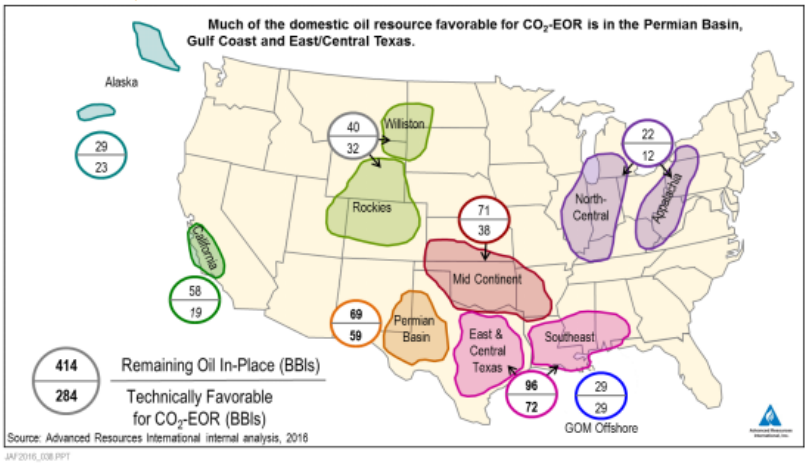
Geologic Uses of CO_2

"Geological CO_2 utilization options have the greatest potential to advance CCUS by creating market demand for anthropogenic CO_2."

At the request of the U.S. Secretary of Energy, Ernest Moniz, the National Coal Council examined how EOR and other geological CO_2 utilization opportunities could incentivize the deployment of carbon capture, utilization and storage (CCUS) technologies. The main findings on geological options included

- Geological CO_2 utilization options have the greatest potential to advance CCUS by creating market demand for anthropogenic CO_2.
- CO_2-EOR – including production and storage activities in residual oil zones (ROZ) – remains the CO_2 utilization technology with the greatest potential to incentivize CCUS.
- Joint industry/government RD&D supportive of "next generation" CO_2-EOR technologies would greatly expand the economically viable market for CO_2 use by the EOR industry. With the benefit of this RD&D, the market for CO_2 from the EOR industry would more than double – from 11 billion metric tons with today's technologies to a potential of 24 billion metric tons with "next generation" technologies.



Source: Advanced Resources International internal analysis, 2016.

- Gaining a more complete understanding of the geological uses of CO_2 for EOR would be greatly enhanced by further evaluations of the domestic ROZ resource and its viability for CO_2-EOR.
- Other geologic utilization markets – including rich-shale formations, enhanced coal bed methane (ECBM) and enhanced water recovery (EWR) – also hold current and future promise as incentives for CCUS.

CO_2-EOR represents the most immediate, highest value opportunity to utilize the greatest volumes of anthropogenic CO_2. With a potential for 81 billion barrels of economically viable oil recovery from mature oil field and residual oil zones (assuming the use of "Next Generation" technology), the various CO_2-EOR stakeholders would gain valuable revenue and economic benefits. Assuming a $70/bbl price for oil, approximately $5.7 billion in revenue might be recovered by various stakeholders, including $1.2 billion for entities responsible for capturing and transporting CO_2.

http://www.nationalcoalcouncil.org/studies/2016/NCC-CO2-Building-Block-FINAL-Report.pdf

CO_2 BUILDING BLOCKS

ASSESSING CO_2 UTILIZATION OPTIONS

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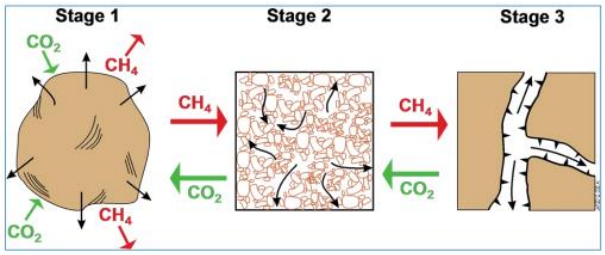
$1.2 billion may be available for capturing and transporting CO_2 from EOR opportunities.

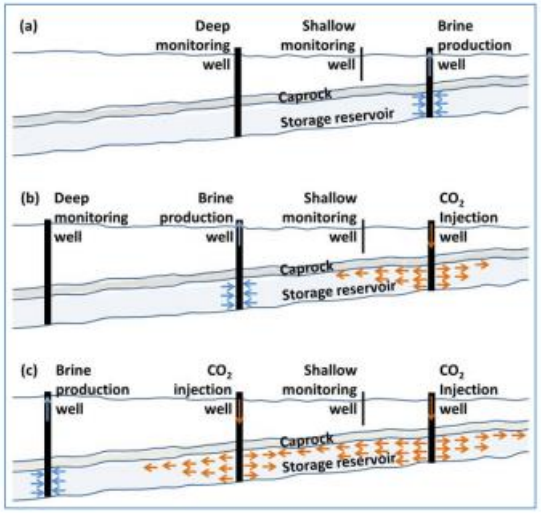
The tight oil and gas sites in Bakken alone are estimated to offer CO_2 storage ranging between hundreds of millions to billons of tons CO_2.

Given their size and broad geographic distribution, tight oil formations and shale gas plays may offer important opportunities to simultaneously store large amounts of CO_2 and increase the recoverable reserves of oil and natural gas. However, there is a lack of field-based understanding as to the storage capacity, EOR and enhanced gas recovery (EGR) potential, and sweep/storage efficiency in unconventional tight oil and gas formations. Initial estimates for CO_2 storage in the Bakken alone range from hundreds of millions to billions of tons.



CO_2 can also be used to extract methane from coal seams (mechanism on left). Research to date demonstrates that there may be cases where CO_2-ECBM can be technically and economically successful. However, none of the demonstration projects conduced to date were commercially profitable; thus, continued R&D in this area is warranted.

Enhanced water recovery (EWR) represents another option for CO_2 utilization, although the revenue would likely be less than that of CO_2 used to produce hydrocarbons. Yet, around the world there is also a considerable need for new sources of fresh water and EWR may be a viable option. Notably, the water in potential CO_2 storage reservoirs is not fresh water and would need to be treated for most uses.



There are other geological use options for CO_2, such as enhanced geothermal energy, that should be advanced through increased R&D based on their potential value and CO_2 storage potential.

In general, the NCC found that geological CO_2 utilization options have the greatest ability to incentivize CCUS. Some of these options are not yet commercial, and would benefit from continued, and in some cases increased, R&D.

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