Strategic Plan Implementation Report

October 2007

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Legal Issues Task Force

CSLF Task Force Strategic Implementation Report (TFIR)

30 September 2007

1. Task Force Members

- John Hartwell, Australia (Chair)
- Margaret Sewell, Australia
- Peter Horracks, European Commission
- Scott Brockett, European Commission
- Carole Lancereau, France
- Philippe Geiger, France
- Jacek Podkanski, France (IEA Secretariat)
- Thomas Kerr, France (IEA Secretariat)
- Hans Spiegler, Netherlands
- Caroline van Dalen, Netherlands
- Dag Trygve Enden, Norway
- Mette Karine Gravdahl Agerup, Norway
- Brian Morris, United Kingdom
- Tim Dixon, United Kingdom
- Barbara McKee, United States (IEA WPFF)
- Jeff Price, United States
- Mike Smith, United States

2. Purpose of Task Force

- Conduct 2nd IEA/CSLF Workshop and Publication on Legal Aspects of Storing CO_2 and produce publication to further investigate the five priority issues (IP, national legal and regulatory frameworks, international environment protection instruments, creating a level playing field for CCS, public awareness) identified in the 1st Workshop (July 2004) and Publication (2005) on Legal Aspects of Storing CO_2
- Goals or outcomes sought include further exploring the five priority issues to:
  - raise awareness of the issues
  - create discussion regarding the five issues (IP, national legal and regulatory frameworks, international environment protection instruments, creating a level playing field for CCS, public awareness) and
  - assist in developing solutions to these issues
- Performance indicators include attendance at Workshop, general level of interest in reviewing Publication, number of copies of Publication sold/downloaded

3. Milestones

- End May 2006 – completed drafting of discussion papers on five priority issues
- 17 October 2006, Paris – 2nd IEA/CSLF Workshop on Legal Aspects of Storing CO_2 held
- November/December 2006 – Task Force finalised draft of legal report and handover to IEA
- Mid-2007 – IEA published 2nd report on Legal Aspects of Storing CO_2

4. Status
▪ IEA launched the publication at the G8-IEA-CSLF Workshop in Oslo in June 2007. ▪ The recommendations have been included in the "Recommendations to G8 Leaders" process. ▪ IEA is exploring the next round of work, after receiving expressions of interest from governments and the private sector to begin implementing the recommendations in the publication. ▪ Goals and objectives met.

Capacity Building in Emerging Economies Task Force
CSLF Task Force Strategic Implementation Report (TFIR)
28 September 2007

1. Task Force Members

- Australia
- Canada
- Colombia
- European Commission
- India
- Italy
- Mexico
- Saudi Arabia
- South Africa
- United Kingdom
- United States - Chair

2. Purpose of Task Force

The objectives of the Task Force (TF) are to assist emerging economy CSLF Members to develop the knowledge, skills, expertise and institutions needed to deploy carbon capture and storage (CCS) technologies, develop training and educational resources that all CSLF Members can utilize, build on lessons learned from CSLF-recognized projects, and collaborate with other international CCS initiatives.

3. Milestones

- Task Force meeting was held in Oslo, Norway on June 20, 2007. Participating countries included the United States (Chair), Australia, Canada, European Commission, India, and Saudi Arabia. Minutes from meeting have been reviewed and revised as appropriate since previous TFIR (dated June 30, 2007)
- The Pittsburgh Capacity Building workshop was reviewed during the Oslo meeting and deemed successful.
- Pittsburgh workshop proceedings were posted on the CSLF website (by CSLF Secretariat) and distributed to participants.
- Evaluations prepared by attendees from the Pittsburgh workshop were analyzed. Results are summarized in the following section
- Workshop on Capacity Building for Carbon Capture & Storage (CCS) for CSLF Members in emerging economies will be held in Porto Alegre, Brazil on October 18 and 19.
- The Task Force will hold a meeting on the sidelines of the 3rd G8 Workshop on Early Opportunities for Carbon Capture and Storage to be held in Calgary, Canada, on November 27 and 28, 2007.

4. Status

- Prior to the Porto Alegre workshop, on October 17, the Brazilian hosts will be conducting an International Seminar on Perspectives for Near-Term CCS Deployment. Petrobras is sponsoring the two events and providing the funding for the international speakers. The Pontifical Catholic University of Rio Grande

do Sul is the host.

- Analysis of evaluations forms of the Pittsburgh Capacity Building workshop drew the following results:
    - Combining the CSLF workshop with the CCS conference was judged to have reinforced the workshop presentations and discussions. The workshop speakers were rated as subject matter experts in their fields, with their performances as a speaker and their presentations rated almost unanimously as very good. All of the workshop topics received positive ratings overall.
    - Summarizing the comments submitted in the workshop evaluation form, it was recommended that the CBTF consider:
        - developing a suite of basic, mid-level, and advanced CCS technology/policy/market workshops;
        - convening future workshops in emerging economies;
        - providing broader international perspectives via delivering Keynote Speeches and sessions devoted to emerging economy issues;
        - allowing more time for dialogue between presenters and participants;
        - visiting a pilot CCS demonstration site in conjunction with a future workshop, and;
        - ensuring the broadest possible CCS information dissemination via CDs, websites, etc.
- Plans have already begun for the next two CSLF capacity building workshops, following the one in Porto Alegre, Brazil: Saudi Arabia, scheduled for January 27-30 2008 in conjunction with the Technical Group meeting and Cape Town, South Africa, tentatively scheduled in conjunction with the Meeting of the CSLF Policy and Technical Groups in Cape Town, South Africa on April 13-17, 2008.
- The Chair of the Task Force, with the input of task force members, is currently developing a 2-year plan for this Task Force, to complement the original task implementation report prepared in August 2005. The Chair plans to present this plan at the task force meeting in Calgary, Canada, in November, 2007.
- The Task Force has discussed holding capacity building workshops over the next 2 years in the following countries: China, Colombia, India, and Mexico – in addition to the ones already scheduled for Brazil, Saudi Arabia, and South Africa.

Financial Issues Task Force

CSLF Task Force Strategic Implementation Report (TFIR)

15 October 2007

1. Task Force Members
▪ India – Chair ▪ Australia ▪ European Commission ▪ Korea ▪ Netherlands ▪ South Africa ▪ United Kingdom ▪ United States
2. Purpose of Task Force
The objective of the Task Force is to develop a detailed plan for financing carbon capture and storage (CCS) projects in emerging economy countries.
4. Milestones
▪ The Task Force was re-formed at the Paris CSLF meeting in March 2007. ▪ A Task Force meeting took place in New Delhi on 11-12 October 2007. Actions from the meeting are described in the Status section, below. ▪ The Task Force will meet at the Cape Town CSLF meeting in April 2008. A progress report will be provided to the Policy Group at the Cape Town meeting that includes follow-up for Actions from the New Delhi meeting.
4. Status
▪ The United States will develop a listing of existing funds, mechanisms, and forums to determine if any can be accessed or utilized for funding CCS activities in developing countries. The Asian Development Bank will provide a copy of a report by former World Bank Vice President Richard Stern which describes many of these entities. ▪ The United States will provide details, once available, of the recently proposed International Clean Energy Technology Fund, which is intended to fund projects in the developing world.

Project Interaction and Review Team (PIRT)
CSLF Task Force Strategic Implementation Report (TFIR)
30 September 2007

1. Task Force Members

The Team consists of:

- A Core Group comprising the Chair and Vice Chairs of the Technical Group, and other delegates as designated by the Technical Group. Current membership consists of representatives from:

Australia	John Bradshaw
Canada	Bill Reynen
Denmark	Flemming Ole Rasmussen
European Commission	Manuel Sanchez-Jimenez
Germany	Volker Breme
India	Malti Goel
Netherlands	Erik Lysen
Norway	Trude Sundset
Saudi Arabia	Khalid Abuleif
UK	Nick Otter
USA	Howard Herzog

  The chair is performed via a 3 co-lead approach (currently with Australia, E.C., and UK) with 1 person to change on an annual basis, so ensuring continuity, sharing the work load and providing opportunity for change.
- A Floating Group comprising representatives of CSLF recognized projects with overall management responsibility in the project (e.g. project manager), as well as other subject area experts.

2. Purpose of Task Force

The PIRT has the following tasks:

- Assess projects proposed for recognition by the CSLF in accordance with the project selection criteria approved by the Policy Group. Based on this assessment, make recommendations to the Technical Group on whether a project should be accepted for recognition by the CSLF.
- Review the CSLF project portfolio and identify synergies, complementarities and gaps, providing feedback to the Technical Group and input for further revisions of the CSLF roadmap.
- Identify technology gaps where further RD&D would be required.
- Foster enhanced international collaboration for CSLF projects, both within individual projects (e.g. expanding partnership to entities from other CSLF Members) and between different projects addressing similar issues.
- Promote awareness within the CSLF of new developments in CO_2 Capture and Storage by establishing and implementing a framework for periodically reporting to the Technical Group on the progress within CSLF projects and beyond.
- Organize periodic activities to facilitate the fulfillment of the above functions and to give an opportunity to individuals involved in CSLF recognized projects and other relevant individuals invited by the CSLF, to exchange experience and views

on issues of common interest and provide feedback to the CSLF.
- Perform other such tasks that may be assigned to it by the CSLF Technical Group.

3. Milestones

Near-term milestones are:

- Assessment of potential candidate CSLF Projects and make recommendations to the Technical Group as to their suitability. (Ongoing)
- Establish a mechanism for formalizing a relationship between the PIRT and the IEA GHG. (Ongoing)
- Examination of CSLF Technology Roadmap to identify any sections that need updating. (October 2007)
- CSLF Secretariat is continuing to engage with Member countries to obtain links to current Technology Road Maps for each country, and/or strategic planning documents for CCS that they have generated. This item is in response to the PIRT Action Plan item to have a "Technical roadmap developed for each area including links with member country roadmaps".

4. Status

- A mechanism for formalizing a relationship between the PIRT and the IEA GHG has been agreed in principle between both parties. It will be formally discussed at the forthcoming IEA GHG R&D Programme ExCo to be held in Daejon, South Korea on 16-19 October 2007.
- Knowledge gained from the E.C.'s Zero Emission Platform (ZEP) project will now be considered for any relevant PIRT activities. Part of this is to seek to use resources from the EC FP7 R&D Programme in the future, this being open to organizations from CSLF members especially developing countries. A future call from the EC for FP7 is due in November 2007. It is planned to raise how this can be used at the forthcoming Technical Group meeting in January 2008.
- A plan to review and potentially update the CSLF TRM has been established under the leadership of the EC as agreed at the Technical Group meetings held in London in November 2006. This will involve a special Review Team being established from within the PIRT in order to make recommendations to the full PIRT and to the Technical Group meeting in January 2008. Nominations for this team have been requested by the end of September 2007.
- The comprehensive Gap Assessment completed and presented at the CSLF Workshop in Paris in April 2007 is being used in the process of reviewing and updating the TRM and so help identify where CSLF projects to could be encouraged in relation to the CSLF Charter.
- The EC has agreed to continue with the role as the third co-Chair of the PIRT. This means that the co-Chair role rotates an annual basis between Australia, the EC and the UK. The UK has the chair at this time and the rotation will proceed with the EC taking the position in 2008.

Task Force for Review and Identification of Standards for CO_2 Storage Capacity Estimation

CSLF Task Force Strategic Implementation Report (TFIR)

15 September 2007

1. Task Force Members

- Stefan **Bachu**, Canada, Chair
- Didier **Bonijoly**, France
- John **Bradshaw**, Australia
- Robert **Burruss**, USA
- Niels Peter **Christensen**, EC
- Sam **Holloway**, UK
- Marcelo **Ketzer**, Brazil
- Odd-Magne **Mathiassen**, Norway

2. Purpose of Task Force

- The main goal of the Task Force is to develop and disseminate a clear set of definitions and methodologies that will allow:
  1) Consistent assessments of CO_2 storage capacity in geological media at various levels based on jurisdiction and/or geological domains that will provide decision makers in government and industry with the information needed for making the right decisions regarding CCS implementation;
  2) Comparison of CO_2 storage capacity at various levels (country, basin, regional) and among sites;
  3) Understanding of the basis for estimation and critical review of results.
- Performance indicators are (updated on September 15, 2007):
  1) Adoption of the report by the CSLF Technical Group (*realistic*) - Achieved
  2) Publication of Task Force work in technical & scientific journals to achieve wide dissemination (*realistic*) – Achieved (paper in press)
  3) Adoption of definitions and methodologies by CSLF member countries (*realistic*) - Partially achieved, some member countries are using them
  4) Provision on an ad-hoc basis of support to the CSLF Task Force on Capacity Building and to CSLF member countries on knowledge transfer and estimation of storage capacity (*realistic*) - Achieved
  5) Adoption of definitions and methodologies by other countries (*ambitious*)
  6) Use of the recommended definitions and methodologies by government, research and/or industry groups in producing assessments of CO_2 storage capacity at various levels (country, basin, regional, local and site specific)

Previous attempts to assess CO_2 storage capacity used a wide variety of approaches and methodologies that considered various trapping mechanisms, and data sets of variable size and quality, resulting in widely varying estimates of inconsistent quality and reliability. In September 2004 CSLF established a *Task Force for Review and Development of Standard Methodology for Storage Capacity Estimation*. In September 2005 the Task Force presented the results of Phase 1 in a Discussion Paper in which previous estimates were critically analyzed and gaps in knowledge and/or methodology

were identified. In March 2007 the Task Force presented the Phase 2 Report covering definitions, concepts and methodologies to be used in estimating CO_2 storage capacity that should serve as a basis for collecting the necessary data and properly estimating the CO_2 storage capacity in geological media. In March 2007 CSLF approved three Task Force recommendations to continue work in Phase 3 on:

- Harmonization of methodologies developed by the CSLF Task Force with methodologies developed by other groups, such as the USDOE Regional Partnerships Geologic Subgroup;
- Compilation of representative case studies of CO_2 storage capacity estimation at various scales in various geological settings and different countries;

Provision of support to the CSLF Capacity Building Task Force on knowledge transfer to CSLF-member developing countries.

3. Milestones

- Phase 2 Report to be completed and adopted at the CSLF Joint Meeting of the Policy and Technical Groups in Paris, March 25-28, 2007 - Achieved
- Recommendations regarding future work to be presented at the next CSLF Joint Meeting of the Policy and Technical Groups in March 2007- Achieved
- Possibly a paper to be submitted to and published in the International Journal of Greenhouse Gas Control, summer 2007- Achieved
- Inclusion of definition and methodologies in training materials to be produced by the CSLF Capacity Building Task Force- Achieved
- Provision of support to the CSLF Capacity Building Workshops organized between the 2007 and 2008 CSLF meetings – New
- Harmonization of methodology between the CSLF Task Force on CO_2 Storage Capacity estimation and the USDOE Regional Partnerships Geologic Subgroup - New

4. Status

- Stefan Bachu, Task Force Chair, was asked by USDOE to become a member of the USDOE Regional Partnerships Geologic Subgroup, and in this capacity he is involved in developing methodologies for estimating CO_2 storage capacity by this group, hence indirectly in identifying differences, if any, between the methodologies proposed for estimation of CO_2 storage capacity by the CSLF Task Force and the USDOE Regional Partnerships Geologic Subgroup.
- Methodologies recommended by the CSLF Task Force are being used within the EU GeoCapacity project which involves approximately 20 European countries (see www.GeoCapcity.EU), and also for estimating CO_2 storage capacity in India
- Examples of application will be compiled as a result of these projects

Task Force to Examine Risk Assessment Standards and Procedures
CSLF Task Force Strategic Implementation Report (TFIR)
September 2007

1. Task Force Members

- Howard Herzog, United States (Outgoing Chair)
- George Guthrie, United States (Incoming Chair)
- John Bradshaw, Australia
- Bill Koppe, Australia
- Stefan Bachu, Canada
- Hubert Fabriol, France
- Mathieu Feraille, France
- R.R. Sonde, India
- Makoto Akai, Japan
- Chiaki Shinohara, Japan
- Ton Wildenborg, Netherlands
- Odd-Magne Mathiassen, Norway
- Tim Dixon, United Kingdom
- John Gale, IEA GHG
- Rabih Chammas, France (new member)
- Claudia Vivalda, France (new member)

2. Purpose of Task Force

In this task force, we will identify potential risks from CO_2 Capture and Storage (CCS) activities and we will examine the risk assessment standards and procedures that could be used to place these risks in context based on their likelihood to occur and their possible consequences. We will focus on risks that are unique to CCS: the risks associated with the injection and long-term storage of CO_2, a reactive, mobile, and buoyant fluid, in geologic reservoirs. Specifically, we will focus on:

1. Risks associated with CO_2 injection, including:
   - fracturing
   - fault re-activation
   - induced seismicity
2. Risk associated with any CO_2 migration from the storage reservoir, including:
   - the health, safety, and environmental risks of long-term CO_2 storage
   - the potential impact on natural resources such as groundwater and hydrocarbon deposits
   - fugitive emissions into the atmosphere

Specific activities of this task force will include:

- Review and summarize the existing literature and international activities on geological storage risk assessment
- Highlight the critical issues
- Propose what is needed to better understand and manage these risks

3. Milestones
▪ March 2007 – Initial meeting of Task Force ▪ June 2007 – Finalize mission statement and agree on planned Phase I activities ▪ January 2008 – Task force meets at TG meeting in Saudi Arabia. Prior to meeting, a draft of sections 1-3 will be circulated. ▪ March 2008 – Complete draft circulated for final review ▪ April 2008 – Complete Phase I activities and report on progress to CSLF
4. Status
▪ Mission statement completed. ▪ Draft outline of final report completed ▪ Action plan for Phase I completed ▪ Currently collecting input from task force members to incorporate into the report

Report of CSLF Secretariat
CSLF Strategic Implementation Reporting System (SPIR)
15 October 2007

A. Meetings and Workshops

- Past
  - CSLF Capacity Building Workshop (7-11 May 2007 in Pittsburgh, USA). The agenda and all presentations from the workshop have been posted to the CSLF website (see below).
  - CSLF Financial Issues Task Force Meeting (11-12 October 2007, New Delhi, India). The agenda for the meeting was developed by the Secretariat. The agenda and all presentations from the workshop have been posted to the CSLF website (see below). The Secretariat will also develop the minutes for the meeting and, once approved, post them at the CSLF website.
- Future
  - CSLF Capacity Building Workshop (17-19 October 2007, Porto Alegre, Brazil). The Secretariat is participating in this meeting and will make a presentation.
  - CSLF Technical Group (27-30 January 2008, Saudi Arabia). The Secretariat and the host country, Saudi Arabia, are working together to plan the meeting. The Secretariat has prepared a conceptual plan for the meeting in the form of a block diagram and also a draft agenda for the meeting that both been approved in principle (but still awaiting approval of suggested timeline changes) by the Technical Group Chair and the meeting host. The Secretariat will set up an online meeting registration page on the CSLF website. Room documents will be posted to the CSLF website at least a month in advance of the meeting. The Secretariat will facilitate all Task Force meetings scheduled in conjunction with the Technical Group meeting. Following the meeting, the Secretariat will develop the minutes for the meeting and, once approved, post them at the CSLF website.
  - CSLF Capacity Building Workshop (January 2008, Saudi Arabia). This will be a follow-up to the Pittsburgh workshop and will be held in conjunction with the Technical Group meeting. The Secretariat has developed a draft agenda for the workshop that has been approved by the Task Force Chairman, the Technical Group Chair, and meeting host.
  - CSLF Policy and Technical Groups (13-17 April 2008, Cape Town, South Africa). The Secretariat and the host country, South Africa, are working together to plan the meeting. The meeting will include another Capacity Building workshop. The Secretariat will set up an online meeting registration page on the CSLF website. Room documents will be posted to the CSLF website at least a month in advance of the meeting. The Secretariat will facilitate all Task Force meetings scheduled in conjunction with the Technical Group meeting. Following the meeting, the Secretariat will develop the minutes for the meeting and, once approved, post them at the CSLF website.

B. CSLF Public Meeting Place (PuMP)

A CSLF online discussion forum, titled the CSLF Public Meeting Place (or "PuMP"), is now online at the CSLF website for an extended trial. Its purpose is to facilitate greater involvement of the stakeholders and to foster greater communications both among stakeholders, and between stakeholders and the CSLF. However, there has been very little activity so far. The Secretariat will report on the performance of the PuMP at the April 2007 Policy Group meeting in South Africa.

C. Updates to CSLF website (www.cslforum.org)

The following change has been made to the CSLF website in order to improve it ease of navigability:

- A new search function for the website was created, which will allow users to locate information on the website about specific topics.

Additional updates to the website include the following:

- Agenda and presentations from CSLF Capacity Building Workshop, 7-11 May 2007 in Pittsburgh,
- Agenda and presentations from CSLF Financial Issues Task Force meeting, 11-12 October 2007 in New Delhi.
- Listings of delegates' contact information have been updated.

D. Other Activities

- Over this reporting period, the Secretariat handled approximately 200 pieces of incoming e-mail correspondence.

E. Stakeholders

There are now 100 registered stakeholders, four of which have requested not to be shown in the CSLF website listing. Members are encouraged to have their stakeholders register.

Report from Stakeholders
CSLF Strategic Implementation Reporting System (SPIR)
28 September 2007

PETROMIN RESOURCES LTD. & CHINA UNITED COALBED METHANE CORP. DEEP COAL CO2 SEQUESTRATION MULTI-WELL PILOT TEST

Canada Vancouver based Petromin Resources Ltd. and China United Coalbed Methane Corp. (CUCBM) has signed a letter of intent to implement the first ever CO_2 sequestration project in deep un-mineable coal in China. The project, estimated to span more than five years, and over more than 5 million US, will involve Petromin Resources Ltd., Hong Kong based Enviro-Energy International Holdings Ltd., Alberta Research Council, and China United Coalbed Methane Corp. to implement a multi-well CO_2 injection into deep coal seam and determine the sequestration potential and enhanced coalbed methane production in China. International partners will provide its own funding and technology to work closely with CUCBM to design, implement and monitor the progress of this pilot test. Results of the test will have significant implication to China in dealing with CO_2 reduction via geological sequestration process and also enhancing methane production. Publications related to the project will be released out to the forum when permissible.

For more information please visit the website at: www.Petromin.ca

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Hatfield Powerfuel (U.K.) Report

Introduction to Hatfield - key facts

- Located Hatfield Colliery, Doncaster, South Yorkshire, United Kingdom. 25 miles from the sea (CCS/EOR).
- 100 million tonnes of British coal reserves.
- Centrally located within a cluster of existing power stations.

Cluster Strategy for CO_2 Capture and Sequestration/EOR

- 60% of coal and gas power stations situated on the estuary of the Trent and Aire in Humberside
- Ideally located for storage in gas fields
- Ideal location for IGCC on shores of Humber for raw material feed (coal imports)
- In total ca 80 million tonnes of CO_2 could be captured within 30km radius of the Humber

Hatfield Power Project Update

- 900 MW gross, 740 MW with Carbon Capture
  Competitive Strengths:
- Humberside location – cluster development
- Minemouth power station – access to 100m tonnes coal

- Local planning permission
- Partial s36 consent
- Shell gasifier license agreed
- Hydrogen available for inner city buses
- Connection agreement
- Process Design Package
- Full FEED awarded to Jacobs
- Agreement with Air Products for ASU

Vision

- To be the first commercial coal fired power station in the world to generate with carbon capture

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The **Australian Petroleum Production & Exploration Association Limited Report**

Fairview Power Project

In November 2006, the Federal Government announced AUD 75 million support from the Federal Government Low Emissions Technology Demonstration Fund for a new gas-fired power station coupled with a CCS project to demonstrate the role of deep unmineable coal as a CO_2 sink in Eastern Australia.

The Fairview Project will see a new coal seam gas-fired power station and CCS project constructed at Injune, near Roma in Queensland. Further details are contained in the attached document.

CCS legislative and regulatory developments in Australia

The industry has continued to present its views to the Australian Government on the proposed development in 2007 of a legislative and regulatory framework for CCS activities in Australia.

Gorgon Project

During the second half of 2007 the Gorgon Project in Western Australia received it State and Federal Government environmental approvals. We understand that this is the first time a commercial scale geosequestration project has been subject to a formal environmental impact assessment process incorporating a public review and comment period. The Gorgon Joint Venturers still require a number of State Government approvals prior to making a final investment decision.

The Gorgon Joint Venturers are continuing to work with the Federal Government to finalise funding arrangements around the AUD 60 million grant offered as part of the Federal Governments Low Emissions Technology Demonstration Fund. This funding offer is contingent on the Project receiving its final approvals.

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United Kingdom Hydrogen Association Meets at Grove Fuel Cell Symposium

The United Kingdom Hydrogen Association (UKHA) met on 27 September in conjunction with the Grove Fuel Cell Symposium in London. Members were briefed on the UK Government commitment to international efforts and open funding opportunities. The UKHA has agreed to undertake the development of fact sheets to advance the understanding of the opportunities and challenges for hydrogen energy technologies in the UK. Also during this quarter the UKHA contributed input to the Stern-King review on low carbon cars.

Alberta Enhanced Coalbed Methane Recovery Project
CSLF Project Status Report (PSR)
September 2007

1. Project
Alberta Enhanced Coalbed Methane Recovery Project Alberta, Canada
2. Project Lead
▪ Brent Lakeman, Alberta Research Council ▪ Telephone: 1 780 450-5274 ▪ E-Mail: Lakeman@arc.ab.ca
3. Project Objectives
▪ Reduce greenhouse gas emissions by subsurface injection of CO_2 into deep coal beds ▪ Enhance coal-bed methane recovery factors and production rates as a result of CO_2 injection
4. Recent Milestones
▪ Completion of a single-well micro-pilot test at Suncor's CSEMP site ▪ Baseline seismic survey completed ▪ N_2 tracer injected with offset well monitoring completed ▪ Long term CO2 injection initiated and suspended due to well-bore issue
5. Status
▪ CO_2 testing completed for single well micro-pilot ▪ Engineering and Reservoir Modelling analysis being completed for micro-pilot ▪ Tiltmeter response being reviewed ▪ Analysis of injection well issue completed ▪ EUB approval obtained for remedial work on injection well

CASTOR

CSLF Project Status Report (PSR)

September 2007

1. Project
CASTOR "CO2 from Capture to Storage" Capture: Esbjerg, DK (Castor pilot plant) Storage: Casablanca (Spain), Atzbach (Austria), K12B (The Netherlands), Snohvit (Norway)
2. Project Lead
▪ Pierre Le Thiez, IFP, France, +33 1 47 42 67 23, pierre.le-thiez@ifp.fr
3. Project Objectives
▪ Develop innovative technology for post-combustion capture, tests in pilot plant (1 tonne CO2 / hour) ▪ Detailed feasibility studies of 4 storage sites in Europe – Update of Best Practice Manual
4. Recent Milestones
▪ Jan 06: Start of the capture pilot plant tests – Base case with MEA ▪ March 07: Start of testing CASTOR 1 solvent in the pilot ▪ September 07: Start of testing of CASTOR 2 solvent in the pilot
5. Status
▪ Start in Feb 04 – End Feb 08 ▪ CASTOR 2 solvent under test (Sept. – Dec. 07) ▪ Four site studies in progress (modeling, monitoring design, …) ▪ Final CASTOR workshop 22-24 January 2008 with ENCAP, CACHET and DYNAMIS EU projects.

CO_2 Capture Project, Phase 2
CSLF Project Status Report (PSR)
June 2007

1. Project

CO_2 Capture Project, Phase 2 (CCP2)
Project Office: 150 West Warrenville Road, Naperville, Illinois, 60563 USA

2. Project Lead

- CCP2 Program Manager: Linda Curran, BP
- CCP2 Executive Board Chairman: Gardiner Hill, BP
- Capture Team Lead: Ivano Miracca, ENI
- Storage Team Lead: Scott Imbus, Chevron
- Communications Team Lead: Iain Wright, BP
- Policy Team Lead: Arthur Lee, Chevron
- CCP2 Advisory Board Chair: Vello Kuuskraa

3. Project Objectives

- Develop advanced technology that will reduce costs and improve efficiencies of CO_2 Capture
- Increase knowledge and reduce uncertainties in technology performance and deliver low-cost CO_2 capture technologies to demonstration stage by 2009
- Demonstrate geological storage of CO_2 is secure and can represent a viable Greenhouse Gas mitigation technique. Develop technology and protocols to address critical issues such as storage site/project certification, well integrity and monitoring
- Increase public awareness and acceptance of CCS
- A distinctive aspect of CCP2 is the emphasis on collaboration and partnership with governments, industry, NGOs, and other stakeholders. The members of the partnership recognize the challenges associated with global climate change require solutions that are economically and socially accepted to all.

4. Recent Milestones

- Well Exposure Information: Quantitative assessment of materials stability in a well exposed over several decades to humid CO2. Two examinations of a single well have made; samples are undergoing analyses to understand interactions with well construction materials.
- Development of a stream-lined, integrated, risk-based model for technical assessment of potential storage sites. The first case study is complete in draft form (Fulshear natural gas storage facility near Katy, Texas). Others are underway.

5. Status

- Progressing 10 capture (post-combustion, pre-combustion and oxy-fuel) technologies to be ready for pilot or demonstration in 2009 ; technology evaluations are underway leading to recommendations for the pilots/demos
- Fundamental data on the status of wells materials after decades-long CO_2 exposure; Simple, transparent and integrated certification framework suitable for regulator use ready for testing by end 2007; Code integration for Coupled Geochemical and Geomechanical simulation; Novel approaches to optimize the resolution and cost

effectiveness of monitoring and leakage detection are under development

- Recent reports and papers published:
  - A Framework for Certification and Operation of CO2 Geological Storage
  - Storing CO2 Underground

  These reports can be found on the CCP2 website: http://www.co2captureproject.org/index.htm

CO2CRC Otway Project
CSLF Project Status Report (PSR)
September 2007

1. Project

CO2CRC Otway Project (Otway Project)
Demonstrating the geological storage and monitoring of CO_2 under Australian conditions

2. Project Lead

Sandeep Sharma, CO2CRC, Kensington WA 6151, Australia, Ph: 08 6436 8736,
Mob: 0412 515 494, ssharma@co2crc.com.au

3. Project Objectives

The Otway project has been designed to demonstrate all aspects of CCS. It will aim to provide technical information on geosequestration processes, technologies and monitoring and verification regimes that will help to inform public policy and industry decision-makers and assurance to the community.

- Operation:
  - Safely produce CO_2 from Buttress well;
  - Safely process the gas stream and transport to the injection site;
  - Safely inject CO_2 into the Naylor reservoir formations through well CRC-1;
  - Install an integrated monitoring system into the existing Naylor –1 well.
  - Maintain an effective risk management system;
  - Safely abandon the site and facilities including necessary restoration work.
- Research:
  - Effectively model the CO_2 behaviour in the sub-surface;
  - Demonstrate safe storage of the CO_2 in the sub-surface to satisfaction of stakeholders;
  - Verify that CO_2 remains within the storage formation, or in the unlikely event of migration from the primary reservoir, it remains contained in the secondary reservoir;
  - Develop, test and deploy new and enhanced M&V technology;
  - Contribute to the technology and other objectives of the CO2CRC towards reducing greenhouse gas emissions.
- Regulation:
  - Map the legislative framework necessary including overlapping jusrisdictions and in doing so provide data to inform a future regulatory regime for CCS;
  - Contribute to test the existing regulatory environment with the development of CCS technologies
- Communication
  - Communicate effectively with the community and stakeholders through a defined outreach program to inform them of the nature, progress and outcomes of the project
  - Capture research outcomes and contribute to the development of acceptance of CCS as a greenhouse gas mitigation mechanism in Australia and globally

4. Recent Milestones

- Reservoir modeling & simulation with new data acquired from new drill injection well CRC-1 revisited and peer-reviewed;
- Injectivity test plan revisited;
- Integrated downhole assembly in the monitoring well Naylor 1 being built in the US and shipped to Australia (ready to be installed);
- Tracers program finalised;
- Perforations of Naylor-1 well and CRC-1 logging;
- Quantitative Risk Assessment (QRA 2) peer – reviewed and accepted;
- Dataloggers first measurements of water levels in boreholes;
- Interpretation of the results from the air monitoring program;
- Southern Rural Water: approval to injection CO2 granted
- Environment Protection Authority Research Demonstration and Development: approval to store CO2 granted;
- Project gazetted as being of State Significance and compulsory acquisition of part of the land to proceed with plant construction.

5. Status

- Construct and install the compressor and pipeline (CO_2 transport from production well to injection well ~2.25km) (Oct-Nov 07);
- Instrument and test the Integrated downhole assembly for geochemical and geophysical measurements in the monitoring well (Naylor-1) (Oct 07);
- Carry out baseline 3DVSP and surface seismic (Nov 07);
- Interpret baseline water chemistry/level measurements (completed by Dec 07)*;*
- Continue to resolve landowner agreements (Nov 07);
- Resolve long term liabilities issue (Dec 07);
- Continue community consultation (ongoing);
- **Injection of CO2 into the depleted gas field Waarre C to start by the end of December 2007;**
- Further develop the Otway Stage 2 activities (ongoing);

CO_2 Separation from Pressurized Gas Stream
CSLF Project Status Report (PSR)
September 2007

1. Project

CO_2 Separation from Pressurized Gas Stream
Coordinator: RITE, Japan

2. Project Lead

- Shingo Kazama, RITE (Research Institute of Innovative Technology for the Earth)
- E-mail: Kazama@rite.or.jp

3. Project Objectives

- Development of membrane material for molecular gate function and composite membrane of excellent CO_2 selectivity over H_2
- Development of membrane module
- Testing of the module (with NETL, USA)

4. Recent Milestones

- Development of membrane material for molecular gate function (2007FY)
- Development of composite membrane of excellent CO_2 selectivity over H2 (2007FY)
- Trial product of pencil module (2007FY)

5. Status

- 1st duration: 11 /2003 – 03/2006 Completed
- Development of novel dendrimer materials for CO_2 separation
- Fabrication of dendrimer composite membrane modules and their test

References:
Shingo Kazama, Teruhiko Kai, Takayuki Kouketsu, Shigetoshi Matsui, Koichi Yamada, James S. Hoffman, Henry W. Pennline, "Experimental Investigation of a Molecular Gate Membrane for Separation of Carbon Dioxide from Flue Gas", Pittsburgh Coal Conference, Pittsburgh, USA (2006)

Takayuki Kouketsu, Shuhong Duan, Teruhiko Kai, Shingo Kazama*, and Koichi Yamada, "PAMAM Dendrimer Composite Membrane for CO_2 Separation: Formation of a Chitosan Gutter Layer", *J. Membrane Sci*. 287 (2007) 51-59 and so on.

- 2nd duration: 04/2006 – 03/2011 ongoing
- Development of novel CO_2 molecular gating materials for a CO_2/H_2 mixture
- Development of membrane modules of CO_2 molecular gate membrane
- Bench scale testing (2010FY)

CO_2SINK
CSLF Project Status Report (PSR)
September 2007

1. Project

CO_2SINK - In situ R&D Laboratory for Geological Storage of CO_2
Ketzin, State of Brandenburg, Germany
http://www.co2sink.org

2. Project Lead

GeoForschungsZentrum Potsdam
Telegrafenberg
D-14473 Potsdam
http://www.gfz-potsdam.de
Coordinator: Prof. Dr. Frank Schilling
Tel: +49.331.288-1510
Fax: +49.331.288-1502
E-mail: fsch@gfz-potsdam.de

3. Project Objectives

- Developing a basis for geologic storage of CO_2 into a saline aquifer
- Establishing the first European in-situ laboratory for onshore storage of CO_2
- Characterization of flow and reaction processes in geologic storage, including detailed analysis of samples of rocks, fluids and microorganisms from the underground reservoir
- Intensive monitoring of the injected CO_2 using a broad range of geophysical and geochemical techniques
- Development and benchmarking of numerical models
- Definition of risk-assessment strategies

4. Recent Milestones

- Feb. 27, 2007 Spud-in of the CO_2SINK injection well IW
- May 25, 2007 Spud-in of the 1st of the observation wells OW1
- June 13, 2007 Opening of the Ketzin Field Lab, CO_2 Storage Site and Info Centre
- June 27, 2007 Annual Review of the Project by EU
- Sept. 8, 2007 One injection and two observation wells drilled and cemented

5. Status

- 5-years lifetime 04/2004 - 03/2009
- 09/2007 start injection of up to 60,000 tonnes CO_2

Completed subprojects:
- Storage site development
- Baseline Storage Site Modeling

Ongoing subprojects:
- Rock/fluid interactions laboratory experimentation
- Economic/ecological analysis and safety concepts
- GeoEngineering: drilling, coring, logging
- CO_2 supply, transport, intermediate storage, conditioning and injection

- Monitoring and verification of CO_2 storage
- Project coordination and public outreach

Reference:
Förster, A., Bech, N., Bielinski, A., Borm, G., Christensen, N.P., Cosma, C., Erzinger, J., Giese, R., Heidug, W., Hurter, S., Juhlin, C., Knöss, S., Kopp, A., Kulenkampff, J., Norden, B., Spangenberg, E., Zimmer, M., Zink-Jörgensen, K. (2005): Baseline Survey in the Preparatory Phase of CO_2SINK. Environmental Geosciences, Vol. 13, No. 3, 145-161

Frio Brine Pilot Project
CSLF Project Status Report (PSR)
September 2007

1. Project
Frio Brine Pilot Project South Liberty oilfield, east of Houston, Texas, USA
2. Project Lead
▪ Susan Hovorka, Gulf Coast Carbon Center, The Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, USA ▪ Tom Daley, Lawrence Berkley National Lab, Berkeley, California, USA ▪ Yousif Kharaka, U.S. Geological Survey, Menlo Park, California, USA
3. Project Objectives
▪ Project Goal: Early success in a high-permeability, high-volume sandstone representative of a broad area that is an ultimate target for large-volume sequestration. ▪ Demonstrate that CO_2 can be injected into a brine formation without adverse health, safety, or environmental effects ▪ Determine the subsurface distribution of injected CO_2 using diverse monitoring technologies ▪ Demonstrate validity of conceptual and numerical models ▪ Develop experience necessary for success of large-scale CO_2 injection experiments
4. Recent Milestones
▪ Second injection competed October 1, 2006 ▪ Confirm no-detect at surface of perfluorocarbon tracers ▪ Post injection monitoring of second injection completed September 2007
5. Status
▪ Two short duration injection tests completed: Frio 1, Oct 2004; Frio 2 September 2006 ▪ Assessment of storage permanence – quantifying residual saturation and dissolution of year long period following injection ▪ Post- injection stable conditions attained – monitoring program nearing completion ▪ Novel tool assessments – U-tube; tubing-conveyed seismic array, inline pH, ▪ Reports can be found at http://www.gulfcoastcarbon.org

IEA GHG Weyburn-Midale CO_2 Monitoring & Storage Project
CSLF Project Status Report (PSR)
September 2007

1. Project
IEA GHG Weyburn-Midale CO_2 Monitoring & Storage Project Weyburn & Midale Units, Weyburn area of south east Saskatchewan, Canada
2. Project Lead
▪ Natural Resources Canada (NRCan) – Frank Mourits, Project Integrator ▪ PTRC – Carolyn K. Preston, Executive Director ▪ PTRC – Ray Knudsen, Project Director (Technical research component of the project) ▪ Sask. Industry & Resources (SIR) – Floyd Wist, Chair of Leading Sponsors Executive Committee (LSEC)
3. Project Objectives
▪ Develop a comprehensive Best Practices Manual for CO_2 geological storage ▪ Building on the successes of the First Phase, focus the technical research component on Site Characterization, Monitoring & Verification, Wellbore Integrity and Performance (Risk) Assessment ▪ Within the new Policy Component, focus on Public Communication & Outreach, Regulatory Issues and the Business Environment
4. Recent Milestones
▪ 2nd Qtr 2007 – OMV Austria Exploration & Production GmbH joins as co-sponsor ▪ 3rd Qtr 2007 – Theme Leader contracts completed ▪ 3rd Qtr 2007 – Research Provider Agreement with University of Saskatchewan executed, initial research activities underway ▪ 3rd Qtr 2007 – Project presented at the NETL Peer Review meeting in Pittsburgh
5. Status
▪ Executing Research Provider Agreements and Research Assignments for technical research tasks ▪ Working with research providers undertaking technical research activities ▪ Continuing Public Communication & Outreach initiatives ▪ Assessing recent proposals received for the Policy Component of the Project ▪ Sponsorship campaign ongoing

Regional Carbon Sequestration Partnerships
CSLF Project Status Report (PSR)
September 2007

1. Project

Regional Carbon Sequestration Partnerships
National Initiative Managed by the U.S. Department of Energy National Energy Technology Laboratory (NETL)

2. Project Lead

- Sean Plasynski, Sequestration Technology Manager, National Energy Technology Laboratory
- John Litynski, Coordinator, Regional Carbon Sequestration Partnerships, National Energy Technology Laboratory

3. Project Objectives

- To coordinate this government/industry effort of seven Regional Carbon Sequestration Partnerships (RCSP) tasked with determining the most suitable technologies, regulations, and infrastructure needs for carbon capture, transport, and sequestration across areas of the United States and Canada.
- To develop the necessary infrastructure for the future deployment and commercialization of carbon capture and storage (CCS) technologies as a critical strategy for climate change and greenhouse gas emissions mitigation.
- To implement the RCSP program in three phases:
  - The Characterization Phase evaluated opportunities for sequestration. The Partnerships collected data on CO_2 sources and sinks; developed the human capital to support and enable deployment of future carbon sequestration field tests; determined which sequestration approaches were best suited for their specific regions of the country; and studied the regulations and infrastructure needed for potential wide-scale deployment of sequestration.
  - The Validation Phase is focused on validating the most promising regional sequestration opportunities through a series of small-scale field tests. This phase builds upon Characterization Phase accomplishments and begins field testing of geologic and terrestrial sequestration technologies to provide the technical foundation for Deployment Phase activities.
  - The Deployment Phase will demonstrate at large scale that CO_2 capture, transport, injection, and storage can be achieved safely, permanently, and economically. The primary goal of the Deployment Phase is the development of large-scale CCS projects across North America. The Partnerships will inject up to 1 million tons of CO_2 per project per year into geologic formations representative of potential sinks in each region.

4. Recent Milestones

- Characterization Phase completed in 2005
  - Regional Carbon Sequestration Partnerships Phase I Accomplishments: http://www.netl.doe.gov/technologies/carbon_seq/partnerships/phase1/workproducts_table.html.
- Validation Phase initiated in 2005, with small-scale field tests currently underway

and scheduled for completion in 2009
    - Development of the Carbon Sequestration Atlas, which identified over 3,600 gigatonnes of estimated geologic CO_2 storage capacity.
    - Storage capacity estimates being modified by data obtained in the validation efforts
    - Injection of CO_2 into depleted oil and gas fields has increased knowledge of CO_2 capture, transport, MMV requirements, and regulations
    - Ten ongoing saline formation field tests
    - Ten enhanced oil or gas recovery projects are being conducted for value-added CO_2 storage
    - Five ECBM tests conducted at unmineable coal seams
    - Eleven ongoing Terrestrial sequestration projects include no-till farming, conversion of marginal croplands to grasslands and forests, restoring vegetation on mined areas, wetland restoration, and reforestation
- Deployment Phase activities scheduled to begin in 2007 and run through 2017

5. Status

- The RCSPs, which span 41 states, 2 Indian nations, and 4 Canadian provinces, include agency participation from six member countries of the CSLF.
- 25 geologic and 11 terrestrial field tests currently underway in the Validation Phase
- Deployment Phase applications submitted in June 2007 with awards expected in 2008.

6. Links to RCSP Programmatic Information

- Carbon Sequestration Atlas of the United States and Canada: http://www.netl.doe.gov/publications/carbon_seq/atlas/ATLAS.pdf.
- An Introduction to Carbon Capture and Sequestration (video): http://ims.netl.doe.gov/Video/carbon_sequestration_sept.wmv.
- Carbon Sequestration Technology Roadmap and Program Plan 2007: http://www.netl.doe.gov/publications/carbon_seq/refshelf.html.
- Carbon Sequestration Program Environmental Reference Document: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/nepa/AA%20 %20Assembled%20Document.pdf.
- Carbon Sequestration Project Portfolio: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/project%20portfolio/2007/table_contents.pdf

Regional Opportunities for Carbon Dioxide Capture and Storage in China
CSLF Project Status Report (PSR)
September 2007

1. Project

Regional Opportunities for Carbon Dioxide Capture and Storage in China

2. Project Leads

- R Gentile, Leonardo Technologies, Inc.
- R Dahowski, Battelle – Pacific Northwest Division
- C Davidson, Battelle – Pacific Northwest Division
- J Dooley, Battelle – Pacific Northwest Division, JGCRI
- X Li, Institute of Rock and Soil Mechanics, Chinese Academy of Sciences
- T Fei, Tsinghua University

3. Project Objectives

- Develop the first ever bottom-up cost assessment of the potential to utilize carbon dioxide capture and storage (CCS) across the Chinese economy
- Assess the potential and costs for CCS technologies to deploy across regions of China
- Inventory large anthropogenic CO_2 point sources from power plants and other industrial sources
- Identify potential candidate geologic CO_2 storage reservoirs/basins which could be used for the safe, long-term storage of CO_2
- Examine the economics of CCS and develop cost curves for CO_2 transport and storage via optimized source-reservoir matching

4. Recent Milestones

- Meetings of project participants held in Beijing in April
- Early development of CO_2 source inventory and storage options in 160 potential storage basins, including deep saline formations, oil and gas reservoirs, and coal seams
- Preliminary characterization and mapping of over 1800 large CO_2 point sources

5. Status

- Ongoing; expected completion: Summer 2008
- Data collection and synthesis phase of project well underway
- Integrated analysis phase to begin shortly

Zama Acid Gas EOR, CO_2 Sequestration, and Monitoring Project
CSLF Project Status Report (PSR)
September 2007

1. Project

Zama Acid Gas EOR, CO_2 Sequestration, and Monitoring Project
Zama City, Alberta, Canada

2. Project Leads

- Ed Steadman, Energy and Environmental Research Center, Grand Forks, ND, USA
- Steven Smith, Energy and Environmental Research Center, Grand Forks, ND, USA
- Bill Jackson, Apache Canada Ltd, Calgary, Alberta, Canada

3. Project Objectives

- To validate the sequestration of CO_2-rich acid gas in a depleted oil reservoir.

4. Recent Milestones

The following reports have been completed to date:

- Acid Gas-Brine Static Partitioning Study
- A Study of the Reservoir Condition Drainage and Imbibition Permeability
- Displacement Characteristics of Supercritical Carbon Dioxide in the Zama Area, Sulphur Point Formation
- Experimental Study of CO2 and H2S Partitioning in a Brine-Saturated Porous Medium
- Evaluation of Zama Field Wellbore Integrity, Part I
- Evaluation of Zama Field Wellbore Integrity, Part II (Evaluation of Leakage Potential by Well)
- Regional-Scale Geology and Hydrogeology of Acid-Gas
- Enhanced Oil Recovery in the Zama Oil Field in Northwestern Alberta, Canada
- Reservoir Condition CO2-Brine Drainage and Imbibition Relative Permeability Displacement Characteristics in the Zama Area, Muskeg Anhydrite Formation (Caprock)
- Uniaxial, Triaxial and Elastic Properties Determinations on Samples from the Zama Field, Northwest Alberta
- Evaluation of Deep Wellbore Integrity In the Zama Field

5. Status

- Injection of Acid Gas is ongoing. Cumulative Acid Gas injection volume of 140,000 mcf (8000 tons) through August 27th, 2007, has occurred.
- Core collection for rock that has been exposed to Acid Gas should occur in late 2007 to early 2008.