Estimates of CO_2 Storage Capacity and Enhanced Oil Recovery Potential in Oil Fields of the Williston Basin

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Abstract

The potential for incremental oil production from CO_2 floods and the CO_2 sequestration capacities of selected oil fields in the Williston Basin were estimated as part of Phase I of the Plains CO_2 Reduction (PCOR) Partnership regional characterization. Reconnaissance-level incremental oil production and sequestration capacity estimations were developed for selected fields in the region using reservoir characterization data that were obtained from the petroleum regulatory agencies and/or geological surveys. The data and the sequestration capacity estimates for each field are stored in a Web-based decision support system for the purpose of matching CO_2 sources to sinks. The initial reconnaissance-level estimates for selected oil fields in the North Dakota, Saskatchewan, and Manitoba portions of the Williston Basin indicate that there is a CO_2 flood enhanced oil recovery potential of over 670 million barrels.

Methodology

In trying to determine the sequestration capacity for the unitized pools, some assumptions had to be made. The first major assumption was to simplify the oil recovery potential from injection of CO_2. Shaw and Bachu (2002) noted that oil production could be increased from 7% to 23% of the original oil in place (OOIP) through successful miscible flooding techniques, while Nelms and Burke (2004) suggested a value of 7% to 11%. This spreadsheet uses an average value of 12% recovery of the OOIP. Next, the quantity of CO_2 necessary to recover incremental oil was estimated. Based on Nelms and Burke (2004), this evaluation assumed 8 thousand standard cubic feet (Mcf) of CO_2 was required for every incremental barrel of oil recovered.

OOIP(stb) * 12% recovery factor = incremental oil recovered (stb)

Incremental oil recovered (stb) * 8 Mcf/stb = CO_2 required (Mcf)

stb = stock tank barrel

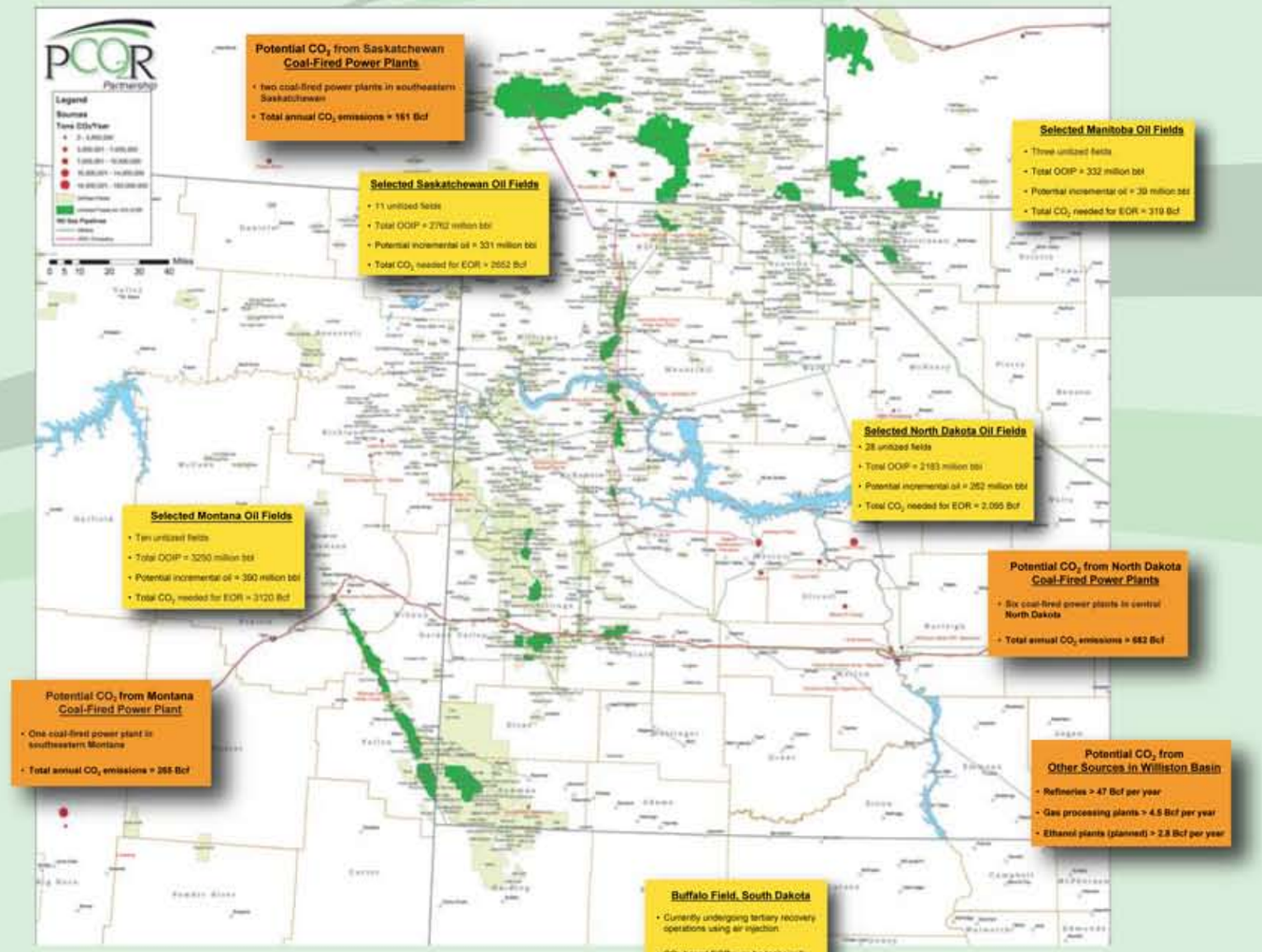
Key Issues to Consider

- Incremental oil production results presented here are reconnaissance-level estimates.
- More accurate evaluations require:
  - Detailed geologic characterization.
  - Updated OOIP statistics.
  - Production history data.
  - Reservoir dynamics data.
  - Modeling efforts.
  - Detailed feasibility studies.
- CO_2 availability
  - Technical issues related to capture, separation, and transportation
  - Economics
- Monetization of carbon credits for geologic storage of CO_2

Summary of Williston Basin CO_2-Based EOR and Sequestration

Williston Basin State/Province	Cumulative OOIP of Selected Units (million stb)	Cumulative Potential CO_2 EOR Incremental Oil from Selected Units (million stb)	CO_2 Quantity Required* (Bcf)	CO_2 Sequestration Potential Through EOR in Selected Units (Bcf)	CO_2 Sequestration Potential Through EOR in Selected Units (tons)
North Dakota	2183	262	2095	2095	109,445,804
Montana	3250	390	3120	3120	181,954,680
Saskatchewan	2762	331	2652	2652	154,648,632
Manitoba	332	39	312	312	18,668,832
South Dakota	High Pressure Air Injection Currently Ongoing in Buffalo Unit				

*CO_2 quantity required is the total purchase amount and does consider recycling of CO_2 from the tertiary recovery operation.



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CO_2 Source Data Provided by:

- Montana, North Dakota, and South Dakota source data were obtained from the U.S. Environmental Protection Agency (EPA) Technology Transfer Network (TTN) database and the EPA Clean Air Markets Web site.
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