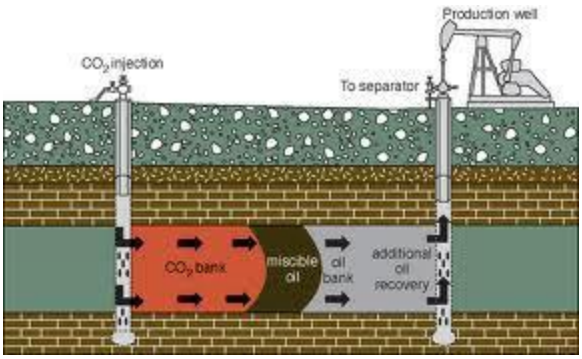
A possible win-win situation: Carbon capture and EOR



It's no secret that a large amount of crude oil is left unproduced in the ground in the case of almost every well that has ever been drilled. Secondary recovery with steam injection has increased recovery in a number of wells and tertiary recovery (also called Enhanced Oil Recovery or EOR) with carbon dioxide has further increased oil production in certain locations. But only seldom is carbon dioxide available in large quantities at the right time and place. Interestingly, there is an excellent opportunity to combine greatly increased oil recovery with using carbon dioxide that could be recovered from power plants (instead of adding to GHG pollution) and sent to oil well injection. Logistically, this is complicated and a great deal of new capital and Federal aid via tax policy would be required.

This post is timely because in Kemper county, Miss. a large lignite-based combined cycle power plant with 65% carbon capture built with a Federal grant and tax relief is being started up by Southern Company.

Carbon dioxide injection, used since 1972 in Texas, lowers the viscosity of the oil left in the ground. Together with additional water flooding, this technique can substantially improve crude oil yield. Historically, it could only be used when carbon dioxide was available from nearby natural sources or in a few cases from industrial sources.

In 2011/ a group called the U.S. Carbon Sequestration Council, using data from a DOE report, published a white paper outlining a plan to combine massive EOR with massive carbon dioxide capture from power plants. The calculated benefits are shown to be enormous: 45 billion barrels of oil could be economically recovered, with crude oil priced at $ 70/barrel (reasonable) and CO2 delivered to the well at $ 45/ton (Impossible, with current technology, which can only produce CO2 at $ 80-100/ton before transportation costs.) What is needed, therefore, is improved technology and, more importantly, Federal tax credits and the benefit of increased economic activity associated with additional oil recovery. A report issued by the State of Texas estimates that the increased economic activity would support 2.5 million additional jobs over a 30-year period. (Ed note: Similar to the huge number of jobs created by the current shale fracking boom). To put the 45 billion barrels in perspective, U.S. oil production in 2011 was about 2 billion barrels per year.

Regarding technology for CO2 capture from power plants, there are two relatively unsatisfactory choices and one promising third alternative, as explained to me by Larry Nault, a good friend and superb engineer very familiar with this issue. Both of the current choice involve substantial capital cost and a serious loss of generation efficiency (Electric energy produced less energy needed to run the process with carbon capture, termed "parasitic loss"). In the combined cycle process, coal is gasified (turned into a gaseous mixture of carbon monoxide and hydrogen) and the so-called synthesis gas is burned to produce high pressure steam to run turbines for power generation. Much of the Co2 produced in the gasification process is easily recovered since oxygen rather than air is used for the gasification. This is the technology used in the Kemper County plant.

As to the second choice, existing plants can add a CO2 absorption system to the flue gases, using amine or other solvents, an expensive operation, again with substantial efficiency loss and capital cost debits. This approach has been tested in a

commercial plant using ammonia solvent, but the results were not encouraging. Siemens, Linde and Hitachi are developing systems of this kind with different types of solvents but, as of now, no large scale installations are planned, to my knowledge.

The third, very promising choice, is to use oxygen rather than air in a conventional power plant, a technology under development by Babcock and Wilcox and Air Products. The only combustion products are carbon dioxide and water, with CO_2 recycled to take the place of nitrogen and the net make withdrawn as essentially pure carbon dioxide. This technology has not been tested in a large plant. It could be used for retrofits or for new plants. If it works, as it should, it would represent a real "breakthrough".

Source: http://chemengineeringposts.wordpress.com/2014/01/08/a-possible-win-win-situation-carbon-capture-and-eor/