the reservoir using the data gathered from stage 1.

Stage 3: Involved the use of CMG-GEM to model fluid properties.

Stage 4: Use of CMG/CMOST to perform history matching, and EOR trials to evaluate and determine the optimal injection rate range to maximize the oil recovery and amount of Carbon Dioxide sequestered into the reservoir.

Results

Below are the 3 different trials for CO2 injection schemes used, and their corresponding effect on production. Figure 1 shows amount of CO2 injected, and on which dates, while Figure 2 shows the total amount of oil produced for each case. Figure 3 shows the net present value of the well in each trial.

Figure 1:

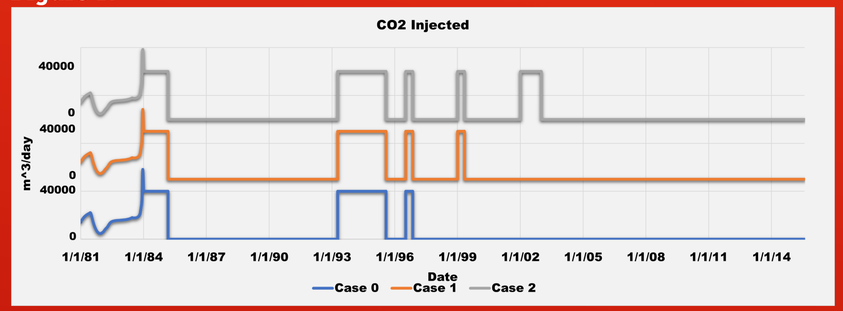


Figure 2:

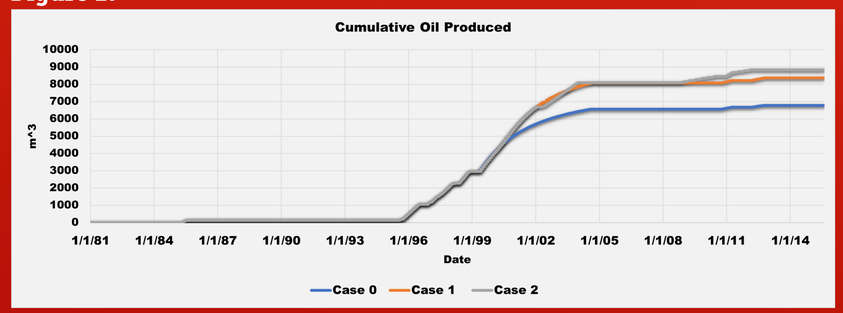


Figure 3:

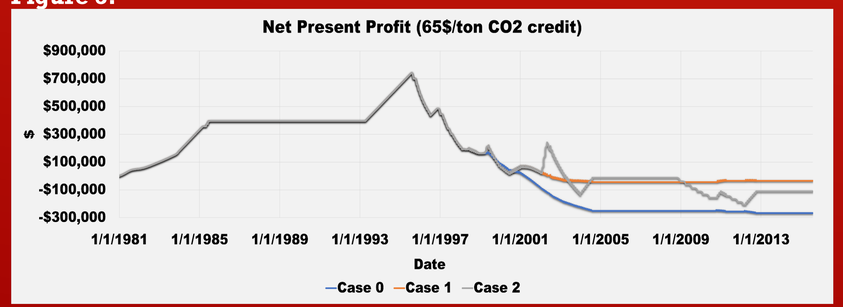
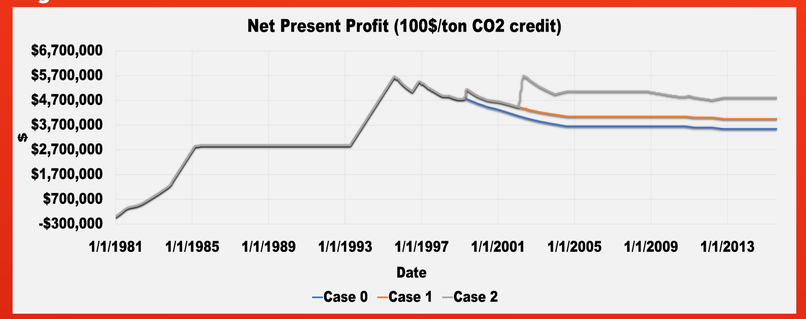


Figure 4:



Conclusion

Based on the results shown in figures 1-4, we can determine that the optimal case for the CO2 EOR/sequestration is case 2, If and only if the CO2 tax credit reaches a high enough value (approximately 100$/ton) in the period after the 1995 peak, otherwise CO2 EOR would not be optimal after 1995.

With an injection rate of 82 tons/day during injection periods, a total of 156,129 tons of CO2 were sequestered and 52,302 bbls of oil were produced over the life of the well.

References

- Dr. Michael Dent, IDTechEx Research CCUS
- Optimization of NPV of CO2 sequestion and EOR, Hamid Reza et al, University of Southern California.
- The Tax Credit for Carbon Sequestration, Jones, A. and Sherlock, M. (2021), United States: Congress.

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