CFE-06-13: CO2 Enhanced Coal Bed Methane (CSIRO-JCOAL–ECBM)

Project

The project is to validate (and if appropriate to modify and improve) the use of CO_2 injection into coal seams to enhance methane recovery. It builds on the work of JCOAL in Japan. This validation will take place using both Japanese and Australian coal, and coal data.

Field trials will be undertaken in Australia in response to a proposal by China to support the transfer of ECBM technology to China. Later stages of this project will involve field trials in China and participation by Chinese industry and other agencies. The stages of the project will need to be authorized by the Chinese before proceeding.

JCOAL commenced a CO_2/ECBM field trial in Hokkaido in 2002 that covers reservoir characterization, micro pilot test, multi-well pilot testing and environmental monitoring. Now CSIRO is endeavoring to answer the remaining questions about the suitability of coal seams as a viable long-term storage option for CO_2 sequestration. The aim is to deliver tools that enable the interactions between CO_2 and coals to be characterized and to develop reservoir models that will use this data to predict the fate of the stored CO2 while enhancing methane recovery.

The outcomes of this project could be used to guide larger projects for CO_2 sequestration. The project will draw on the JCOAL data, actual experience and the CSIRO models, and will develop:

- Validate and provide analysis of the JCOAL project at Hokkaido with cross testing of coal and methods.
- Impact on the methane recovery rates.
- Quantitative predictions of the maximum rate of injection and uptake of CO_2.
- Likely environmental impacts of the high CO_2 concentrations in the formation waters.
- Lifetime of the storage.

The interaction of supercritical CO_2 with coal, water and other gases within the seam environment.

The overall project plan is to use existing JCOAL and CSIRO knowledge and expertise in CO_2-Enhanced Coal Bed Methane (CO_2-ECBM) and to apply this technology and model in Australia. This existing technology will be analyzed and where appropriate modified and then applied in Australia and other Partner countries.

The project plan consists of three Stages:

- Stage 1: Laboratory work and verification.

- Stage 2: Pilot field test to validate existing JCOAL and CSIRO experimental data especially that obtained from the JCOAL test site at Hokkaido. This test will be conducted in Australia to ensure control of the test conditions and ideally use a source of CO2 from a fossil fuel-powered power station.

- Stage 3: When the pilot field test in Australia has been completed successfully the collaborators will be confident as to the applicability of this sequestration technology to other coal and coal gas reservoirs. The participants will work with authorities in China to develop field trials in China to support the transfer of technology to China.

Stage 1 of the project is to validate the methodology of enhancement of methane recovery by injecting CO_2 in coal seams that has been developed in Japan by JCOAL. This validation will take place using Japanese and Australian coals, and coal data.

JCOAL commenced a CO_2-ECBM field trial in Hokkaido in 2002 that covers reservoir characterization, micro pilot test, multi-well pilot testing and environmental monitoring. Now CSIRO is endeavoring to answer the remaining questions about CO_2-ECBM. The aim is to deliver tools that enable the interactions between CO_2 and coals to be characterized and to develop reservoir models that will use this data to predict the fate of the stored CO_2 and quantify the enhancement of methane recovery.

The outcomes of this project could be used to guide larger projects for ECBM that are planned for Stage 2 and Stage 3 of this project.

The project will utilize the JCOAL and CSIRO field and laboratory experimental data and findings to validate and develop the experimental and analytical tools for CO_2-ECBM operation.

It is anticipated that this will require additional experimental work either in the laboratory or at the JCOAL test site in Hokkaido to answer specific questions that arise during this paper based analysis.

Stage 2 of the project will select a site with Japanese and Australian interests and a source of CO_2 such as that at Callide in Australia with the JCOAL 'oxy-firing' project. It may use CO_2 sourced from a power station.

The location of this project will depend upon the suitability of the site location relative to sourcing CO2 and favorable geological conditions.

The suggested work program of Stage 2 will be as follows:

- Detailed analysis of data on some coal gas reservoirs at the potential sequestration sites.

- CO_2-ECBM pilot test will be performed at the selected site.

- Stage 3 of the project will be similar to Stage 2 and would seek China's collaboration, subject to China's agreement to enable the involvement of Chinese industry and researchers.

JCOAL and CSIRO have a strong history of collaboration and this project would follow on from our other projects on mine safety and coal seam methane drainage.

Participation

Management of this project will be JCOAL and CSIRO. These two participants will complete Stage 1 and then seek other collaborators for subsequent stages. These other collaborators might include:

- The IHI oxy-firing project managed by JCOAL.
- Companies involved in the CO_2-ECBM project in Hokkaido, for example Mitsubishi Materials.
- Companies developing an LETDF (Low emission Technology Development Fund) project in Australia, such as PCC Ltd.
- Power companies, coal companies and Government agencies.

Objectives

To develop and apply JCOAL/CSIRO CO_2-ECBM technology to other coal seam reservoirs in Australia and to other Partner countries.

To achieve the objective of the project the following main tasks should be undertaken:

- Understand the interaction between coal and supercritical CO_2.
- Investigation of the geological and geochemical interactions of CO_2 and the host minerals/coals and other materials.
- Investigation of reservoir engineering for CO_2 storage in coal seams and understanding of the likely fate of injected CO_2 in a well constrained geological setting from a study of natural analogues.
- Design and conduct of pilot field trial in Australia and China.

Milestones

12/2006	Set up protocol to identify the common areas of experimentation between CSIRO and JCOAL.
6/2007	Complete experiments to analyze and recommend trial design for Stage 2 and commence negotiations to collaborate with Australian project that will produce a source of CO2.
2008/9	Commence ECBM trial in Australia.

2009/10	Commence ECBM trial, for example, in China, subject to agreement by the Chinese Government and upon securing Chinese private sector participation.

Location

Stages 1 and 2 will be conducted in Japan and Australia and Stage 3 in the agreed location.

Resources

JCOAL and CSIRO have allocated funding for their existing research into CO2-ECBM for Stage 1 of this project. The majority of additional expenditure for Stage 1 will be travel and accommodation to "compare notes" and the time of researchers. Additional funding would be required for the next stages of the project. For Stages 2 and 3 it is difficult to estimate the costs as there is little certainty (even the sites are unknown.) The funding requirements have not been budgeted by either JCOAL or CSIRO, but it is estimated that the costs of Stages 1, 2 and 3 of the project will be a total AuD$10 million.