



Assessing Outcomes from Completed Projects

Alberta Enhanced Coalbed Methane Recovery Project



- Flue gas injection offers better economics than pure CO₂ injection (unless there is a credit for CO₂).
- Flue gas injection appears to enhance methane production to a greater degree possible than with CO₂ alone while still sequestering CO₂, albeit in smaller quantities.
- The CO₂ will remain sorbed in the coal while the majority of the nitrogen will be produced along with the hydrocarbons. In this case, however, the process will require an extra processing step of rejecting the N₂ from the produced gas stream. Considering both economic and CO₂ sequestration factors, there might be an ideal CO₂/N₂ composition where both factors will be optimized.
- Technical issues that need to be addressed in the next include flue gas conditioning, compression and delivery, N₂/CH₄ separation and improvement of the numerical reservoir simulators.

CASTOR



The following results have been obtained during the project:

- Developed an economic tool for CCS
- Established scenarios for large-scale implementation of CCS in Europe (30% CO₂ emission reduction in European power generation)
- Studied CO₂ geological storage in 8 European countries
- Developed new solvents (absorption liquids) with a thermal energy consumption of 2 GJ/ton CO₂ at 90% recovery rates
- Costs per ton CO₂ avoided not higher than 20 to 30 €/ton CO₂, depending on the type of fuel
- European pilot plant tests showing the reliability and efficiency of the post-combustion capture process

China Coalbed Methane Technology/CO₂ Sequestration Project



- There are over 1,620 large stationary CO₂ point sources in China that each emit at least 100,000 metric tons of CO₂ per year. Combined annual CO₂ emissions from these sources are estimated at over 3,890 MtCO₂.
- China has a theoretical CO₂ storage capacity in excess of 2,300,000 MtCO₂ in onshore basins and 780,000 MtCO₂ in close offshore basins.
- Cost curve analysis appears to support value-added CO₂ storage formations that may result in recovery of incremental oil or coalbed methane as a result of CO₂ injection.
- Results of project will hopefully spur additional research, not only in China, but around the world.

CO₂ Capture Project — Phase 2



- Studies confirm that CO₂ can be stored underground safely and securely.
- About 10 technologies, covering the whole range of techniques (post-combustion, pre-combustion, oxy-fuel), and applicable to varied point sources, were developed from concept and are now being evaluated for potential demonstration.
- The Capture Project is now entering its third phase — using insights from the first two phases to further test and trial high potential technologies.

CO2STORE



- The suitability of all four sites for storage of CO₂ has been clarified and outline risk assessments were performed for the sites.
- All cases confirm the experiences from Sleipner, that the main happening mechanisms are pore trapping and dissolution of CO₂ in the water. As a consequence the CO₂ will be gradually more and more stable and safely stored.
- At the time of acquisition of new seismic at Sleipner in September 2006, 8.4 million tons of CO₂ had been injected. No indication of leakage into the reservoir seal has been observed.
- As a synthesis of what has been learnt regarding how to perform CO₂ storage in a saline aquifer, the Best Practice Manual has been developed and published.

Dynamis Project



- Co-production of electricity and H₂ from coal and natural gas is feasible and deemed techno/economically viable.
- Pre-combustion CO₂ capture will benefit from efficiency improvements in the gasification process and the power cycle (pioneering work).
- Pre-normative work suggests new requirements for CO₂ and H₂ (proper balance is key for the cost of CCS and H₂ production).
- Pressure build-up from CO₂ injected into deep aquifers.

ENCAP Project



- Performing research and development on pre-combustion CO₂ capture and validate by testing technical and economic feasibility of concepts, and also interact with research-related networks and carry out training and dissemination.
- ENCAP will generate knowledge and results that enable power companies to decide to launch a new design project aimed at a large-scale demonstration plant.
- Results will enhance the competitiveness of European industry.
- Project will contribute to the creation of a European Research Area for CO₂ Capture.

Frio Project



- Description and quantification of injection zone hydrogeology is a low-cost but important element.
- Geochemical techniques were successful in documenting the evolution of the CO₂ plume.
- Geophysical measurements of CO₂ saturation using neutron logging (RST), cross-well seismic, and VSP were successful in measuring plume evolution and CO₂ retained in the formation over time.

Regional Opportunities for CO₂ Capture and Storage in China



- Over 1620 large stationary CO₂ point sources with total emissions of more than 3,890 MtCO₂/yr.
- Estimated CO₂ storage capacity on the order of 2300 GtCO₂ in onshore basins in China.
- Ninety-one percent of these large CO₂ point sources have a candidate CO₂ storage reservoir within 100 miles (161 km).
- There appears to be strong potential for CCS technologies to offer significant emissions reductions in China at costs less than \$10/tCO₂ for transport and storage.