



# Strategic Plan Implementation Report

March 2008

# Table of Contents

<b>ITEM</b>	<b>PAGE</b>
<b>Task Force Reports</b>	
<u>Policy Group</u>	
Capacity Building Task Force .....	1
Financial Issues Task Force .....	2
<u>Technical Group</u>	
Projects Interaction and Review Team (PIRT) .....	4
Storage Capacity Estimation Task Force .....	6
Risk Assessment Task Force .....	8
<b>Other Reports</b>	
Report from CSLF Secretariat .....	10
Report from Stakeholders .....	12
<b>Status Reports from CSLF Recognized Projects</b>	
Alberta Enhanced Coalbed Methane Recovery Project .....	15
CASTOR .....	16
CO <sub>2</sub> Capture Project, Phase 2 (CCP2) .....	17
CO <sub>2</sub> GeoNet Project .....	18
CO <sub>2</sub> CRC Otway Project .....	19
CO <sub>2</sub> SINK .....	20
ENCAP .....	21
Frio Brine Pilot Project .....	22
Geologic CO <sub>2</sub> Storage Assurance at In Salah, Algeria .....	23
IEA GHG Weyburn-Midale CO <sub>2</sub> Monitoring and Storage Project .....	24
International Test Center (ITC) CO <sub>2</sub> Capture with Chemical Solvents .....	25
Regional Carbon Sequestration Partnerships .....	26
Regional Opportunities for Carbon Dioxide Capture and Storage in China .....	28
Zama Acid Gas EOR, CO <sub>2</sub> Sequestration, and Monitoring Project .....	29

**Capacity Building in Emerging Economies Task Force**  
**CSLF Task Force Strategic Implementation Report (TFIR)**  
*March 2008*

<b>1. Task Force Members</b>
<ul style="list-style-type: none"><li>▪ Australia</li><li>▪ Canada</li><li>▪ Colombia</li><li>▪ European Commission</li><li>▪ France</li><li>▪ India</li><li>▪ Italy</li><li>▪ Mexico</li><li>▪ Saudi Arabia</li><li>▪ South Africa</li><li>▪ United Kingdom</li><li>▪ United States - Chair</li></ul>
<b>2. Purpose of Task Force</b>
<p>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.</p>
<b>3. Milestones</b>
<ul style="list-style-type: none"><li>▪ A Workshop on Capacity Building for Carbon Capture &amp; Storage (CCS) for CSLF Members in Emerging Economies was held in, Saudi Arabia, January 27 to 30, 2008.</li><li>▪ Seventeen countries were represented at the Al Khobar workshop which was offered within the framework of the CSLF Technical Group Business Meeting. Sixty participants and twenty one presenters took part in this third Capacity Building Workshop. There was a total flow of 130 participants during the workshop which was held in conjunction with the Technical Group meeting.</li><li>▪ The Saudi government hosted the meeting and workshop and Saudi Aramco sponsored the event, providing support for some of the lecturers travel expenses.</li><li>▪ The Saudi Arabia workshop featured a slightly different format, with the lectures centered around four themes:<ol style="list-style-type: none"><li>1. Commercial Aspects and Opportunities for Storage of CO<sub>2</sub> in Oil and Gas Reservoirs</li><li>2. Technology Roadmaps and Their Importance</li><li>3. Issues that Impact CCS</li><li>4. The Needs of Emerging Economy Countries</li></ol></li><li>▪ The workshop featured ample opportunities for panel discussion and interaction with the audience. The format was set so that the amount for presentations was limited thus allowing time for questions and answers. A moderator was responsible for keeping the dialogue flowing.</li><li>▪ Of the four topics, the first one dealing with Commercial Aspects and Opportunities appeared to be of most interest. The workshop was more regional in its approach and topics discussed thus the emphasis in oil and gas related issues as opposed to coal issues that had been highlighted in previous workshops.</li><li>▪ The topic on Roadmaps was also well-received. The workshop was the venue where the Saudi representatives chose to unveil their own Technical Roadmap for CCS.</li><li>▪ The workshop also featured a visit to the Shaybah Field Gas-Oil Separation Plant where some of the sessions were also held.</li></ul>

- Another highlight of the workshop was the participation of an official from the Asian Development Bank who addressed issues of financing projects in emerging economies.
- The excellence attendance along with the exceedingly high caliber of the presenters, the dynamic format, and the field trip deemed this workshop a success.
- All presentations from the workshop have been posted on the CSLF website.

#### **4. Status**

- The Chair of the Task Force, presented a 2-year plan for this Task Force to the members during the meeting held in Calgary. The plan was discussed at the meeting and comments on the plan have been submitted to the Task Force Chair. The plan will be finalized in early 2008.
- The Task Force continues to explore the manner to create core training modules for capacity building based on the materials thus far gathered from the workshops held. The materials would be standardized and aimed at decision-makers from both the public and private sectors.
- The complete list of workshops confirmed or proposed is:
  - Saudi Arabia, January 2008 - confirmed
  - Mexico, July 2008 - proposed
  - Brazil, September 2008 - confirmed
  - U.S.A., November 2008 - confirmed
  - India, January 2009 - proposed
  - China, second quarter 2009 - proposed
  - Colombia, second half 2009 – proposed
  - South Africa, TBD
- The next meeting of the Task Force will take place in Cape Town, South Africa, on Sunday April 13, 2008.
- Financing the workshops continues to be an issue of concern and the Task Force members will keep trying to determine options and available opportunities.

**Financial Issues Task Force**  
*CSLF Task Force Strategic Implementation Report (TFIR)*  
March 2008

<b>1. Task Force Members</b>
<ul style="list-style-type: none"><li>▪ India – Chair</li><li>▪ Australia</li><li>▪ European Commission</li><li>▪ France (<i>new member as of October 2007</i>)</li><li>▪ Korea</li><li>▪ Netherlands</li><li>▪ South Africa</li><li>▪ United Kingdom</li><li>▪ United States</li></ul>
<b>2. Purpose of Task Force</b>
The objective of the Task Force is to develop a detailed plan for financing carbon capture and storage (CCS) projects in emerging economy countries.
<b>4. Milestones</b>
<ul style="list-style-type: none"><li>▪ The Task Force was re-formed at the Paris CSLF meeting in March 2007.</li><li>▪ 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.</li><li>▪ 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.</li></ul>
<b>4. Status</b>
<ul style="list-style-type: none"><li>▪ The United States was to 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 (ADB) has provided a copy of a report by former World Bank Vice President Richard Stern which describes many of these entities.</li><li>▪ The United States was to provide details, once available, of the recently proposed International Clean Energy Technology Fund, which is intended to fund projects in the developing world.</li><li>▪ The Task Force members were requested to provide comments on proposed conclusions from Task Force meeting, as offered by India.</li><li>▪ The United States has informed that the Richard Stern report provides little information related to support for CCS activities, indicating that this is an area the multilateral development institutions (MDIs) are yet to focus and that we may make a formal request to ADB for identifying opportunities within MDIs and by other international financial institutions for facilitating CCS adoption.</li><li>▪ No other comment has been received so far.</li><li>▪ The matter is proposed to be further discussed in the meeting of the Task Force which has been scheduled on 13 April 2008 in South Africa.</li></ul>

***Project Interaction and Review Team (PIRT)***  
***CSLF Task Force Strategic Implementation Report (TFIR)***  
***March 2008***

**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	Derek Taylor
Germany	Jürgen-Friedrich Hake
India	Malti Goel
Netherlands	Harry Scheurs
Norway	Trude Sundset
Saudi Arabia	Khalid Abuleif
UK	Nick Otter
USA	George Guthrie

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<sub>2</sub> 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. (April 2008)
- Implement the established mechanism between the PIRT and the IEA GHG with specific `pilot` activity. (April 2008)
- Update the CSLF Technology Roadmap to identify any sections that need updating. (September 2008)
- 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”. (Ongoing)

### 4. Status

- The EC supported DYNAMIS project is recommended by the PIRT and TG for acceptance as a CSLF project : to be considered at the CSLF meeting in Cape Town in April 2008
- A mechanism for formalizing a relationship between the PIRT and the IEA GHG has been established and agreed formally by the IEA GHG R&D Programme at the ExCo held in Daejeon, South Korea on 16-19 October 2007. A `pilot` topic on CO2 storage capacity coefficients is now proceeding through the IEA GHG selection process and will be considered at the next IEA GHG ExCo on 21-24<sup>th</sup> April 2008 in Berlin.
- Knowledge gained from the EC 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. An EC call for FP7 has been issued on 30th November 2007. The response to this opportunity will be reviewed in Cape Town in April 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 and supported in Al Khobar in January 2008. The established Review Team will provide a draft for consideration in Cape Town in April 2008.
- The comprehensive Gap Assessment completed and presented at the CSLF Workshop in Paris in April 2007 is being used in the current process reviewing and updating the TRM. This will be used to help identify where CSLF projects to could be encouraged in relation to the CSLF Charter, a topic for discussion in Cape Town in April 2008. Also to be addressed will be the benefits of being a CSLF project and how to engage better with stakeholders. To this end a short survey will be conducted by the end of March 2008 as an input Cape Town.

**Task Force for Review and Identification of Standards  
for CO<sub>2</sub> Storage Capacity Estimation**  
CSLF Task Force Strategic Implementation Report (TFIR)  
February 2008

<b>1. Task Force Members</b>
<ul style="list-style-type: none"><li>▪ Stefan <b>Bachu</b>, Canada, Chair</li><li>▪ Didier <b>Bonijoly</b>, France</li><li>▪ John <b>Bradshaw</b>, Australia</li><li>▪ Robert <b>Burruss</b>, USA</li><li>▪ Niels Peter <b>Christensen</b>, EC</li><li>▪ Sam <b>Holloway</b>, UK</li><li>▪ Marcelo <b>Ketzer</b>, Brazil</li><li>▪ Odd-Magne <b>Mathiassen</b>, Norway</li></ul>
<b>2. Purpose of Task Force</b>
<ul style="list-style-type: none"><li>▪ The main goal of the Task Force is to develop and disseminate a clear set of definitions and methodologies that will allow:<ol style="list-style-type: none"><li>1) Consistent assessments of CO<sub>2</sub> 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;</li><li>2) Comparison of CO<sub>2</sub> storage capacity at various levels (country, basin, regional) and among sites;</li><li>3) Understanding of the basis for estimation and critical review of results.</li></ol></li><li>▪ Performance indicators are (updated on February 12, 2008):<ol style="list-style-type: none"><li>1) Adoption of the report by the CSLF Technical Group (<i>realistic</i>) - <b>Achieved</b></li><li>2) Publication of Task Force work in technical &amp; scientific journals to achieve wide dissemination (<i>realistic</i>) – <b>Achieved (two papers have been published in the International Journal of Greenhouse Gas Control)</b></li><li>3) Adoption of definitions and methodologies by CSLF member countries (<i>realistic</i>) - <b>Partially achieved, some member countries are using them</b></li><li>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 (<i>realistic</i>) – <b>Achieved (Task Force members have provided support to three Capacity Building workshops)</b></li><li>5) Adoption of definitions and methodologies by other countries (<i>ambitious</i>) – <b>Partially achieved, methodology is being applied in and for non-CSLF member countries</b></li><li>6) Use of the recommended definitions and methodologies by government, research and/or industry groups in producing assessments of CO<sub>2</sub> storage capacity at various levels (country, basin, regional, local and site specific) - <b>Achieved</b></li></ol></li></ul> <p>Previous attempts to assess CO<sub>2</sub> 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 <i>Task Force for Review and Development of Standard Methodology for Storage Capacity Estimation</i>. In September 2005 the Task Force presented the results of Phase 1 in a Discussion Paper in which previous estimates were</p>

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<sub>2</sub> storage capacity that should serve as a basis for collecting the necessary data and properly estimating the CO<sub>2</sub> 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<sub>2</sub> 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, paper published in Issue 4 of Volume 1, 2007**
- 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, being achieved**
- Harmonization of methodology between the CSLF Task Force on CO<sub>2</sub> Storage Capacity estimation and the USDOE Regional Partnerships Geologic Subgroup – **New, completed**

### 4. Status

- A Phase 3 report on “Comparison between Methodologies Recommended for Estimation of CO<sub>2</sub> Storage Capacity in Geological Media by the CSLF Task Force on CO<sub>2</sub> Storage Capacity Estimation and the USDOE Capacity and Fairways Subgroup of the Regional Carbon Sequestration Partnerships Program” has been completed and submitted to the CSLF Secretariat for distribution and discussion at the upcoming CSLF meeting in Cape Town, April 13-17, 2008.
- A preliminary table of storage efficiency coefficients has been compiled.
- John Bradshaw and Marcelo Ketzer have participated and provided lectures at the 3<sup>rd</sup> Capacity Building Workshop held in Dhahran, Saudi Arabia, January 2008.

**Task Force to Examine Risk Assessment Standards and Procedures**  
**CSLF Task Force Strategic Implementation Report (TFIR)**  
 March 2008

<b>1. Task Force</b>
<b>Task Force to Examine Risk Assessment Standards and Procedures: Phase I Activities</b>
<b>2. Task Force Members</b>
<ul style="list-style-type: none"> <li>▪ George Guthrie, United States (Chair)</li> <li>▪ John Bradshaw, Australia</li> <li>▪ Bill Koppe, Australia</li> <li>▪ Stefan Bachu, Canada</li> <li>▪ Hubert Fabriol, France</li> <li>▪ Mathieu Feraille, France</li> <li>▪ Claudia Vivalda, France</li> <li>▪ Rabih Chammas, France</li> <li>▪ R.R. Sonde, India</li> <li>▪ Makoto Akai, Japan</li> <li>▪ Chiaki Shinohara, Japan</li> <li>▪ Ton Wildenborg, Netherlands</li> <li>▪ Odd-Magne Mathiassen, Norway</li> <li>▪ Howard Herzog, United States</li> <li>▪ Tim Dixon, IEA GHG</li> </ul>
<b>3. Purpose of Task Force</b>
<p>In this task force, we will identify potential risks from CO<sub>2</sub> 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<sub>2</sub>, a reactive, mobile, and buoyant fluid, in geologic reservoirs. Specifically, we will focus on:</p> <ol style="list-style-type: none"> <li>1. Risks associated with CO<sub>2</sub> injection (including fracturing, fault re-activation, induced seismicity)</li> <li>2. Risk associated with any CO<sub>2</sub> migration from the storage reservoir, including:       <ul style="list-style-type: none"> <li>▪ the health, safety, and environmental risks of long-term CO<sub>2</sub> storage</li> <li>▪ the potential impact on natural resources such as groundwater or other resources</li> <li>▪ fugitive emissions into the atmosphere</li> </ul> </li> </ol> <p>Specific activities of this task force will include:</p> <ul style="list-style-type: none"> <li>▪ Review and summarize the existing literature and international activities on geological storage risk assessment</li> <li>▪ Highlight the critical issues</li> <li>▪ Propose what is needed to better understand and manage these risks</li> </ul>
<b>4. Milestones</b>
<ul style="list-style-type: none"> <li>▪ March 2007 – Initial meeting of Task Force</li> <li>▪ June 2007 – Finalize mission statement and agree on planned Phase I activities</li> <li>▪ January 2008 – Task force meets at TG meeting in Saudi Arabia. Prior to meeting, a draft of sections 1-3 will be circulated.</li> <li>▪ March 2008 – Complete draft circulated for review</li> <li>▪ April 2008 – Discuss and finalize draft phase I report at task force meeting in Cape Town.</li> </ul>

## 5. Status

- Mission statement completed.
- Draft outline of final report completed
- Action plan for Phase I completed
- Task force discussed draft at Saudi Arabia Technical Group meeting; revised plan to complete a draft report for discussion at task force meeting in Cape Town.
- Preparing draft of phase I report, including collection of input from task force members on risk activities in each of the countries to incorporate into the report.

**Report of CSLF Secretariat**  
*CSLF Strategic Implementation Reporting System (SPIR)*  
March 2008

**A. Meetings and Workshops**

- Past
  - CSLF Technical Group (27-28 January 2008, Al Khobar, Saudi Arabia). The Secretariat and the host country, Saudi Arabia, worked together to plan the meeting. The Secretariat prepared the block diagram and the agenda for the meeting, developed talking points for the meeting Chair, and handled all presentations that were made at the meeting. All presentations from the meeting have been posted to the CSLF website. The Secretariat also facilitated all task force meetings held in conjunction with the meeting, and is developing summaries for these meetings that, after approval by the task forces, will be posted to the CSLF website. Following the meeting, the Secretariat developed the draft minutes, sent them to the delegates for comments, incorporated the comments and posted the revised draft at the CSLF website.
  - CSLF Capacity Building Workshop (28–29 January 2008, Al Khobar, Saudi Arabia). This was a follow-up to the Pittsburgh and Porto Alegre workshops and was held in conjunction with the Technical Group meeting. The Secretariat planned and developed the agenda for the workshop, invited the presenters for the workshop, worked with the host country on logistical issues, and handled all presentations that were made at the workshop. All presentations from the meeting have been posted to the CSLF website.
  - 3rd IEA-CSLF Workshop on Near Term Opportunities for Carbon Capture and Storage (27-28 November 2007, Calgary, Canada), The Secretariat participated in follow-up activities for this Workshop.
- Future
  - 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 a Roundtable Dialogue event. The Secretariat has developed agendas for each session, invited the presenters, and set up a meeting information page on the CSLF website that includes online meeting registration. Room documents have been posted to the CSLF website. The Secretariat will facilitate all task force meetings scheduled in conjunction with the meeting. Following the meeting, the Secretariat will develop the minutes for the meeting and, once approved, post them at the CSLF website. All presentations from the meeting will also be posted to the CSLF website.

**B. CSLF Public Meeting Place (PuMP)**

A CSLF online discussion forum, titled the CSLF Public Meeting Place (or “PuMP”), remains online at the CSLF website as part of 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. 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](http://www.cslforum.org))**

The Secretariat has made numerous updates to the website include the following:

- Presentations from the CSLF Technical Group meeting, 27-28 January 2008 in Al Khobar, Saudi Arabia.
- Presentations from the CSLF Capacity Building Workshop, 28-29 January 2008 in Al Khobar, Saudi Arabia.
- A meeting registration page for the upcoming Cape Town CSLF meeting is now online.
- Agendas and room documents for the upcoming Cape Town CSLF meeting are now online.
- Listings of Policy Group and Technical Group delegates' contact information have been updated.

The Secretariat has reviewed and posted numerous news releases from CSLF Members and others that are related to carbon capture and storage (CCS) projects, programs, and events in the "What's New" section of the CSLF website. The purpose is to help promote CCS outreach and awareness.

### **D. Other Activities**

- Over this reporting period, the Secretariat handled approximately 300 pieces of incoming e-mail correspondence.

### **E. Stakeholders**

There are now 112 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)*  
March 2008

**ALSTOM Power Systems Report**

Alstom has recently entered into an exclusive joint development and commercialisation agreement with and The Dow Chemical Company (Dow) for advanced amine scrubbing technology for the removal of CO<sub>2</sub> emitted from fossil fuel-fired power plants. Under the agreement, Alstom will commercialise and manage the installation of carbon capture solutions, based on an advanced amine scrubbing process developed from Dow's broad experience in scrubbing solvent development.

This latest deal complements Alstom's development of other CO<sub>2</sub> removal technologies, including chilled ammonia scrubbing and oxy-firing combustion. The company is involved in several CO<sub>2</sub> capture pilot projects in Europe and the US, including:

A 5MW plant testing chilled ammonia technology in Wisconsin, US - a joint project with WE Energies and EPRI to test the technology on a coal plant flue gas - is due to come into operation at the time of writing.

- Vattenfall's 30MW project in Germany, due to come on-stream this summer, where Alstom is supplying the oxy-combustion boiler.
- A 5 MW chilled ammonia industrial pilot with EoN on a gas plant in Sweden.
- A 30 MW Chilled Ammonia project with AEP at the Mountaineer coal plant site, US
- A 40 MW Chilled Ammonia project with Statoil at the Mongstad site, on a natural gas CHP plant flue gas
- A 30 MW oxy-combustion boiler retrofit project with Total, at the Lacq site in France

In addition, Alstom is preparing other partnerships to complete its technology validation program on post-combustion and oxy-combustion technology.

\* \* \* \* \*

**The Carbon Capture And Storage Association (CCSA)**

The Carbon Capture and Storage Association (CCSA) and several of its member companies are in discussion with the Government over the details of its Competition to support the building of a pilot carbon capture and storage (CCS) plant to be operational within a decade. The Association and member companies attended an 'Industry Day' at the Department for Business, Enterprise and Regulatory Reform (BERR) in November.

The UK is firmly on course to build what will be the first commercial-scale CCS power plant in the world, following an October announcement by the Business and Enterprise Secretary John Hutton that the Government is to support a single 'post-combustion' project for a coal-fired power station. This was followed in November by an announcement in the Queen's Speech on the forthcoming Energy Bill 2008, which will: "create a regulatory framework to enable private sector investment in CCS projects." Prime Minister Gordon Brown threw his weight behind CCS development in November, in a speech on climate change to the WWF where he officially launched the Competition.

The large-scale deployment of CCS is widely acknowledged to be the only way to reconcile meeting carbon dioxide reduction targets with the continuing use of indigenous fossil fuels in the UK. But development times can be lengthy and early investment in demonstration plants is essential to meet evolving emissions targets. The CCSA welcomed the Hutton announcement, which will see a pioneering full-scale plant built by 2014, but is disappointed that the Government has chosen to select just one specific technology: a single coal-fired project where carbon dioxide is captured after the combustion of the fuel, for storage offshore. Plans were already in place to build up to five ‘pre-combustion’ capture projects and, unless there is a change of heart by the Government, these projects will be abandoned, leaving the technology to be developed elsewhere in the world.

The Government says that post-combustion capture is the most relevant technology to the majority of existing coal-fired generation capacity around the world, and that Britain could take a lead in developing and then exporting the technology, particularly to China and India. However, the UK CCS industry is developing a number of technologies for commercial sized projects, including precombustion capture, as well as post combustion, and is looking to develop several plants, for both coal and gas-fired power stations, rather than just one. By choosing to support only one, modestly sized project, the Government will miss the opportunity to make the UK a world leader across the technology options. CCSA Chief Executive Dr Jeff Chapman concluded: “This news has severely damaged the confidence of sectors of the industry, and will result in several projects being abandoned after considerable development costs.

This particularly affects several pre-combustion CCS projects that were significantly advanced in their development, with a total capacity over ten times the size of this proposal and likely to be installed in a shorter timeframe than that envisaged in the announcement.”

Worse, without early investment in a programme of commercial-scale CCS plants, the UK must commit to a host of new-build fossil fuel power plants without any associated carbon dioxide reductions, thereby increasing emissions of carbon dioxide. The scale and scope of the Government’s proposed single demonstration project is simply not in proportion to climate commitments or the necessary programme to replace aged electricity generating capacity. The CCS project envisaged by the Government should demonstrate post-combustion technology on a coal-fired power station, with carbon dioxide stored offshore.

The Government says it will consider a phased approach to the project, as long as the full CCS chain is demonstrated by 2014, and the project captures around 90% of the carbon dioxide emitted by the equivalent of 300 MW of power generating capacity as soon as possible thereafter. Norway, Australia and the US have also committed to supporting commercial-scale CCS plants: post-combustion capture technology on a natural gas power station in Norway; and pre-combustion capture technology on a coal power station in the US. Back in the UK, E.ON has confirmed its intention to take part in the Government’s CCS Competition. The company is one of a handful of UK companies that have developed both pre- and post-combustion projects, most notably through its plans for carbon capture-ready supercritical coal-fired units at Kingsnorth in Kent.

[www.berr.gov.uk/energy/sources/sustainable/carbonabatement-tech/ccs-demo/page40961.html](http://www.berr.gov.uk/energy/sources/sustainable/carbonabatement-tech/ccs-demo/page40961.html)

\* \* \* \* \*

## **World Coal Institute**

The World Coal Institute has formed a Working Group of its members to focus on the inclusion of CCS in the CDM. Currently, CCS projects are not eligible for credits under the UNFCCC Clean Development Mechanism. A decision on this issue is due at the next international climate change talks which will be held in Poland in December 2008.

This working group will produce a submission outlining the importance of the inclusion of CCS in the CDM and addressing the issues raised by a number of Parties on CCS technologies. The deadline for submitting documents to this process is 16 June 2008 and in the interim WCI is working with like minded organisations to encourage broad support for the inclusion of CCS. In addition to the submission process WCI is engaging with key Parties to these negotiations to generate support for a positive decision in Poland.

*Alberta Enhanced Coalbed Methane Recovery Project*  
*CSLF Project Status Report (PSR)*  
*February 2008*

<b>1. Project Location</b>
Alberta, Canada
<b>2. Project Lead</b>
Brent Lakeman, Alberta Research Council <ul style="list-style-type: none"><li>▪ Telephone: 1 780 450-5274</li><li>▪ E-Mail: <a href="mailto:Lakeman@arc.ab.ca">Lakeman@arc.ab.ca</a></li></ul>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"><li>▪ Reduce greenhouse gas emissions by subsurface injection of CO<sub>2</sub> into deep coal beds</li><li>▪ Enhance coal-bed methane recovery factors and production rates as a result of CO<sub>2</sub> injection</li></ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"><li>▪ Completion of a single-well micro-pilot test at Suncor's CSEMP site</li><li>▪ Baseline seismic survey completed</li><li>▪ N<sub>2</sub> tracer injected with offset well monitoring completed</li><li>▪ Long term CO<sub>2</sub> injection initiated and suspended due to well-bore issue</li><li>▪ Alberta and China activities have led to a signing ceremony in China for another CO<sub>2</sub>-ECBM project in the Qinshui Basin</li></ul>
<b>5. Status</b>
<ul style="list-style-type: none"><li>▪ CO<sub>2</sub> testing completed for single well micro-pilot</li><li>▪ Engineering and Reservoir Modelling analysis being completed for micro-pilot</li><li>▪ Tiltmeter response being reviewed</li><li>▪ Analysis of injection well issue completed</li><li>▪ EUB approval obtained for remedial work on injection well</li></ul>

**CASTOR “CO<sub>2</sub> from Capture to Storage”**  
*CSLF Project Status Report (PSR)*  
*February 2008*

<b>1. Project Location</b>
Capture: Esbjerg, DK (Castor pilot plant) Storage: Casablanca (Spain), Atzbach (Austria), K12B (The Netherlands), Snohvit (Norway)
<b>2. Project Lead</b>
Pierre Le Thiez, IFP, France <ul style="list-style-type: none"><li>• E-mail : <a href="mailto:pierre.le-thiez@ifp.fr">pierre.le-thiez@ifp.fr</a></li><li>• Tel : +33 1 47 42 67 23</li></ul>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"><li>▪ Develop innovative technology for post-combustion capture, tests in pilot plant (1 tonne CO<sub>2</sub> / hour)</li><li>▪ Detailed feasibility studies of 4 storage sites in Europe – Update of Best Practice Manual</li></ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"><li>▪ Jan 06: Start of the capture pilot plant tests – Base case with MEA</li><li>▪ March 07: Start of testing CASTOR 1 solvent in the pilot</li><li>▪ September 07: Start of testing of CASTOR 2 solvent in the pilot</li><li>▪ February 08 : Project completed</li></ul>
<b>5. Status</b>
<ul style="list-style-type: none"><li>▪ Start in Feb 04 – End Feb 08</li><li>▪ CASTOR 2 solvent under test (Sept. – Dec. 07)</li><li>▪ Four site studies in progress (modeling, monitoring design, ...)</li><li>▪ Final CASTOR workshop 22-24 January 2008 with ENCAP, CACHET and DYNAMIS EU projects.</li><li>▪ Final technical reporting in progress</li></ul>

*CO<sub>2</sub> Capture Project Phase 2 (CCP2)  
 CSLF Project Status Report (PSR)  
 February 2008*

<b>1. Project Location</b>
Project Office: 150 West Warrenville Road, Naperville, IL USA 60563
<b>2. Project Lead</b>
<ul style="list-style-type: none"> <li>▪ CCP2 Program Manager: Linda Curran, BP</li> <li>▪ CCP2 Executive Board Chairman: Gardiner Hill, BP</li> <li>▪ Capture Team Lead: Ivano Miracca, ENI</li> <li>▪ Storage Team Lead: Scott Imbus, ChevronTexaco</li> <li>▪ Communications Team Lead: Iain Wright, BP</li> <li>▪ Policy Team Lead: Arthur Lee, ChevronTexaco</li> <li>▪ CCP2 Advisory Board Chair: Vello Kuuskraa</li> </ul>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"> <li>▪ Develop technology that will reduce costs and improve efficiencies of CO<sub>2</sub> Capture through advanced technologies</li> <li>▪ Increase knowledge and reduce uncertainties in technology performance and deliver low-cost CO<sub>2</sub> capture technologies to demonstration stage by 2009</li> <li>▪ Demonstrate that geological storage of CO<sub>2</sub> is secure and can represent a viable Greenhouse Gas mitigation technique. Develop technology to address critical issues such as storage site/project certification, well integrity and monitoring</li> <li>▪ Increase public awareness and acceptance of CCS</li> <li>▪ A distinctive aspect of CCP2 is the emphasis on collaboration and partnership with governments, industry, NGO's 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.</li> </ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"> <li>▪ Well Exposure Information: Quantitative assessment of materials stability of a well exposed over several decades to CO<sub>2</sub>; additional data has been obtained from the first well examined and plans have been completed for a second well investigation.</li> <li>▪ Certification Framework: Further development of a stream-lined, integrated, risk-based model for technical assessment of potential storage sites, including operational parameters, monitoring systems, and success criteria for demonstrating long-term containment.</li> </ul>
<b>5. Status</b>
<ul style="list-style-type: none"> <li>▪ Thirteen technologies (post-combustion, pre-combustion and oxy-fuel) have been assessed relative to the ability to reduce CO<sub>2</sub> emissions and readiness for demonstration in 2009</li> <li>▪ A rigorous process is underway to evaluate the most promising capture technologies for potential pilot or demonstration</li> <li>▪ A multi-well evaluation has been undertaken to determine the long-term sealing capacity of wells in a CO<sub>2</sub>-rich environment, type and levels of risk posed by failure of well components, and preventative and remediative engineering solutions.</li> <li>▪ Novel approaches to optimize the resolution and cost effectiveness of monitoring, leakage detection and verification are under development</li> <li>▪ Plans are underway to define the Phase 3 program beginning in 2009</li> <li>▪ Recent reports: can be found on the CCP2 website:  <a href="http://www.co2captureproject.org/index.htm">http://www.co2captureproject.org/index.htm</a></li> </ul>

**CO<sub>2</sub> GeoNet**  
*CSLF Project Status Report (PSR)*  
 March 2008

<b>1. Project Location</b>
Western Europe
<b>2. Project Lead</b>
<ul style="list-style-type: none"> <li>▪ Coordinator: Dr. Nick Riley (British Geological Survey)           <ul style="list-style-type: none"> <li>- E-mail: <a href="mailto:njr@bgs.ac.uk">njr@bgs.ac.uk</a></li> </ul> </li> <li>▪ Network Manager: Isabelle Czernichowski-Lauriol (BRGM)</li> <li>▪ Secretariat: Sergio Persoglia (OGS)</li> <li>▪ Contact: <a href="mailto:info@co2geonet.com">info@co2geonet.com</a></li> </ul>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"> <li>▪ Focus is R&amp;D into geological storage of CO<sub>2</sub> and strengthening the European Research Area.</li> <li>▪ Form a durable integration of the original 13 partners over 5 years, involve more partners.</li> <li>▪ Provide the underpinning science capability and knowledge to help enable deployment of large scale CO<sub>2</sub> storage in Europe as quickly as possible</li> <li>▪ Collaborate internationally</li> <li>▪ Be a source of impartial scientific information on CO<sub>2</sub> geological storage for stakeholders</li> <li>▪ Train existing and new researchers</li> <li>▪ Develop and share research infrastructure</li> </ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"> <li>▪ Just finishing year 4 (March 2008) of the 5 year project funding period</li> </ul>
<b>5. Status</b>
<ul style="list-style-type: none"> <li>▪ Preparing for 3<sup>rd</sup> Annual Stakeholder workshop to be held April 2008. New joint research activity areas being planned- existing activity will be reported.</li> <li>▪ Submitted to European Commission FP7 a proposal (Feb 2008) to support international open access and capacity building with respect to CO<sub>2</sub> GeoNet's laboratory and field lab facilities. The proposal has the support of the IEAGHG and wishes to utilize the CSLF as an interface for assisting in research capacity building in the emerging economies. The proposal (if supported by the EC) will also resource transnational exchanges of personnel and equipment between established CO<sub>2</sub> research programmes.</li> <li>▪ Network has world-class unique expertise in monitoring and understanding CO<sub>2</sub> migration in the shallow subsurface and ecosystem responses to CO<sub>2</sub> in marine, freshwater and terrestrial settings</li> <li>▪ Network and training and dialogue workshop on CO<sub>2</sub> geological storage in Paris on October 3<sup>rd</sup> 2007 (report published in Green House Gas Issues- talks posted on CO<sub>2</sub>GeoNet website).</li> <li>▪ Network is finalizing legal mechanisms to allow new members and also to form a European Economic Interest Group (EEIG)</li> <li>▪ e-mail: <a href="mailto:info@co2geonet.com">info@co2geonet.com</a> or at the CO<sub>2</sub> GeoNet website:  <a href="http://www.co2geonet.com">http://www.co2geonet.com</a></li> </ul>

**CO2CRC Otway Project**  
*CSLF Project Status Report (PSR)*  
 March 2008

<b>1. Project Location</b>
Southwestern Victoria, Australia
<b>2. Project Lead</b>
Sandeep Sharma, CO2CRC, Kensington WA 6151, Australia, - Ph: 08 6436 8736 - Mob: 0412 515 494 - E-mail: <a href="mailto:ssharma@co2crc.com.au">ssharma@co2crc.com.au</a>
<b>3. Project Objectives</b>
The Otway project has been designed to demonstrate all aspects of CCS, and will demonstrate the geological storage and monitoring of CO <sub>2</sub> under Australian conditions. 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. The objectives are the same as previously described.
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"> <li>▪ Final baseline groundwater monitoring survey (Mar 08):           <ul style="list-style-type: none"> <li>- Download dataloggers (water level measurements) from water-wells (1-2 Mar 08)</li> <li>- Groundwater chemistry monitoring (4<sup>th</sup> trip) on privately- and state-owned water bores (1-9 Mar 08)</li> </ul> </li> <li>▪ Final baseline atmospheric monitoring survey (Feb 08):           <ul style="list-style-type: none"> <li>- Atmospheric flask sampling for CO<sub>2</sub>, CH<sub>4</sub> and tracers analysis</li> <li>- Download Lo-Flo &amp; Flux Tower data for CO<sub>2</sub> continuous measurements</li> </ul> </li> <li>▪ Baseline soil gas monitoring survey (5<sup>th</sup> trip) (15-28 Feb 08)</li> <li>▪ Baseline 3D seismic survey completed (Dec-Jan 08)</li> <li>▪ Testing of the downhole geophones of the observation well (Naylor-1) during reperforation of CRC-1 (Jan 08)</li> <li>▪ Pipeline installation completed (Jan 08)</li> <li>▪ Plant installation (gas process skid, compressor and air cooler all installed) completed; electrical work completed (Feb 08)</li> <li>▪ Pre-commissioning of plant &amp; pipeline (Feb 08)</li> <li>▪ Successful re-perforation of the injection well (CRC-1) due to unsatisfactory injectivity testing carried out in Dec 07;</li> <li>▪ U-Tube set up and collect samples from the 3 U-tubes finalised and ongoing HAZOP of the U-tube system at Naylor-1 (Jan – Feb 08)</li> <li>▪ CO2CRC Visitor Centre completed (Feb 08)</li> <li>▪ Ongoing site preparation for official opening (Jan – Feb 08)</li> <li>▪ EPA approval for CO<sub>2</sub> storage: final letter of approval received (Jan 08)</li> <li>▪ Long term liability issues resolved (Feb 08)</li> <li>▪ Discovery Channel TV visit to site (Feb 08)</li> </ul>
<b>5. Status</b>
<ul style="list-style-type: none"> <li>▪ Final commissioning of site including plant &amp; pipeline (Mar 08)</li> <li>▪ Possible additional seismic survey (testing of the Naylor-1 geophones below packer) before injection (Mar 08)</li> <li>▪ Finalise licence from DOI over compulsorily acquired land by Vic Gov (ongoing)</li> <li>▪ Continue community consultation (reference group meeting scheduled in Mar 08);</li> <li>▪ <b>Start of injection and Official Opening of the project (2 Apr 08);</b></li> <li>▪ Finalise working plan for the Otway Stage 2 activities (ongoing);</li> </ul>

**CO<sub>2</sub>SINK**  
*CSLF Project Status Report (PSR)*  
March 2008

<b>1. Project</b>
<b>CO<sub>2</sub>SINK - In situ R&amp;D Laboratory for Geological Storage of CO<sub>2</sub></b> Ketzin, State of Brandenburg, Germany <a href="http://www.co2sink.org">http://www.co2sink.org</a>
<b>2. Project Lead</b>
GeoForschungsZentrum Potsdam; Telegrafenberg; D-14473 Potsdam <a href="http://www.gfz-potsdam.de">http://www.gfz-potsdam.de</a> Coordinator: Prof. Dr. Frank Schilling Tel: +49.331.288-1510; Fax: +49.331.288-1502 E-mail: <a href="mailto:fsch@gfz-potsdam.de">fsch@gfz-potsdam.de</a>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"><li>▪ Developing a basis for geologic storage of CO<sub>2</sub> into a saline aquifer</li><li>▪ Establishing the first European in-situ laboratory for onshore storage of CO<sub>2</sub></li><li>▪ Characterization of flow and reaction processes in geologic storage, including detailed analysis of samples of rocks, fluids and microorganisms from the underground reservoir</li><li>▪ Intensive monitoring of the injected CO<sub>2</sub> using a broad range of geophysical and geochemical techniques</li><li>▪ Development and benchmarking of numerical models</li><li>▪ Definition of risk-assessment strategies</li></ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"><li>▪ Feb. 27, 2007 Spud-in of the CO<sub>2</sub>SINK injection well IW</li><li>▪ May 25, 2007 Spud-in of the 1st of the observation wells OW1</li><li>▪ June 13, 2007 Opening of the Ketzin Field Lab, CO<sub>2</sub> Storage Site and Info Centre</li><li>▪ Sept. 8, 2007 One injection and two observation wells drilled and cemented</li><li>▪ Feb. 8, 2008 Injection facility installed and tested</li><li>▪ Feb. 29, 2008 Hydraulic testing successful</li></ul>
<b>5. Status</b>
<ul style="list-style-type: none"><li>▪ 5-years lifetime 04/2004 - 03/2009</li><li>▪ 04 2008 start injection of up to 60,000 tonnes CO<sub>2</sub></li></ul> <p>Completed subprojects:</p> <ul style="list-style-type: none"><li>▪ Storage site development</li><li>▪ Baseline Storage Site Modeling</li></ul> <p>Ongoing subprojects:</p> <ul style="list-style-type: none"><li>▪ Rock/fluid interactions laboratory experimentation</li><li>▪ Economic/ecological analysis and safety concepts</li><li>▪ GeoEngineering: drilling, coring, logging</li><li>▪ CO<sub>2</sub> supply, transport, intermediate storage, conditioning and injection</li><li>▪ Monitoring and verification of CO<sub>2</sub> storage</li><li>▪ Project coordination and public outreach</li></ul> <p>Reference:</p> <p>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-Jørgensen, K. (2005): Baseline Survey in the Preparatory Phase of CO<sub>2</sub>SINK. Environmental Geosciences, Vol. 13, No. 3, 145-161</p>

**ENCAP “Enhanced capture of CO<sub>2</sub>”**  
*CSLF Project Status Report (PSR)*  
 March 2008

<b>1. Project Location</b>
Companies and research providers in a number of places in Europe
<b>2. Project Lead</b>
<ul style="list-style-type: none"> <li>▪ Leif Brandels, Vattenfall AB, Sweden           <ul style="list-style-type: none"> <li>- Tel: +46 8 739 60 40</li> <li>- E-mail: <a href="mailto:leif.brandels@vattenfall.com">leif.brandels@vattenfall.com</a></li> </ul> </li> </ul>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"> <li>▪ Develop and verify IGCC/IRCC, Oxy-Fuel and Chemical Looping Combustion technologies with CO<sub>2</sub> capture for large scale power plants</li> <li>▪ By early 2009 Recommend one of the technology for a demonstration in 350 MW scale</li> <li>▪ Develop and test high temperature oxygen production technologies</li> <li>▪ Investigate an number of novel CO<sub>2</sub> technologies</li> </ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"> <li>▪ Reference cases and guidelines for evaluation for a number of large power plants developed</li> <li>▪ IGCC/IRCC concepts developed</li> <li>▪ Tests of ALSOM and Siemens developed gas turbines fuelled by H<sub>2</sub> rich gas executed</li> <li>▪ Concept developed for large Oxyfuel PF, CFB power plants</li> <li>▪ Successful test of oxyfuel combustion in 20kW and 100kW scale completed. Initial test in a 500kW test facility completed.</li> <li>▪ Chemical looping combustion based on CFB technology developed</li> <li>▪ Three high temperature oxygen production technologies further developed and investigated for integration in power plants with CO<sub>2</sub> capture</li> <li>▪ A number of new technologies possible for CO<sub>2</sub> capture investigated</li> <li>▪ The project has entered into phase II and the large scale testing in phase II is under further preparation in the 30MW Oxyfuel Pilot in Germany (Vattenfall power plant site Schwartze Pumpe)</li> </ul>
<b>5. Status</b>
<ul style="list-style-type: none"> <li>▪ Some further test with gas turbines with lean-premixed H<sub>2</sub>-rich combustors will be executed at DLR during 2007. Further comparison with test results and development of CFD combustion model including H<sub>2</sub> reaction mechanisms continues during 2007 and 2008. Some testing will continue 2008 based on the results from the tests in 2007.</li> <li>▪ Test programmes in the 500kW oxyfuel test rig at Stuttgart has been executed and are under evaluations</li> <li>▪ Preparation of the test programme for verification large scale testing in the 30MW oxyfuel Pilot plant continues during 2007. The test period is planned to autumn 2008 and evaluation of the test results will following in early 2009.</li> <li>▪ The final benchmarking of the pre-combustion technologies in ENCAP and the recommendation for a demonstrator will be done during 2008.</li> <li>▪ Website address: <a href="http://www.encapco2.org/">http://www.encapco2.org/</a></li> </ul>

***Frio Brine Pilot Project***  
*CSLF Project Status Report (PSR)*  
*February 2008*

<b>1. Project Location</b>
South Liberty oilfield, east of Houston, Texas, USA
<b>2. Project Lead</b>
<ul style="list-style-type: none"><li>▪ Susan Hovorka, Gulf Coast Carbon Center, The Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, USA<ul style="list-style-type: none"><li>- E-mail: <a href="mailto:susan.hovorka@beg.utexas.edu">susan.hovorka@beg.utexas.edu</a></li></ul></li><li>▪ Tom Daley, Lawrence Berkley National Lab, Berkeley, California, USA</li><li>▪ Yousif Kharaka, U.S. Geological Survey, Menlo Park, California, USA</li></ul>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"><li>▪ 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.</li><li>▪ Demonstrate that CO<sub>2</sub> can be injected into a brine formation without adverse health, safety, or environmental effects</li><li>▪ Determine the subsurface distribution of injected CO<sub>2</sub> using diverse monitoring technologies</li><li>▪ Demonstrate validity of conceptual and numerical models</li><li>▪ Develop experience necessary for success of large-scale CO<sub>2</sub> injection experiments</li></ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"><li>▪ Second injection completed October 1, 2006</li><li>▪ Confirm no-detect at surface of perfluorocarbon tracers</li><li>▪ Post injection monitoring of second injection completed September 2007</li></ul>
<b>5. Status</b>
<ul style="list-style-type: none"><li>▪ Two short duration injection tests completed: Frio 1, Oct 2004; Frio 2 September 2006</li><li>▪ Assessment of storage permanence – quantifying residual saturation and dissolution of year long period following injection</li><li>▪ Post- injection stable conditions attained – monitoring program nearing completion</li><li>▪ Final repeat VSP prior to plug and abandon scheduled for spring 2008</li><li>▪ Novel tool assessments – U-tube; tubing-conveyed seismic array, inline pH,</li><li>▪ Reports can be found at <a href="http://www.gulfcoastcarbon.org">http://www.gulfcoastcarbon.org</a></li></ul>

*Geologic CO<sub>2</sub> Storage Assurance at In Salah, Algeria*  
*CSLF Project Status Report (PSR)*  
*March 2008*

<b>1. Project Location</b>
In Salah, Algeria, Africa
<b>2. Project Lead</b>
Iain W. Wright, BP Alternative Energy, Chertsey Road, Sunbury, Middlesex TW16 7LN, UK
<b>3. Project Objectives</b>
<ul style="list-style-type: none"><li>• Provide assurance that secure geological storage of CO<sub>2</sub> can be cost-effectively verified and that long-term assurance can be provided by short-term monitoring.</li><li>• Demonstrate to stakeholders that industrial-scale geological storage of CO<sub>2</sub> is a viable greenhouse gas (GHG) mitigation option.<ul style="list-style-type: none"><li>– Set precedents for the regulation and verification of the geological storage of CO<sub>2</sub>, allowing eligibility for GHG credits</li></ul></li></ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"><li>• Sonatrach (Algerian National Oil Company) joined the Joint Industry Project</li><li>• NBNL delivered InSAR initial results</li></ul>
<b>5. Status</b>
<ul style="list-style-type: none"><li>• Storing 1mmtpa CO<sub>2</sub> in a deep saline aquifer (1900m deep, 2m thick, 10mD permeability).</li><li>• Preparing for repeat seismic at end 2008.</li></ul>

**IEA GHG Weyburn-Midale CO<sub>2</sub> Monitoring & Storage Project**  
*CSLF Project Status Report (PSR)*  
 February 2008

<b>1. Project</b>
<b>IEA GHG Weyburn-Midale CO<sub>2</sub> Monitoring &amp; Storage Project</b> Weyburn & Midale Units, Weyburn area of southeast Saskatchewan, Canada
<b>2. Project Lead</b>
<ul style="list-style-type: none"> <li>▪ Natural Resources Canada (NRCan) – Frank Mourits, Project Integrator</li> <li>▪ PTRC – Carolyn K. Preston - Executive Director</li> <li>▪ PTRC – Ray Knudsen, Project Director- technical research component of the project</li> <li>▪ Sask. Industry &amp; Resources (SIR) – Floyd Wist, Chair of the Leading Sponsors Executive Committee (LSEC)</li> </ul>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"> <li>▪ Develop a comprehensive Best Practices Manual for CO<sub>2</sub> geological storage</li> <li>▪ Building on the successes of the First Phase, focus the technical research component on Site Characterization, Monitoring &amp; Verification, Wellbore Integrity and Performance (Risk) Assessment</li> <li>▪ Within the new Policy Component, focus on Public Communication &amp; Outreach, Regulatory Issues and the Business Environment</li> </ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"> <li>▪ November 2007 – First PRISM (Project Integration and Sponsor Meeting) for the Final Phase held in Calgary</li> <li>▪ December 2007 – Shell joined as project co-sponsor</li> <li>▪ January 2008 – Nexen committed to continue as project co-sponsor</li> <li>▪ January 2008 – Research ongoing on 9 tasks under 6 Research Provider Agreements</li> </ul>
<b>5. Status</b>
<ul style="list-style-type: none"> <li>▪ Working through 7 other Research Provider Agreements linked with 15 additional technical research tasks</li> <li>▪ Developing plans and cost estimates for key proposed monitoring activities, including a monitoring well and permanent seismic array</li> <li>▪ Developing a strategy and plans for the non-technical (policy) component of the project</li> <li>▪ Sponsorship campaign is ongoing</li> </ul>

*International Test Center (ITC) CO<sub>2</sub> Capture with Chemical Solvents*  
*CSLF Project Status Report (PSR)*  
*March 2008*

<b>1. Project Location</b>
University of Regina, Regina, Saskatchewan, Canada
<b>2. Project Lead</b>
Dr. Malcolm Wilson, University of Regina • E-mail: <a href="mailto:Malcolm.Wilson@uregina.ca">Malcolm.Wilson@uregina.ca</a> Dr. Paitoon Tontiwachwuthikul, University of Regina ( <a href="mailto:paitoon@uregina.ca">paitoon@uregina.ca</a> ) Dr. Raphael Idem, University of Regina ( <a href="mailto:Raphael.idem@uregina.ca">Raphael.idem@uregina.ca</a> )
<b>3. Project Objectives</b>
<ul style="list-style-type: none"><li>▪ To reduce the cost of post combustion CO<sub>2</sub> capture through<ul style="list-style-type: none"><li>- Formulated solvent development</li><li>- process optimization &amp; systems integration</li><li>- reduction of heat duty for solvent regeneration</li></ul></li><li>▪ Perform cost study for post-combustion CO<sub>2</sub> capture in collaboration with an Engineering company on a site specific case (Europe, Australia, North America, etc.)</li></ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"><li>▪ Received prestigious NSERC Synergy award for Innovation – October 2006</li><li>▪ Received the Innovation Award by Regina Chamber of Commerce - Paragon Awards – April 2008</li><li>▪ Breakthroughs in solvent development</li><li>▪ Breakthroughs in heat duty reductions</li><li>▪ Breakthrough in process integration</li><li>▪ Site specific cost study in progress (Europe, Australia, North America, etc.)</li></ul>
<b>5. Status</b>
<ul style="list-style-type: none"><li>▪ US provisional patent on process integration</li><li>▪ US provisional patent on solvents</li><li>▪ US provisional patent on special chemical additives</li><li>▪ Cost studies in progress (Europe, Australia, North America, etc.)<ul style="list-style-type: none"><li>- (CO<sub>2</sub> capture cost is now in the range of \$20 to \$45 per ton)</li></ul></li><li>▪ Project website: <a href="http://www.co2-research.ca">http://www.co2-research.ca</a></li></ul>

**Regional Carbon Sequestration Partnerships (RCSP) Project**  
**CSLF Project Status Report (PSR)**  
**March 2008**

<b>1. Project Location</b>
Various locations in United States and Canada
<b>2. Project Lead</b>
<p>National Initiative Managed by the U.S. Department of Energy National Energy Technology Laboratory (NETL)</p> <ul style="list-style-type: none"> <li>▪ Sean Plasyanski, Sequestration Technology Manager, National Energy Technology Laboratory. E-mail: <a href="mailto:sean.plasyanski@netl.doe.gov">sean.plasyanski@netl.doe.gov</a></li> <li>▪ John Litynski, Coordinator, Regional Carbon Sequestration Partnerships, National Energy Technology Laboratory. E-mail: <a href="mailto:john.litynski@netl.doe.gov">john.litynski@netl.doe.gov</a></li> </ul>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"> <li>▪ 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.</li> <li>▪ 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.</li> <li>▪ To implement the RCSP program in three phases: <ul style="list-style-type: none"> <li>– The Characterization Phase evaluated opportunities for sequestration. The Partnerships collected data on CO<sub>2</sub> 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.</li> <li>– 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.</li> <li>– The Deployment Phase will demonstrate at large scale that CO<sub>2</sub> 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<sub>2</sub> per project per year into geologic formations representative of potential sinks in each region.</li> </ul> </li> </ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"> <li>▪ Characterization Phase completed in 2005</li> <li>▪ Regional Carbon Sequestration Partnerships Phase I Accomplishments: <a href="http://www.netl.doe.gov/technologies/carbon_seq/partnerships/phase1/workproducts_table.html">http://www.netl.doe.gov/technologies/carbon_seq/partnerships/phase1/workproducts_table.html</a></li> <li>▪ Validation Phase initiated in 2005, with small-scale field tests currently underway and scheduled for completion in 2009 <ul style="list-style-type: none"> <li>– Development of the Carbon Sequestration Atlas, which identified over 3,600 gigatonnes of estimated geologic CO<sub>2</sub> storage capacity.</li> <li>– Storage capacity estimates being modified by data obtained in the validation efforts</li> <li>– Injection of CO<sub>2</sub> into depleted oil and gas fields has increased knowledge of CO<sub>2</sub> capture, transport, MMV requirements, and regulations</li> </ul> </li> </ul>

- Nine ongoing saline formation field tests
- Ten enhanced oil or gas recovery projects are being conducted for value-added CO<sub>2</sub> 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. DOE has awarded the first four large-scale carbon sequestration projects which are the largest single set of such projects issued to date in the world.
  - The Plains CO<sub>2</sub> Reduction Partnership will conduct 2 large-volume geologic CO<sub>2</sub> storage projects. The Williston Basin (North Dakota) will demonstrate EOR and CO<sub>2</sub> storage in a deep carbonate formation that is also a saline formation. The Alberta Basin test in British Columbia, Canada will demonstrate co-sequestration of CO<sub>2</sub> and hydrogen sulfide.
  - The Southeast Regional Carbon Sequestration Partnership will demonstrate large-volume CO<sub>2</sub> storage in the lower Tuscaloosa Formation, injecting CO<sub>2</sub> at two locations to assess different CO<sub>2</sub> streams.
  - The Southwest Regional Partnership for Carbon Sequestration will inject several million tons of CO<sub>2</sub> into a deep saline formation in the Southwest United States, testing the limits of injection and demonstrating the integrity of the cap rock to trap CO<sub>2</sub>.
  - The Midwest Geological Sequestration Consortium will inject 1 million tons into one of the thickest section of the Mount Simon Sandstone in central Illinois. The Mount Simon is a prolific formation in Illinois, Kentucky, Indiana, and Ohio.

## 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.
- 24 geologic and 11 terrestrial field tests currently underway in the Validation Phase
- Deployment Phase applications submitted in June 2007, with the first four awards announced in late 2007.
- 2007 Regional Carbon Sequestration Partnerships Program Review Proceedings  
<http://www.netl.doe.gov/publications/proceedings/07/rcsp/index.html>

## 6. Links to RCSP Programmatic Information

- Carbon Sequestration webpage on the NETL website at:  
[http://www.netl.doe.gov/technologies/carbon\\_seq/index.html](http://www.netl.doe.gov/technologies/carbon_seq/index.html)
- Carbon Sequestration Newsletter (distributed monthly):  
[http://www.netl.doe.gov/technologies/carbon\\_seq/refshelf/subscribe.html](http://www.netl.doe.gov/technologies/carbon_seq/refshelf/subscribe.html)
- Carbon Sequestration Technology Roadmap and Program Plan 2007:  
[http://www.netl.doe.gov/technologies/carbon\\_seq/refshelf/project%20portfolio/2007/2007Roadmap.pdf](http://www.netl.doe.gov/technologies/carbon_seq/refshelf/project%20portfolio/2007/2007Roadmap.pdf)
- Carbon Sequestration Atlas of the United States and Canada:  
[http://www.netl.doe.gov/technologies/carbon\\_seq/refshelf/atlas/ATLAS.pdf](http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlas/ATLAS.pdf)
- An Introduction to Carbon Capture and Sequestration (video):  
[mms://prod-mmedia.netl.doe.gov/carbon\\_sequestration\\_sept.wmv](mms://prod-mmedia.netl.doe.gov/carbon_sequestration_sept.wmv)
- Carbon Sequestration Program Environmental Reference Document:  
[http://www.netl.doe.gov/technologies/carbon\\_seq/refshelf/nepa/index.html](http://www.netl.doe.gov/technologies/carbon_seq/refshelf/nepa/index.html)
- Carbon Sequestration Project Portfolio:  
[http://www.netl.doe.gov/technologies/carbon\\_seq/refshelf/project%20portfolio/2007/table\\_contents.pdf](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 Project**  
**CSLF Project Status Report (PSR)**  
*February 2008*

<b>1. Project Location</b>
Various locations in China
<b>2. Project Leads</b>
<p>R Gentile, Leonardo Technologies, Inc.</p> <ul style="list-style-type: none"> <li>• E-mail: <a href="mailto:rhgentile@lti-global.com">rhgentile@lti-global.com</a></li> </ul> <p>R Dahowski, Battelle – Pacific Northwest Division</p> <ul style="list-style-type: none"> <li>• E-mail: <a href="mailto:bob.dahowski@pnl.gov">bob.dahowski@pnl.gov</a></li> </ul> <p>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  F Teng, Tsinghua University</p>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"> <li>▪ Develop the first ever bottom-up cost assessment of the potential to utilize carbon dioxide capture and storage (CCS) across the Chinese economy</li> <li>▪ Assess the potential and costs for CCS technologies to deploy across regions of China</li> <li>▪ Inventory large anthropogenic CO<sub>2</sub> point sources from power plants and other industrial sources</li> <li>▪ Identify potential candidate geologic CO<sub>2</sub> storage reservoirs/basins which could be used for the safe, long-term storage of CO<sub>2</sub></li> <li>▪ Examine the economics of CCS and develop cost curves for CO<sub>2</sub> transport and storage via optimized source-reservoir matching</li> </ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"> <li>▪ Continued characterization, refinement, and mapping of inventory of over 1800 large, stationary CO<sub>2</sub> sources</li> <li>▪ Storage capacity analysis and mapping for oil, gas, coal and deep saline formations currently underway</li> </ul>
<b>5. Status</b>
<ul style="list-style-type: none"> <li>▪ Ongoing; expected completion: Summer 2008</li> <li>▪ Data collection and synthesis phase of project nearing completion</li> <li>▪ Refinement of capacity analysis underway, to be followed by data integration and source-sink matching and economic analysis</li> </ul>

**Zama Acid Gas EOR, CO<sub>2</sub> Sequestration, and Monitoring Project**  
*CSLF Project Status Report (PSR)*  
March 2008

<b>1. Project Location</b>
Zama City, Alberta, Canada
<b>2. Project Leads</b>
<ul style="list-style-type: none"><li>• Ed Steadman, Energy and Environmental Research Center, Grand Forks, ND, USA<ul style="list-style-type: none"><li>- E-mail: <a href="mailto:esteadman@undeerc.org">esteadman@undeerc.org</a></li></ul></li><li>• Steven Smith, Energy and Environmental Research Center, Grand Forks, ND, USA<ul style="list-style-type: none"><li>- E-mail: <a href="mailto:ssmith@undeerc.org">ssmith@undeerc.org</a></li></ul></li><li>• Bill Jackson, Apache Canada Ltd, Calgary, Alberta, Canada<ul style="list-style-type: none"><li>- E-mail: <a href="mailto:bill.jackson@apachecorp.com">bill.jackson@apachecorp.com</a></li></ul></li></ul>
<b>3. Project Objectives</b>
<ul style="list-style-type: none"><li>• To validate the sequestration of CO<sub>2</sub>-rich acid gas in a depleted oil reservoir.</li></ul>
<b>4. Recent Milestones</b>
<ul style="list-style-type: none"><li>• Tracer injection has taken place on February 26, 2008. This tracer is being utilized to identify leakage into adjacent stratigraphic horizons and will provide additional confidence in the Zama Field as a superior storage site for injection of acid gas.</li><li>• Petrography and mineralogy on newly collected cap rock and reservoir core has been initiated.</li></ul>
<b>5. Status</b>
<ul style="list-style-type: none"><li>• Since December 2006, acid gas injection has occurred at a rate of between 400,000 and 1 million cubic feet a day. To date, the total volume injected is over 220 million cubic feet.</li><li>• Geomechanical laboratory studies are ongoing.</li></ul>