PCO2R Partnership

EERC Energy & Environmental Research Center

University of North Dakota

Plains CO_2 Reduction (PCOR) Partnership

Practical, Environmentally Sound CO_2 Sequestration

CO_2 EOR and CO_2 Sequestration – The Case for Collaboration

Introduction

Events currently unfolding at national and state levels have strong implications with regard to the pace of deployment of carbon dioxide (CO_2) emission reductions. CO_2 capture and sequestration (CCS) policies are under rapid development. It is critical to the economy that the right decisions be made in this important area of energy policy.

One very serious concern has to do with any policy that might marginalize enhanced oil recovery (EOR) as a sequestration tool. The emission reduction potential and sequestration associated with EOR is immense, and revenues from oil produced partially offset the cost to the public and, ultimately, accelerate more widespread deployment of CCS.

With the growing energy and carbon management concerns in North America, the contributions of CO_2 EOR need to be placed front and center in the policy debate. This fact sheet addresses the key principles of CO_2 EOR policy in the sequestration arena.

The Case for CO_2 EOR

EOR involves injecting substances into a reservoir through thermal, chemical, and/or gas-miscible processes. One very important and growing example of a gas-miscible process is that of a CO_2 flood. CO_2 is injected into an oil reservoir whereupon it mixes with the oil, creating a mixture of oil and CO_2, freeing the oil from the rock, and driving additional oil to producing wells. EOR can recover an average of 35% of the oil remaining after the previous stages of production. Some of the injected CO_2 returns with the recovered oil and is reinjected into the reservoir to minimize operating costs while maximizing economic and environmental benefits.

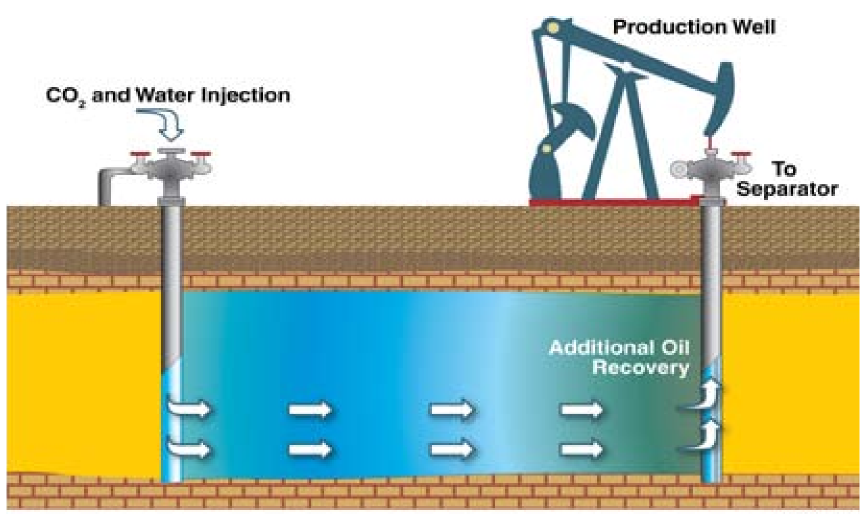
The era of CO_2 EOR effectively began with two large-scale floods in west Texas in the 1970s. The industry has grown since then to become a major production component in Texas, Wyoming, New Mexico, and Mississippi and produces over 90 million barrels of oil a year for the U.S. economy. Historically, the chief limiting factors of growth in most other areas with oil production have been low oil prices and the lack of ready and reliable sources of CO_2.

Industry experience from the Permian Basin region of West Texas and New Mexico demonstrates that 6 to 8 mcf of CO_2 is permanently stored per barrel of oil recovered. And since over a billion barrels have been recovered there, that represents 6 to 8 tcf (340–460 gigatons) of stored CO_2.

CCS and CO_2 EOR

So what does this all mean for CCS? First, an existing industry has evolved that possesses the operational practices to handle huge volumes of CO_2 safely and effectively. The industry's best practices can be extended into the field of CCS almost seamlessly. Surface CO_2 handling (including gas processing, compression, and transportation), well designs, injection practices, and surveillance of emplaced CO_2 are all directly applicable. Key to its success is that net stored volumes need to be documented and long-term storage must be assured.

Second, expansion of the EOR industry is seriously constrained by the availability of CO_2. With coal plants and other industrial facilities seeking to find a home for their emitted CO_2, it becomes a matter of CO_2 capture technology, economics, and mutual trust to develop joint



This diagram illustrates CO_2 EOR.

ventures between these two industries that are so critical to America's future and provide a transition to next-generation energy technology.

Third, the American oil produced from EOR has been the sole revenue stream available to fund U.S. EOR projects—this would include the capture and processing from the source of CO_2 to the funding of pipelines to move it to the injection site to produce the oil. With EOR qualified as sequestration, the oil revenue acts as a large and critical revenue stream to offset the huge infrastructure costs that otherwise need to be funded by the public through higher energy costs. Storing the CO_2 and funding the infrastructure from the additional oil recovery occurs at the same time that important low- to zero-carbon barrels of oil contribute to North American energy security and a cleaner energy future.

Fourth, CO_2-based EOR is important in that it extends the life of existing oil fields. Up to an additional 30 years of life can be gained by CO_2-based EOR. This provides valuable employment, reduces the need to develop as many new fields, and greatly enhances our North American oil supply.

Barriers

Nature provides examples of deeply sourced, geologically trapped CO_2, thereby demonstrating that some subsurface sites will permanently secure CO_2. However, at other sites, CO_2 will vertically migrate, which may or may not prove to be problematic. CO_2 is a naturally occurring substance; generation and migration within the subsurface are very common. Rather than trying to fashion rules that protect against surface escape in any subsurface condition, regulatory oversight needs to recognize the ubiquitous occurrence and presence of the molecule while screening out the high-risk sites for injection and providing flexibility of regulatory rules to accommodate the attendant levels of risk.

The CO_2 EOR experience within the oil and gas industry can provide the pathways to successful sequestration on the needed operational scales. The oil and gas industry can provide the experience with the tools of exploration, the science and experience to assess risks of site security and, very importantly, the tools and techniques to design the wells for emplacement.

One of the largest potential barriers to deployment of sequestration projects is the specification of overly complex well designs and excessive levels of monitoring of sites. Experience shows that exotic well designs add little benefit while, on the other hand, judicious site selection adds greatly to the security of emplacement. For example, subsurface sequestration formations overlain by bedded salts provide optimal conditions for long-term storage.

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EOR can extend an oil field's life by decades.

EOR and Sequestration: Separate Paths?

Examples of recent policy actions appear to be charting separate paths for CO_2 EOR and sequestration. For reasons stated earlier, recognizing EOR as a CO_2 storage event is critical. Advancements in using fossil fuels such as coal in such a way as to capture the by-product CO_2 are important steps for North America's energy future. Disqualifying CO_2 stored during EOR as an offset to emissions will do nothing but delay the necessary commercial demonstrations of those technologies and further burden an already-distressed energy infrastructure. One example of an action working against this progress is separate well design requirements for sequestration as compared to the time-tested designs currently used in CO_2 EOR.

Conclusions

Industry participation in the ongoing policy debates about qualifying storage during CO_2 injection projects is critical. Particular contributions are needed in rating potential sequestration sites, specifying well design requirements, volumetric CO_2 storage accounting, and in situ surveillance and monitoring.

The Plains CO_2 Reduction (PCOR) Partnership is a group of public and private sector stakeholders working together to better understand the technical and economic feasibility of sequestering CO_2 emissions from stationary sources in the central interior of North America. The PCOR Partnership is managed by the Energy & Environmental Research Center (EERC) at the University of North Dakota and is one of seven regional partnerships under the U.S. Department of Energy's National Energy Technology Laboratory Regional Carbon Sequestration Partnership Initiative. To learn more, contact:

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Visit our Web site (www.undeerc.org/PCOR) for online sequestration resources.

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