



Strategic Plan Implementation Report

February 2011



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Report from the CSLF Secretariat



From right: Deputy Prime Minister and Minister of Economy of the Republic of Poland Waldemar Pawlak, CSLF Policy Group Chair Victor Der, and CSLF Technical Group Chair Trygve Riis welcome CSLF members and stakeholders during the opening session of the CSLF Annual Meeting in Warsaw, Poland on October 7, 2010.

2010 CSLF Annual Meeting

The CSLF held its 2010 Annual Meeting in Warsaw, Poland from October 6-8, 2010. The first day consisted of individual group meetings, including the Carbon Capture and Storage (CCS) in the Academic Community Task Force, Financing CCS Task Force, Risk Assessment Standards and Procedures Task Force, Capacity Building in Emerging Economies Task Force, Projects Interaction and Review Team (PIRT), and the CSLF Stakeholders.

The second day featured an opening session and welcoming by Waldemar Pawlak, Deputy Prime Minister and Minister of Economy of the Republic of Poland. Main agenda items included a roundtable on Financing Carbon Capture and Storage. A Joint Task Force was formed, along with a new Ministerial Steering Committee.

The meeting also included a discussion on whether to recommend an extension of the

CSLF Charter to the Ministers. In addition, the following five new projects were approved for CSLF recognition:

- CCS Bełchatów Project
- CO₂ Field Lab Project
- Gorgon CO₂ Injection Project
- SECARB Early Test at Cranfield Project
- Quest CCS Project

This brings the total number of CSLF recognized projects to 32, including 22 active projects.

The United Arab Emirates was approved and welcomed as the 25th

Recent Headline News

- October 7, 2010 - United Arab Emirates joins the CSLF as the 25th member
- October 8, 2010 - CSLF endorses five new CCS projects
- December 2, 2010 - 2010 CSLF Technology Roadmap released

Upcoming CSLF Meetings

- CSLF Projects Workshop and PIRT Meeting
Al Khobar, Saudi Arabia
March 1-3, 2011
- CSLF Financing Roundtable (Co-sponsored with Asian Development Bank)
Singapore
First week of April 2011
- CSLF Technical Group Meeting
Edmonton, Alberta, Canada
May 18-20, 2011
- 2011 CSLF Ministerial Meeting
Beijing, China
September 20-23, 2011

From left: United States Ambassador Jeffrey Bleich, Australian Prime Minister Julia Gillard, Australian Minister for Resources and Energy Martin Ferguson, and Chevron MD Roy Krzywosinski visit Barrow Island on October 9, 2010 to celebrate the Gorgon CO₂ Injection Project being formally recognized by the CSLF. Additional photos can be found in their project report on page 32.



and newest member of the CSLF. The Policy Group elected China, Japan, and Mexico as Policy Group Vice Chairs. Three completed CSLF-recognized projects received recognition awards presented by Poland's Deputy Prime Minister and Minister of Economy Waldemar Pawlak and CSLF Policy Group Chair Victor Der. The recognized projects were the Frio Project, CO₂ SINK, and ENCAP. During the meeting, planning for the 2011 CSLF Ministerial Meeting in China was also continued.

CSLF Technology Roadmap

In December, the CSLF released the 2010 Technology Roadmap. This 90-page report indicates that significant international progress has been made in the past year on advancing carbon capture and storage, but that a number of important challenges must be addressed if widespread commercial deployment is to be achieved. A full copy of the report can be found on the CSLF website at the following link: http://www.cslforum.org/publications/documents/CSLF_Technology_Roadmap_2010.pdf

Public Outreach

During the last half of the year, the CSLF released publications and videos that helped raise public awareness and knowledge towards carbon capture and storage technology.

In June, the CSLF released its inFocus Papers on Carbon Capture and Storage Technology. These short, educational papers are brief and non-technical, making them easy for the general public to understand. Each paper ranges from one to six pages in



From left: Deputy Prime Minister and Minister of Economy of the Republic of Poland Waldemar Pawlak, CSLF Policy Group Chair Victor Der, and CSLF Secretariat Director Barbara McKee present awards during the CSLF Project Recognition Event in the "Forteca" at the CSLF Annual Meeting in Warsaw, Poland on October 7, 2010.

length and answers some of the most common questions surrounding carbon capture and storage technology. Paper topics include:

- Why Carbon Capture and Storage?
- Is Geologic CO₂ Storage Safe?
- Underground CO₂ Storage: A Reality?
- CO₂ Capture: Does it Work?
- CO₂ Transportation: Is it Safe and Reliable?
- 10 Facts About CCS

In September, the CSLF released a new series of videos featuring industry experts addressing CCS issues. These experts include top researchers and directors from around the world. Video topics include:

- Why do we need CCS?
- CCS: Myth or Reality?
- CCS: Is it safe?
- CCS: Does it work?
- CO₂ Transport: Is it safe?

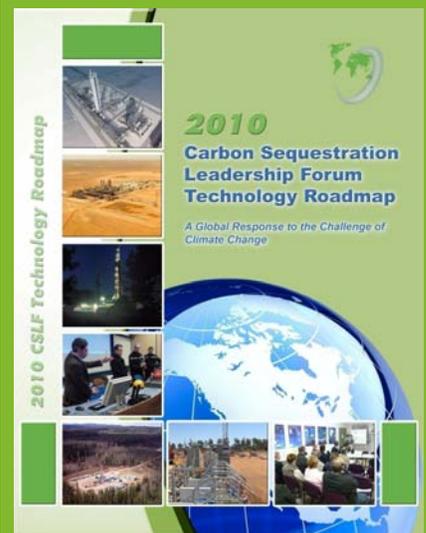
Overall feedback for these papers and videos has been positive, including requests to have the inFocus Papers translated into other languages. Both the inFocus Papers and the videos are available on the CSLF website.

2011

The CSLF has a number of

upcoming workshops and meetings planned for 2011. Three major meetings will occur during the first half of the year. The CSLF Projects Workshop and PIRT Meeting will be held in Al Khobar, Saudi Arabia from March 1-3, 2011. The CSLF Financing Roundtable (co-sponsored with the Asian Development Bank) will be held in Singapore during the first week of April. The CSLF Technical Group Meeting will be held in Edmonton, Alberta, Canada from May 18-20, 2011. In the latter half of 2011, the 2011 CSLF Ministerial Meeting will be held in Beijing, China from September 20-23, 2011.

Released in December 2010, the 2010 CSLF Technology Roadmap is now available on the CSLF website.





**CSLF Project Recognition
Event in the “Forteca” hosted
by Waldemar Pawlak, Deputy
Prime Minister and Minister of
Economy of the Republic of
Poland ■ October 7, 2010**





Waldemar Pawlak, Deputy Prime Minister and Minister of Economy of the Republic of Poland, presents CSLF Project Recognition awards ■ October 7, 2010



Frio Project

Accepted by:
Ramon Trevino



CO₂ SINK

Accepted by:
Axel Liebscher



ENCAP

Accepted by:
Wiktor Raldow





**CSLF Policy Group Meeting
Warsaw, Poland ■ October 7, 2010**





CSLF Technical Group Meeting Warsaw, Poland ■ October 7, 2010



Report from the Stakeholders

February 2011

* * * * *

Alberta Energy ***The Government of Alberta (GOA), Canada***

- In December 2010, Alberta passed the *Carbon Capture and Storage Statutes Amendment Act*, 2010, which removes two key regulatory barriers to CCS:
 1. The Province now has the authority to accept the long-term liability for CO₂ storage and will only consider doing so based on technical data that assures the Province the site is stable; and
 2. The Province has declared ownership of all pore space to allow storage sites to be selected for their ability to store CO₂ permanently and safely.
- Starting in 2011, Alberta Energy, in conjunction with national and international stakeholders, will lead the Regulatory Framework Assessment to ensure that Alberta's CCS regulatory framework is world class.
- This effort is necessary to map out the regulatory process for large-scale CCS activity, to ensure there is no regulatory overlap, and to assure government and the public that CCS will be conducted in a safe and efficient manner.
- Alberta Energy is negotiating final grant agreements with four CCS projects to allow access to Alberta's \$2 billion (Cdn) investment in CCS.

* * * * *

The South African Centre for Carbon Capture and Storage (SACCCS) ***South Africa***

The carbon dioxide geological storage Atlas was launched by the Minister during September 2010 and the Atlas report was released during January 2011. The Atlas is available on the website www.sacccs.org.za.

A project to take the potential storage from a theoretical level to an effective level in the Zululand Basin is underway. A study to undertake a similar study in the on-shore Outeniqua Basin is scheduled to start March, 2011. A Scoping Study for the South African Test Injection Project is scheduled to start January 2011.

* * * * *

***Second Study of Carbon Dioxide Capture and Storage in Indonesia
World Energy Council Indonesian Member Committee***

The first study of Carbon Dioxide Capture and Storage potential in Indonesia had been conducted by the Indonesia CCS Study Working Group. The Working Group comprises the Agency for Oil and Gas Research Development (LEMIGAS) of the Ministry of Energy and Mineral Resources of Indonesia, Indonesian National Committee-World Energy Council (KNI-WEC), PT PLN (Persero)-Indonesia State Electricity Corporation, Ministry of Environment of Indonesia, Royal Dutch Shell and UK Embassy. The study results were launched successfully on 10 November 2009.

Memorandum of Understanding (MoU) between Government of Indonesia (represented by National Development Planning Agency and Directorate General of Oil and Gas) and Asian Development Bank (ADB) was signed on 2 September 2010, as a main part to support regional capacity development technical assistance (TA) for determining the potential for CCS in Southeast Asia which is financed by ADB as a grant basis.

As the second CCS study in Indonesia, this TA would comprise a scoping analysis of the potential for CCS in Indonesia culminating in the development of a roadmap for CCS demonstration. Some of the main activities of the TA will cover:

- Identify priority technologies and sites for a demonstration project, conduct pre-feasibility studies, and identify requirements for further research and due-diligence;
- Review policy, technical, geological, regulatory, financial, economic and public acceptance issues pertaining to the entire CCS cycle (capture, transport, and utilization or storage) as it applies to the identified demonstration project;
- Identify opportunities for public and private sector investments in the demonstration project;
- Develop draft and final road maps for CCS demonstration in Indonesia;
- Establish and regularly convene meetings of the national working group on CCS in Indonesia;
- Identify capacity gaps and design and implement a capacity development plan, targeting policy makers, key project hosts, and research institutes in Indonesia;

* * * * *

Capacity Building in Emerging Economies Task Force
 CSLF Task Force Strategic Implementation Report
 February 2011

1. Task Force Members
<ul style="list-style-type: none"> • Saudi Arabia – Abdulmuhsen Alsunaid (Chair) • Australia – Bruce Murphy • Canada – Siddiq McDoom • European Commission – Jeroen Schuppers • France – Bernard Frois, Pierre Le Thiez • Mexico - José Miguel González Santaló • United Kingdom – Louise Barr • United States – Victor Der • GCCSI - Bob Pegler • World Bank - Natalia Kulichenko • Stakeholders - Judd Swift, Andrew Paterson, Jeff Jarrett
2. Purpose of Task Force
<p>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>
3. Milestones
<ul style="list-style-type: none"> • Six workshops held (2007-2008) • New Capacity Building Initiative launched at CSLF Ministerial Meeting (2009)
4. Status
<ul style="list-style-type: none"> • Task Force meeting held in October 2010 (Warsaw, Poland). • Task Force workshops have evolved and been tailored to meet the needs and inputs from participants. Each workshop has built on the successes and lessons-learned from previous workshops, helping to create a solid CCS knowledge foundation that will carry into the future. • The Task Force continues to explore creation of standardized, core training modules for capacity building based on materials from the initial workshops. These materials would be aimed at both public and private sector decision-makers. • Letters were sent to all emerging country members seeking their input on their needs for capacity building. A capacity building implementation plan has been developed, which includes a criteria for selection of projects.

Communications Task Force
 CSLF Task Force Strategic Implementation Report
 February 2011

1. Task Force Members
<ul style="list-style-type: none"> • Australia – Margaret Sewell • European Commission – Marisa Atienza Morales • Mexico – José Miguel González Santaló • Norway – Tone Skogen • United Kingdom – Jeremy Martin • United States – John Grasser (Chair)
2. Purpose of Task Force
Implement a communications strategy to raise the profile of the CSLF and CCS.
3. Milestones
<ul style="list-style-type: none"> • Initiated development of an overall CSLF outreach strategy; • Initiated the rebuilding of the CSLF web so as to have a first-rate site and a communications tool available to help promote the organization; • Initiated the redevelopment of the CSLF information kit; • Initiated the establishment of a CSLF daily clipping service to all members; • Initiated conceptual redesign of CSLF exhibit with new graphics to mirror web page and handout material graphics; • Initiated development of CSLF web page linking policy; • Initiated development of CSLF conference sponsorship policy; • Initiated development of CSLF speech for member use; • Initiated development of CSLF power point presentation for member use; • Initiated development of CSLF event at COP-15; • Initiated development and preparation of CCS message paper series; • Initiated development of DVDs containing CSLF materials. • Initiated review and updating of all CSLF materials for media and public handout, including the full set of “InFocus” CCS message papers; • Initiated task force discussions on implementing media outreach activities.
4. Status
<ul style="list-style-type: none"> • Communications strategy finalized and now being implemented; • Completed development of new CSLF web site with improved functionality and graphic presentation; • Completed development of CSLF daily clipping service for members/stakeholders; • Completed redesign and printing of new CSLF handout materials; • Completed redesign of a new CSLF exhibit; • Completed CSLF web page linking policy; • Completed CSLF conference sponsoring policy; • Standard CSLF speech completed and distributed to Policy and Technical Groups; • CSLF power point presentation completed and distributed to Policy and Technical Groups; • Completed CCS message papers as directed by the Policy Group; the “InFocus”

message papers have been approved by Communications and Risk Assessment Task Forces and ready for public distribution;

- Completed production of DVDs containing various CSLF materials for public distribution.

Financing CCS Task Force
 CSLF Task Force Strategic Implementation Report
 February 2011

1. Task Force Members
<ul style="list-style-type: none"> • France (Chair: Bernard Frois) • Australia (Margaret Sewell) • Brazil (Bernardo Stumm) • Canada (Siddiq McDoom) • European Commission (Jeroen Schuppens) • Japan (Ryo Kubo) • Mexico (José González) • New Zealand (Alice Hume) • Poland (Piotr Kisiel) • South Africa (Landi Themba) • United Kingdom (Louise Barr) • United States (James Wood) • Asian Development Bank (Ashok Bhargava) • GCCSI (Nick Otter) • World Bank (Richard Zechter) • CSLF Stakeholders (Peta Ashworth, Australia; Tomohiro Sembongi, Japan; Monica Lupion, Spain; Luke Warren, UK; Stu Dalton, USA; David Denton, USA; Jeff Jarrett, USA; Jack Parkes, USA; Andrew Paterson, USA; Maria Pineda, USA)
2. Purpose of Task Force
Investigate incentives and investments for CCS in both developing and developed countries, which will allow the CSLF a new means of engaging financial and multinational entities.
3. Milestones
<ul style="list-style-type: none"> • Creation of Task Force (June 2009) • Completion of report sponsored by Asian Development Bank for analyzing key policy issues and barriers to CCS (2010) • Completion of report on “Framework of Risks and Rewards for Commercial Deployment of Projects with CCS” (2010) • Engage financial community (2009 and beyond)
4. Status
<ul style="list-style-type: none"> • Collaborate with Global CCS Institute on dialog and gathering insights from the investor and industrial communities. • Interview interested financing sources on key issues and critical risks identified by the “Framework” paper completed in 2010 and by the roundtables held in 2010. • CSLF Financing Roundtable (co-sponsored with the Asian Development Bank) will be held in Singapore during the first week of April. • Support forums in Developing countries on CCS, e.g., the World Bank workshop for Projects with CCS in the Balkans (tentative: April 2011 in Dubrovnik). • Provide input on incentives and project financing structures for the CSLF Energy Ministerial in September 2011.

CCS in the Academic Community Task Force
CSLF Task Force Strategic Implementation Report
February 2011

1. Task Force Members
<ul style="list-style-type: none">• Brazil (Chair: Marcelo Ketzer)• IEA GHG (Chair: Tim Dixon)• Australia (Bruce Murphy)• Germany (Jürgen-Friedrich Hake)• Mexico (José González)• New Zealand (Alice Hume)• South Africa (Tony Surridge)• United Kingdom (Jeremy Martin)• IEA (Brendan Beck)• CSLF Stakeholders (Robert Gentile, USA; Judd Swift, USA)
2. Purpose of Task Force
<p>Develop contacts within the academic community, identify academic perspectives and programs on CCS for universities in CSLF Member countries, and determine the path forward for the CSLF in this area.</p> <p>The Technical Outreach/Student Body Initiative Working Group is a sub-group to this Task Force. This Working Group is intended to encourage international interaction between students engaged in the study of CCS and to give them a resource for interaction, which could include networking, discussing research, and communicating with researchers in other institutions. The short-term goals of this Working Group are to increase the technical capacity in CCS, encourage student/researcher collaboration, and assemble a directory of student and researcher international activities.</p>
3. Milestones
<ul style="list-style-type: none">• Creation of Task Force (June 2009)• Develop survey of existing academic CCS programs (begun July 2009)• Determine points of contact for CCS programs at universities (begin January 2010)• Implementation of website for Technical Outreach/Student Body Initiative Working Group (2010)
4. Status
<ul style="list-style-type: none">• Task Force meeting held in October 2010 (Warsaw, Poland).• CCS in the Academic Task Force Report released in January 2011, featuring surveys from Italy, Spain, and South Africa• Next meeting of the Task Force will be at the CSLF Technical Group meeting, in Alberta, Canada in May 2011• Two survey reports of postgraduate degree programs will be combined into a single report and finalized for the 2011 CSLF Ministerial Meeting in China• The IEA GHG will develop a website for use by the Technical Outreach/Student Body Initiative Working Group.

Projects Interaction and Review Team (PIRT)
 CSLF Task Force Strategic Implementation Report
 February 2011

1. Task Force Members																						
<p>The PIRT consists of:</p> <ul style="list-style-type: none"> • A core group comprising Members of the Technical Group, or as nominated by a CSLF Member country. Current membership consists of representatives from: <table style="margin-left: 40px; border: none;"> <tr> <td>Australia</td> <td>Clinton Foster (Chair)</td> </tr> <tr> <td>Canada</td> <td>Stefan Bachu</td> </tr> <tr> <td>Denmark</td> <td>Flemming Ole Rasmussen</td> </tr> <tr> <td>European Commission</td> <td>Jeroen Schuppers</td> </tr> <tr> <td>France</td> <td>Pierre Le Thiez</td> </tr> <tr> <td>Germany</td> <td>Jürgen-Friedrich Hake</td> </tr> <tr> <td>Netherlands</td> <td>Harry Schreurs</td> </tr> <tr> <td>Norway</td> <td>Trygve Riis</td> </tr> <tr> <td>Saudi Arabia</td> <td>Khalid Abuleif</td> </tr> <tr> <td>UK</td> <td>Philip Sharman</td> </tr> <tr> <td>USA</td> <td>George Guthrie</td> </tr> </table> <p>During the period of this report the PIRT chairmanship resides with Australia.</p> <ul style="list-style-type: none"> • An <i>ad hoc</i> group of Stakeholders comprising representatives from CSLF-recognized projects. 	Australia	Clinton Foster (Chair)	Canada	Stefan Bachu	Denmark	Flemming Ole Rasmussen	European Commission	Jeroen Schuppers	France	Pierre Le Thiez	Germany	Jürgen-Friedrich Hake	Netherlands	Harry Schreurs	Norway	Trygve Riis	Saudi Arabia	Khalid Abuleif	UK	Philip Sharman	USA	George Guthrie
Australia	Clinton Foster (Chair)																					
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Germany	Jürgen-Friedrich Hake																					
Netherlands	Harry Schreurs																					
Norway	Trygve Riis																					
Saudi Arabia	Khalid Abuleif																					
UK	Philip Sharman																					
USA	George Guthrie																					
2. Purpose of Task Force																						
<p>The PIRT has the following functions:</p> <ul style="list-style-type: none"> • Assess projects proposed for recognition by the CSLF in accordance the project selection criteria developed by the Technical Group and 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, and gaps, providing feed back to the Technical Group • Provide input for further revisions of the CSLF Technology Roadmap (TRM). • Identify technical, economic, environmental and other issues where it would be appropriate to have CSLF recognized projects. • 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. • Ensure a framework for periodically reporting to the Technical Group on the progress within CSLF projects. • Organize periodic events to facilitate the exchange of experience and views on issues of common interest among projects, delegates, and stakeholders and provide feedback to the CSLF. • Perform other such tasks which may be assigned to it by the CSLF Technical Group 																						
3. Milestones																						
<p>Near term (next 6 months)</p> <ul style="list-style-type: none"> • Develop CSLF-Project workshops: The CSLF Projects Workshop and PIRT Meeting will be held in Al Khobar, Saudi Arabia from March 1-3, 2011. The CSLF Technical Group Meeting will be held in Edmonton, Alberta, Canada from May 18-20, 2011. 																						

- Develop and populate a Project Submission Form Checklist.
- Continue to update the technology gaps matrix and technology readiness level.
- Contribute through four Working Groups (WGs) to the Task Force to Assess Progress on Technical Issues Affecting CCS (see Status, below).
- Develop schedule for 2011 update to CSLF Technology Roadmap (TRM), expanded to incorporate the assessment of technology gaps.
- Develop plan for attracting new projects using input from new project questions.

Long term (next >18 months)

- Complete periodic assessments of gaps and upgrades of the TRM
- Promote awareness of activities among the CSLF members and stakeholders
- Project engagement workshops, events, networks
- Collaboration with other organizations

All long term activities are in progress.

4. Status

- The 2010 TRM has been updated and was ratified at the Warsaw meeting.
- Actions arising from the Warsaw meeting to ensure consistency with the CSLF Strategic Plan and to create alignment where possible with other international and global actions of CCS (such as the IEA, the IEA GHG, and the Global CCS Institute), included:
 - Development of a plan for Attracting New Projects completed upon a good response from CSLF-recognized members responding to questionnaire.
 - Global CCS Institute taking a lead role in new Taskforce (see below).
 - Submission of CSLF proposal to the IEAGHG R&D program for support.
 - The CSLF Project Submission Form and Gaps Analysis Checklist was sent to PIRT members.
- The *Task Force to Assess Progress on Closing the Gaps*, was by consensus at the Warsaw meeting, renamed “*Task Force to Assess Progress on Technical Issues Affecting CCS*”. Progress of the four Working Groups (WGs), as reported by the WG Chairs, is variable. Storage Working Group (SWG) has become the Storage and Monitoring WG and the project submission form has been refined. The Taskforce will be reviewed by the Chair (Australia) in February.
- Four new projects were assessed and unanimously recommended for CSLF recognition at the Warsaw meeting. They are:
 - CO₂ Field Lab Project (nominated by Norway, France, and United Kingdom)
 - SECARB Early Test at Cranfield Project (nominated by United States, Canada, and the United Kingdom)
 - Quest CCS Project (nominated by Canada, United States, and United Kingdom)
 - CCS Bełchatów Project (nominated by Poland, European Commission, and United States)

In addition the Gorgon CO₂ Injection Project (nominated by Australia, United States, and Canada) received formal CSLF recognition (assessed at the Pau meeting).
- A revised project proposal for consideration and support by the IEAGHG R&D program on storage capability of basalts/shales was discussed and will be resubmitted.
- Updated the website with new CSLF-recognized project summaries

CanmetENERGY R&D Oxyfuel Combustion for CO₂ Capture Project
 CSLF Project Status Report
 February 2011

1. Project Location
CanmetENERGY, Natural Resources Canada, Ottawa, Canada
2. Project Lead
Dr. Kourosh Zanganeh Zero-Emission Technologies Group Clean Electric Power Generation CanmetENERGY, 1 Haanel Drive, Ottawa, Ontario K1A 1M1 Tel: (613) 996-3916; Fax: (613) 992-9335 Email: kzangane@nrcan.gc.ca
3. Project Objectives
<ul style="list-style-type: none"> • To research and develop advanced near-zero emission technologies, including CO₂ capture systems, for fossil fuel plants. • To develop next-generation oxy-fuel combustion and burner technologies and improve the overall performance and economics of these systems. • To assess CO₂ capture and compression processes, phase changes, and the impact of impurities on the performance of CO₂ capture systems using pilot scale facilities. • To research and develop dynamic models and optimal control schemes for CO₂ capture systems. • To develop novel solvent-based CO₂ capture processes for fossil fuel plants.
4. Recent Milestones
<ul style="list-style-type: none"> • Developed and tested novel multi-pollutant control strategies and processes for oxy-coal plants with CO₂ capture and compression. • Enhanced process modeling capability to simulate advanced oxy-combustion processes. • Further process evaluation and optimization of a pilot scale CO₂ capture and compression unit. • Developed performance and economic models for advanced supercritical oxy-coal plants with integrated CO₂ capture and compression.
5. Status
<ul style="list-style-type: none"> • CANMET CO₂ R&D Consortium research program started in 1994 and is currently in the process of initiating the Phase 10 work program. • Phase 10 work program under consideration includes projects relating to: <ol style="list-style-type: none"> a) Development of an advanced oxy-fuel slagging combustor for solid fuels combustion with CO₂ capture b) performance testing of an advanced CO₂ recovery module and study of phase change in CO₂ gas mixtures; c) development of dynamic models & optimal control strategies for CO₂ capture units; d) testing of a novel hot sieving electrostatic precipitator prototype; • Consortium technical reports and presentations are confidential.

CCS Bełchatów Project
CSLF Project Status Report
February 2011

1. Project Location

The Bełchatów CCS Project is located in Poland, in the Łódź province (in the center of Poland), Rogowiec village, 180 km south-west of Warsaw – Poland's capital city. Bełchatów CCS installation will be integrated into 858MW power unit being located within the area mentioned above.

Currently three potential storage sites have been identified. Until a final site has been selected (expected by the end of I half of 2011), potential routes to each of the sites will be studied (all three within the Łódzkie Voivodeship).

The three potential storage sites are: Budziszewice, Wojszyce, and Lutomiersk Tuszyn structures. The Budziszewice structure is located about 60 km NE of Bełchatów (and SE of Łódź). The Wojszyce structure near Kutno town, is located about 115 km from Bełchatów. The Lutomiersk-Tuszyn structure is located between 45 and 60 km north of the power plant.

2. Project Lead

- **Project Manager:**
Marzena Gurgul
CCS Project Director
Phone: +48 44 735 4324
Fax: +48 44 735 4060
- **Project Contact Person:**
Artur Walentek
Investment Specialist
artur.walentek@elb.pl
Phone: +48 44 735 10 56
Fax: +48 44 735 41 40

3. Project Objectives

The project's objective is to complete the following CCS components:

- CCP plant
 - amine based post combustion CO2 capture process
 - equivalent power of 260MWe
 - capture efficiency at least 85%
 - capture rate of 1.8 Mtpa
- CO2 transport
 - pipeline transport of captured CO2 in super critical conditions over a distance of 70-140km (depending on the final storage site selection)
- CO2 storage
 - CO2 storage in deep saline aquifers

4. Recent Milestones

- Basic engineering (FEED study) for the capture component launched in November 2009 and nearly completed.
- Building permit for the capture component obtained – February 2010.
- Feasibility study for the transport component completed.
- Geological storage site selection process launched

5. Status

- PGE Górnictwo i Energetyka Konwencjonalna SA (PGE GiEK SA) has been actively developing the CCS project with partners: Alstom, Gazoprojekt, Polish Geological Institute (PGI), Schlumberger and additional contractors of examination works regarding characterisation of the potential storage sites. Alstom is a leading provider of supercritical power plants and currently constructing the Base Plant, and together with The Dow Chemical Company a leading provider of CO₂ Capture Solutions. Gazoprojekt, a subsidiary of the Polish Oil and Gas Company is specialised in gas pipelines and Polish Geological Institute and Schlumberger contribute world-class storage capability.
- In terms of the capture process, extensive test work has been progressing in the US with ongoing trials, using flue gases produced by fossil fuel power generation, anticipated to provide further robust data for the design and engineering of the capture component (CCP). This work also draws on The Dow Chemical Company's long history of providing amine solvents for CO₂ removal applications. The contract for the CCP base engineering works (i.e. FEED) was signed on 2 November 2009. The timing of the works was developed to allow preparation of documentation required to support the permitting process aiming at obtaining the CCP building permit which was already issued and validated in February 2010. A Comprehensive Environmental Impact Assessment Study for the entire CCS installation was prepared as well. This study demonstrated enough information to obtain "environmental decision" for CCP, that was issued by relevant authority on 11 December 2009 but it still must be supplemented with more details on the transport and storage component.
- In terms of the CO₂ transport and storage, three potential storage sites and associated transportation routes have been identified. Detailed appraisal of the storage sites is ongoing and a final selection will be made by the end of first half of 2011.
- Permitting for the transportation and storage will commence upon selection of the storage site. Permits for the Power Plant have been obtained and as such the specific site experience is in place to facilitate the process for the building and operation permits required for CCS. Corresponding plans are in place for obtaining all necessary permits and initial engagement with the relevant authorities has been commenced.
- On 5th May 2010 PGE GiEK S.A. signed Grant Agreement with European Commission and was awarded with the amount of €180 million within the framework of European Energy Programme for Recovery.
- In addition to the € 180 million grant being the subject of the Grant Agreement, PGE GiEK S.A. is seeking additional funding from sources as New Entrants Reserve (NER) from the EU Emissions Trading System, the European Investment Bank (EIB), Bank Ochrony Środowiska S.A. (Poland's Environmental Bank), EU Structural Funds allocated to Poland, Environmental funds and Commercial Financing facilities. In addition, PGE GiEK S.A. intends to invest own equity. PGE GiEK S.A. and its contractors recognise the importance of widespread commercialization of the developed technologies and participate in knowledge sharing activities organized by European Commission.
- PGE GiEK SA regularly publishes updates concerning its public awareness campaign on the following website: <http://www.pgegiiek.pl/index.php?dzid=139&did=2099> (information in Polish only).
- Project's website: <http://www.pgegiiek.pl/index.php?dzid=123&did=2075> (website in Polish and in English)

CCS Northern Netherlands Project
 CSLF Project Status Report
 February 2011

1. Project Location
Groningen Province, Netherlands
2. Project Lead
Desmond de Vries (ddevries@provinciegroningen.nl)
3. Project Objectives
<p>This project will implement a large-scale regional plan for capture, transport and storage of CO₂ on-shore around the Eemsharbor complex in Groningen province in the northern part of the Netherlands. The project will capture CO₂ from existing and planned power plants, transport the CO₂ to the storage location, and store the CO₂ safely underground in on-shore and off-shore natural gas fields. The project represents all elements of the CCS chain (capture, transport, reuse and storage), as well as including different CO₂ capture techniques (pre-combustion and post-combustion). Additionally, the project will develop a communication strategy, engage stakeholders, and work toward developing a legal framework for CCS in the region.</p>
4. Recent Milestones
<ul style="list-style-type: none"> • The companies NUON and RWE are preparing their proposal for the NER300. • The national government has started with local information meetings on CCS and will continue this year. • Provincial Council resolution which restricts the way in which the province of Groningen is dealing with CCS for the moment. This is a reaction on the abortion of the Barendrecht CCS onshore project and the new national coalition agreement plan on energy (CCS, nuclear and sustainable energy).
5. Status
<p>Projects of Nuon (Vattenfall) en Essent (RWE) are in preparation as planned for the NER300. Both power plants are built. Both companies are preparing their NER proposals which will be presented to the Dutch Ministry of ELI before the 9th February.</p> <p>In the Netherlands the necessary CCS regulation is being implemented.</p> <p>Local acceptance is getting more and more an issue, especially since the stopping of the Barendrecht project. This has fueled a (social and political) discussion in the Northern Netherlands concerning local support for CCS in this part of the country. In the Northern Netherlands CCS is getting an issue on local/ regional political agenda as well as part of the public debate. Especially since regional elections are at hand. Regional governments are only willing to support CCS, if certain conditions have been met with: public acceptance, safety etc.</p>

CCS Rotterdam Project
 CSLF Project Status Report
 February 2011

1. Project Location
Rotterdam, Netherlands
2. Project Lead
<ul style="list-style-type: none"> • Maarten de Hoog (maarten.dehoog@dcmr.nl) • Hans Knippels (hans.knippels@dcmr.nl)
3. Project Objectives
<ul style="list-style-type: none"> • Development of CCS in the greater Rotterdam area (Port of Rotterdam) • 2015 annual storage of 3 Mton CO₂ • 2025 annual storage of 17,5 Mton CO₂
4. Recent Milestones
<ul style="list-style-type: none"> • September 2010, annual progress report on CCS, “CO₂ capture and storage in Rotterdam, A network approach” <ul style="list-style-type: none"> ○ Characterization of Rotterdam, energy port ○ Presentation of roadmap and network approach. Sharing transport and storage functions will result a decrease in cost for transport and storage. ○ Factsheets of possible CCS-project in the greater Rotterdam area, including: ROAD, C-Gen, Air Products, Air Liquide, OCAP, Shell, Liquid Logistic Shipping Concept (Cintra), GdF Suez, Maersk, TAQA • EU-EEPR funding for the EON/Electrabel project. (ROAD) CCS demonstration plant of 250 MW size at the new EON coal fired power plant. Final Investment Decision to be made in second quarter of 2011. • Several possible NER300 projects in pipeline. Submission for tender due 9 February 2011 with national government
5. Status
<ul style="list-style-type: none"> • Cancellation of Barendrecht, demonstration of storage of CCS on land due to negative public perception; • Advise of national taskforce CCS regarding necessary (legal) actions by national government for development of CCS. Advise is written as a reaction to the EBN and Gasunie study “Transport and storage strategy for CCS” • Publication of 2010 RCI-CCS status report • Due diligence of several (three) possible CO₂ storage locations on Dutch Continental Shelf had been performed. Further detailed analysis performed to have clarity on suitability storage location for NER300 applications • Consortium (CINTRA) Development of the shipping business case, participants, Athony Veder, Gasunie, VOPAK and Air Liquide for development of CO₂ terminal. • Consortium with Mearsk and Linde, EOR with CO₂ • Discussion with industry and regulators on the need of additional safeguards for the implementation of CCS (Ensuring CCS). • Withdrawal of C-GEN activities in the Rotterdam area. • NER300 requirements of EU published.

CO2CRC Otway Project
 CSLF Project Status Report
 February 2011

1. Project Location
Southwestern Victoria, Australia
2. Project Lead
<p>Nadja Muller – Program Manager, Storage</p> <ul style="list-style-type: none"> - Phone: +61 3 8344 4309 - Mobile: +61 417 066 318 - Email: nmuller@co2crc.com.au - CO2CRC, Room 449, School of Earth Science, University of Melbourne, VIC 3010 <p>Rajindar Singh – Otway site Operations Manager</p> <ul style="list-style-type: none"> - Mobile: +61 418 428 020 - rssingh@co2crc.com.au - CO2CRC, Room 449, School of Earth Science, University of Melbourne, VIC 3010
3. Project Objectives
<p>The Otway project has been designed to demonstrate geological storage and monitoring of CO₂ under Australian conditions. It aims 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.</p> <p>Stage 1: Continue Monitoring and Verification.</p> <p>Stage 2: Drill well CRC-2(Stage 2a), determine residual gas saturation (Sgr) of CO₂ from a single well test (Stage 2b) and inject up to 10,000 tons (Stage 2c) into the Parratte saline water formation.</p>
4. Recent Milestones
<ul style="list-style-type: none"> • Geochemical sampling using U-Tube continues and understanding of the plume movement is being built up of Stage 1. • Community Reference Group meeting held on 14th September 2010. • Multiple site visits by local and international visitors.
5. Status
<ul style="list-style-type: none"> • U tube sampling of reservoir data, atmospheric monitoring, ground water sampling and soil testing to continue as part of Stage 1 activities. • Otway Stage 2b & c progressing. Completions equipment being ordered. Surface facilities long lead items being ordered. Detailed design being finalized after peer review and surface facilities HAZOP completed. Completion of CRC-2 with tubing and downhole measurements set for early Feb 2011. Stage 2b test program slated to start in June 2011. • Community is continuously updated on forward plans through public meetings with the next one planned in the beginning of March 2011.

CO₂ Field Lab Project
CSLF Project Status Report
February 2011

1. Project Location
Project is coordinated by SINTEF in Trondheim (Norway). The Field Laboratory is located at Svelviksand, 50 km south-east of Oslo (Norway).
2. Project Lead
<ul style="list-style-type: none">• Project Manager: Maria Barrio; SINTEF; maria.barrio@sintef.no• Project Coordinator: Audun Bakk; SINTEF; audun.bakk@sintef.no• Site & HSE Coordinator: Eyvind Aker, NGI, eyvind.aker@ngi.no
3. Project Objectives
<ul style="list-style-type: none">• Determine the sensitivity of monitoring systems to detect shallow CO₂ subsurface movements & surface seepage• Combination of appropriate monitoring technologies• Definition of a monitoring protocol as a tool for certification• Test and calibrate geo-models in well controlled conditions• Inform the public about the safety of CO₂ storage by showing the performance of monitoring systems
4. Recent Milestones
<ul style="list-style-type: none">• April 2010: Surface measurements completed• July 2010: Drilling of deep investigation well (333 m) completed• July - December 2010: logging of investigation well, geochemical measurements and transport properties (permeability) measurements conducted
5. Status
<ul style="list-style-type: none">• First phase of project (suitability phase) to be concluded in January 2011• Shallow CO₂-injection (20 m - 40 m depth) will be completed in 2011• Further planning and initial measurements for the deep CO₂-injection (200 m -400 m) will be conducted in 2011• More information found on project web: http://www.sintef.no/co2fieldlab

CO₂ GeoNet
 CSLF Project Status Report
 February 2011

1. Project Location
Western Europe
2. Project Lead
<ul style="list-style-type: none"> • Coordinator: Dr. Nick Riley (British Geological Survey) - njr@bgs.ac.uk • Executive Committee Chair: Samuela Vercelli (Sapienza University of Rome – CERI) • Secretary General: Sergio Persoglia (OGS) • Contact: info@co2geonet.com
3. Project Objectives
<ul style="list-style-type: none"> • Focus is R&D into geological storage of CO₂ and strengthening the European Research Area • Form a durable integration of the original 13 partners over 5 years, involve more partners • Provide the underpinning science capability and knowledge to help enable deployment of large scale CO₂ storage in Europe as quickly as possible • Collaborate internationally • Be a source of impartial scientific information on CO₂ geological storage for stakeholders • Train existing and new researchers • Develop and share research infrastructure
4. Recent Milestones
<ul style="list-style-type: none"> • In April 2008, formed a legal entity, “CO₂GeoNet Association” – www.co2geonet.eu • This will enable new strategic partners to join and existing partners to continue working together • In March 2009, the CO₂GeoNet project supported by EC under FP6 has been successfully completed and the new Association members continue to be committed to consider CO₂GeoNet as mean for open and active collaboration with the other running CSLF projects • Since then, the Association has continued the mutual integration and joint research programming, acting as a virtual institute involving more than 300 researchers from 7 European nations • CO₂GeoNet is actually leading (BRGM-Co₂GeoNet acting as project coordinator) “CGS Europe – Pan-European coordination action on CO₂ Geological Storage”, a new EC coordination and support action under FP7, aimed at pooling together the expertise of the key institutes for CO₂ storage in each relevant European Member State and Associated Country – www.cgseurope.net
5. Status
<ul style="list-style-type: none"> • The CO₂GeoNet researchers have prepared basic answers to several frequently asked questions, as to how CO₂ geological storage can be carried out, under what circumstances it is possible, and what the criteria are for its safe and efficient implementation. These are in the CO₂GeoNet’s new brochure available in Danish,

Dutch, French, German, Hungarian, Italian, Norwegian, Polish, Romanian, Spanish (and soon in Chinese, Russian, Arab and other languages), at www.co2geonet.eu

- Latest results of research presented at Annual Stakeholder workshop held April 2010. The focus has been this year on “The integration of research on CO₂ geological storage across Europe and beyond”, with presentations by European Commission, CSLF, ZEP, EERA, ECCSEL, CCS Demonstration Network, IEA-GHG, Bellona, EGS-CO₂, ESA, CO₂Net-East, demonstration projects (Statoil, ENEL, GFZ), and updates of the CCS projects in China, Japan, Canada, Eastern European
- Co-organization of two courses in March and September 2010 on CCS and “Geochemical Modelling”
- Co-organisation of the EAGE 2nd Workshop, Berlin, Germany, 11-12 March 2010, “From laboratory to deployment”
- Co-organisation of the 2nd Romanian Workshop ‘Promoting CCS in Romania’, Bucharest, 25 March 2010
- Co-organisation of the European Conference on CCS Research, Development and Demonstration, Rotterdam, The Netherlands, 19-22 April 2010
- Contribution to the GHG Research Workshop on Natural Analogues and Summer School, in August 2010
- Co-organisation of the EAGE Student Lecture Tour Europe 2010-2011 on CO₂ Geological Storage. Different experts from CO₂GeoNet will give lectures in amongst 45+ universities around Europe
- Many presentations at the GHGT-10, Amsterdam, 19-23 September 2010
- Studies performed for IEA-GHG on various aspects of CO₂ geological storage
- Participation as partner to proposals and contracts supported by EC under FP7
- Scientific advice on development of monitoring plans for CCS demo projects

- e-mail: info@co2geonet.com
- CO₂ GeoNet website: <http://www.co2geonet.com>

CO₂ Separation from Pressurized Gas Stream
 CSLF Project Status Report
 February 2011

1. Project Location
Kyoto, Japan (membrane module development) Pittsburgh, Pennsylvania, USA (testing)
2. Project Lead
Dr. Shingo Kazama RITE (Research Institute of Innovative Technology for the Earth) E-mail: kazama@rite.or.jp
3. Project Objectives
<ul style="list-style-type: none"> • Development of membrane material with molecular gate function and composite membrane of excellent CO₂ selectivity over H₂ • Development of commercial size membrane module • Testing of the module (with NETL, USA)
4. Recent Milestones
<ul style="list-style-type: none"> • Bench membrane module production and real gas pre-testing (2009FY) • Preproduction sample of commercial size membrane module (2010FY) • Testing of commercial size membrane module (2010FY) • Process simulation (2008FY-)
5. Status
<p>1st duration: 11/2003 – 03/2006 Completed</p> <ul style="list-style-type: none"> • Development of novel dendrimer materials for CO₂ separation • Fabrication of dendrimer composite membrane modules and their test <p><u>References:</u> 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”, Session 30, Proceedings of Pittsburgh Coal Conference, Pittsburgh, USA (2006)</p> <p>T. Kai, T. Kouketsu, S. Duan, S. Kazama, K. Yamada, “Development of commercial-sized dendrimer composite membrane modules for CO₂ removal from flue gas”, Separation and Purification Technology 63 (2008) 524–530 and so on.</p> <p>2nd duration: 04/2006 – 03/2011 ongoing</p> <ul style="list-style-type: none"> • Launch of bench and commercial membrane module production (Jan. 2009) • Bench membrane module production (Oct. 2009) • Real gas pre-testing of bench membrane module (Nov. 2009) • Testing of pre-commercial size membrane module (Dec. 2010 -) <p>3rd duration: 04/2011 – 03/2015</p> <ul style="list-style-type: none"> • Succeeding membrane project is in preparation

Demonstration of an Oxyfuel Combustion System
 CSLF Project Status Report
 August 2010

1. Project Location
Renfrew, Scotland, U.K.
2. Project Lead
Sang Hyeun Kim (skim2@doosanbabcock.com)
3. Project Objectives
<ul style="list-style-type: none"> • to demonstrate the successful performance of a full-scale (40MWt) OxyCoal™ burner firing at conditions pertinent to the application of an oxyfuel combustion process in a utility power generating plant; • to demonstrate the performance of an oxyfuel burner with respect to combustion efficiency, NOX, flame shape, and heat transfer characteristics; • to demonstrate the operational envelope of an oxyfuel burner with respect to flame stability, turndown, start-up, shutdown, and the transition between air- and oxyfuel-firing, • to demonstrate the safe operation of an oxyfuel combustion process under realistic operating conditions; • to generate sufficient performance data from the oxyfuel combustion process to inform future investment decisions; and • to demonstrate the level of technology readiness of the oxyfuel combustion process.
4. Recent Milestones
<ul style="list-style-type: none"> • A full scale 40MWt OxyCoal™ burner was successfully demonstrated on air and oxyfuel operation. Safe and stable operation was achieved across a wide operational envelope. Oxyfuel flame stability was comparable to air firing experience. • Safe and smooth transitions between air and oxyfuel operation were demonstrated; three different transition methodologies were proven. • Turndown from full load to 40% load was demonstrated. Stable and well rooted flames were observed across the whole load range. Flame length reduces with load (as for air firing). • Realistic CO₂ levels were achieved (in excess of 75% v/v dry, and up to 85% v/v dry). • Project won Rushlight Energy Environmental Award • Gateway review meeting, to discuss the progress of the project to-date and the proposal to continue the project for a further 2 years, was held on 13 July with DECC, Black & Veatch and independent assessors
5. Status
<ul style="list-style-type: none"> • Revised version of public report to be issued by end of August • Actions from gateway review meeting to be issued by end of August • Gain approval for the continuation project proposal

European CO₂ Technology Centre Mongstad (TCM) Project
CSLF Project Status Report
February 2011

1. Project Location
Mongstad, Norway
2. Project Lead
Tore Amundsen; Managing Director. tam@tcmda.no
3. Project Objectives
<ul style="list-style-type: none">• Develop technologies for CO₂-capture capable of wide national and international deployment• Reduce cost and technical, environmental and financial risks related to large scale CO₂-capture• Test, verify and demonstrate CO₂-capture technology owned and marketed by Vendors• Encourage the development of a market for such technology
4. Recent Milestones
<ul style="list-style-type: none">• Admin complex building completed,• Chilled Ammonia Plant: mechanical installations ongoing• Amine Plant: Mechanical and E&I installations ongoing• Installation ongoing within Electrical substation building• Seawater intake ready for installation of pumps• Overall progress November 2010 approximately 60%
5. Status
<ul style="list-style-type: none">• Investment (\$ 905 million) approved in June 2009• Construction underway (60% progress)• Operating organization established and preparing for operations

Fort Nelson Carbon Capture and Storage Project
 CSLF Project Status Report
 February 2011

1. Project Location
Fort Nelson, British Columbia, Canada
2. Project Lead
<ul style="list-style-type: none"> • Al Laundry (alaundry@spectraenergy.com) • Ed Steadman (esteadman@undeerc.org)
3. Project Objectives
<p>The primary objective of the Fort Nelson carbon capture and storage (CCS) feasibility project is to verify and validate the concept of utilizing one of North America's large number of saline formations for large-scale CO₂ injection, proposed to be in the 1.3 to 2 Mt per year range, of anthropogenic CO₂ for permanent storage. Specific goals include the following:</p> <ul style="list-style-type: none"> • Cost-effective risk management, simulation, and monitoring, verification, and accounting (MVA) strategies for large-scale CO₂ storage in deep saline formations. • Testing and refinement of reservoir modeling intended to predict and estimate CO₂ injectivity (the potential for placing CO₂ into the reservoir) and to confirm the practical CO₂ storage capacity for this site, areal extent and mobility of the supercritical CO₂ plume in the reservoir, and improved methodologies to ensure that site characterization and MVA results better support risk management objectives and modeling efforts. • Testing strategies to predict the effects of CO₂ plume on the integrity of vertical and horizontal sealing formations, including the testing and modeling of key geomechanical and geochemical parameters. Includes assessing impact of injecting a cooler sour CO₂ stream into a hotter, in situ saline fluid. • Test and model for reactions and fate of entrained H₂S in the injected supercritical CO₂ stream and impacts on reservoir and containment rocks.
4. Recent Milestones
<ul style="list-style-type: none"> • Significant update to static geological model completed, dynamic simulations are being evaluated to predict areal footprint of CO₂ and propagation of pressure build-up in the project area. • Mercury injection capillary pressures have been estimated on rock cores sampled from the exploratory well. • Cuttings from the exploratory well have been exposed to supercritical CO₂ and H₂S in a batch reactor at conditions representative of the "near wellbore" and "deep reservoir" environments. Analytical work including XRD, SEM, optical mineralogy, and geochemical modeling are ongoing.
5. Status
<ul style="list-style-type: none"> • Project areas related to geological interpretation, laboratory evaluations, risk assessment and planning of MVA activities are all ongoing and progressing. • Locations, geometries, and materials for injection wells are being assessed and are planned for completion in 2012.

Geologic CO₂ Storage Assurance at In Salah, Algeria
 CSLF Project Status Report
 February 2011

1. Project Location
In Salah, Algeria, Africa
2. Project Lead
Iain W. Wright, wrightiw@bp.com BP Alternative Energy, Chertsey Road, Sunbury, Middlesex TW16 7LN, UK
3. Project Objectives
<ul style="list-style-type: none"> • Provide assurance that secure geological storage of CO₂ can be cost-effectively verified and that long-term assurance can be provided by short-term monitoring. • Demonstrate to stakeholders that industrial-scale geological storage of CO₂ is a viable GHG mitigation option. • Set precedents for the regulation and verification of the geological storage of CO₂, allowing eligibility for GHG credits
4. Recent Milestones
<ul style="list-style-type: none"> • Processing and interpretation of the 2009 seismic has dramatically improved our resolution of the CO₂ storage complex. • The storage project Quantified Risk Assessment was updated and the storage management strategy was accordingly modified. • INSAR program continues to exceed expectations of resolution and reliability. • Monitoring well KB-5 is now fully decommissioned. • A project website is available at: www.insalahco2.org • 19 technical In Salah JIP papers were presented at the IEA's GHGT10 conference (September in Amsterdam), more than any other CCS project.
5. Status
<ul style="list-style-type: none"> • Storing up to 1mmtpa CO₂ in a deep saline aquifer (1900 deep, 2m thick, 10mD permeability). 3.3mmtCO₂ stored to date.

Gorgon CO₂ Injection Project
 CSLF Project Status Report
 February 2011

1. Project Location	
Barrow Island, Western Australia, Australia	
2. Project Lead	
<p>Inquiries in relation to the project should be addressed to: Chevron Australia Pty Ltd John Torkington - Senior Advisor, Climate Change Policy trkn@chevron.com</p>	
3. Project Objectives	
<p>The project aims to demonstrate the safe commercial scale application of greenhouse gas storage technologies at a scale not previously attempted.</p> <ul style="list-style-type: none"> • It is proposed to inject approximately 120 million tonnes of carbon dioxide at rates of between 3.5 and 4 million tonnes per annum. • The Gorgon Joint Venture Participants have given a public commitment to the disclosure of monitoring data associated with the project in order to help inform the community and other project proponents about the progress of the project. • The Gorgon Joint Venture Participants propose the sharing of lessons learned in areas such as site selection, environmental impact assessment, policy and regulatory development. 	
4. Recent Milestones	
1998	Commence detailed site selection studies
2003	Identified the Dupuy Formation as the most suitable injection site
2003	Commenced environmental impact assessment process
2003	Barrow Island Act 2003 (WA) proclaimed. This act includes the world's first greenhouse gas storage legislation
2005	Published the Gorgon Project Environmental Impact Statement / Environmental Review and Management Programme (EIS/ERMP)
2007	Received Western Australian and Australian Government environment approval the Gorgon Project.
2008	Published the Public Environmental Review (PER) for a revised and expanded Gorgon Project
2009	Received Western Australian and Australian Government environment approval of the revised and expanded Gorgon Project.
2009	Project receives final approvals, sanction from Joint Venture participants and moves into construction (September 2009)
2009	Order placed for carbon dioxide compressors (October 2009).
2009	Official groundbreaking on Barrow Island (December 2009)
<p>The project has progressed through its early development stages including site selection, site appraisal, facilities front end engineering and design and has obtained high level approvals including environmental approvals and approval to dispose of carbon dioxide by underground injection. The project is fully funded and construction has commenced.</p>	

5. Status

The Gorgon Carbon Dioxide Injection Project is an integral component of the much larger \$43 billion Gorgon Project which involves the development of the several deepwater gas fields and the development of a gas processing facility on Barrow Island. The Australian Government has committed \$60 million to the Gorgon Carbon Dioxide Injection Project as part of the Low Emissions Technology Demonstration Fund (LETDF).

The Gorgon Project is operated by an Australian subsidiary of Chevron and is a joint venture of the Australian subsidiaries of Chevron (approximately 47 percent), ExxonMobil (25 percent) and Shell (25 percent), Osaka Gas (1.25 percent), Tokyo Gas (one percent) and Chubu Electric Power (0.417 percent).

The Gorgon Project aims to export approximately 15 million tonnes of liquefied natural gas annually to east Asia markets and up to 300TJ of domestic gas into Western Australian markets.

Achievements as of January 2011 include:

- The Gorgon Project remains on schedule for first gas in 2014. December 2010 marked 12 months of construction on Barrow Island
- \$9 billion has already been committed to be expended in Australia and has already delivered 3,000 jobs to Australian industry – from Perth to Dampier, Barrow Island, Karratha, Adelaide, Brisbane, Sydney and Melbourne. Over the construction period about \$20 billion will flow to Australian industry.
- In the past year, the Project has shipped 110,000 tonnes of freight to Barrow Island, sent 1,300 truckloads of material to Dampier, mobilised 85 marine vessels around the Barrow Island, added 1,200 beds to the accommodation facilities and inducted 5,000 people.
- Work continues to focus on constructing accommodation, site preparation and logistics activities.
- In October, the Project received world recognition for its Gorgon Carbon Dioxide Injection Project from the Carbon Sequestration Leadership Forum at its annual meeting in Warsaw, Poland.
- In May, the Australian Petroleum Production and Exploration Association recognised the Gorgon Project's environmental custodianship and leadership with a 2009 Environment Award at its annual meeting. For details on these announcements and other Project news, visit <http://www.chevronaustralia.com/media.aspx>. Additional information can be found in the Gorgon Project newsletter – <http://www.chevronaustralia.com/media/publications/gorgonnewsletters.aspx> and by visiting www.chevronaustralia.com/ourbusinesses/gorgon

6. Project photographs

US Ambassador Jeffrey Bleich, Prime Minister Julia Gillard, Resources Minister Martin Ferguson and Chevron MD Roy Krzywosinski visit Barrow Island on 9 October 2010



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Australian company Thiess and Western Australian sub-contractor Decmil have a \$500 million contract to provide site preparation and the installation of temporary facilities on Barrow Island.



**



Gas will be delivered Barrow Island beneath the shoreline helping to minimise environmental impacts. Work at the site continues.

**



The Gorgon Village – which will house more than 3,000 of the island’s workforce – is taking shape.

**



The Marine Offloading Facility (MOF) foundations begin to extend from the gas plant footprint. The MOF will enable the offloading of materials required for the Gorgon Project.

Heartland Area Redwater Project (HARP)
 CSLF Project Status Report
 February 2011

1. Project Location
Redwater, Alberta, Canada
2. Project Lead
William Sawchuk (wsawchuk@arcresources.com)
3. Project Objectives
<ul style="list-style-type: none"> • Develop a low-cost, secure and long-term CO₂ storage site in the close vicinity of major CO₂ emitters in the Heartland Industrial Area of Alberta, Canada, that will attain a storage rate of at least 1 Mt CO₂/year by 2015 • Develop a characterization and monitoring program that is suited for onshore continental conditions specific to the northern plains of North America (geology, farmland area, four climatic seasons, etc.) • Support the development of a regulatory framework for CCS in Alberta, including tenure of the pore space, long-term liability as well as regulatory permitting and follow-up • Achieve synergies with a CO₂-EOR operation being developed by the operator in the oil leg of the same carbonate reef
4. Recent Milestones
<p>Phase II of the project started in August 2009 and has the aim of drilling and testing an exploratory well for the collection of specific data about rock mineralogy, flow and geomechanical properties of the injection aquifer, overlying caprock and other relevant units in the sedimentary succession. Achievements to date include:</p> <ul style="list-style-type: none"> • The Redwater reef (approximately 600 km² in size, up to 275 meters in thickness, and 1000 meters deep at its shallowest) and the Ireton shale caprock have been characterized • The geology and hydrogeology of entire sedimentary succession in an area of 24 × 30 square miles around the site has been analyzed and characterized • Hydrogeological analysis and characterization of the aquifers and aquitards in the entire sedimentary succession from the Precambrian crystalline basement to the top of the bedrock was completed • Selected the site of the injection and observation wells • Met with local land owners, communities and counties • Met with representatives of government agencies regarding the permitting process for and tenure of pore space • Completed an assessment of the natural seismicity in the area • Executed funding agreements with government and joint-industry participants • Applied to the government agency for access to the required pore space • Received licenses from the regulatory agency to drill an injection well and one observation well • Conducted a risk workshop with research providers aimed at identifying technical risks • Collected two sets of samples for the baseline surface and atmospheric MMV program • Provincial government passed a Carbon Capture and Storage Act (CCS Act)

5. Status

- The province of Alberta is now working on regulations to support the CCS Act
- Drilling of the injection and observation wells have been postponed until the CCS Act regulations have been developed

IEA GHG Weyburn-Midale CO₂ Monitoring and Storage Project
Final Phase
 CSLF Project Status Report
 February 2011

1. Project Location
Weyburn and Midale Units, Weyburn area, southeast Saskatchewan, Canada
2. Project Lead
<ul style="list-style-type: none"> • Floyd Wist (Saskatchewan Energy and Resources), Chair, Leading Sponsors Executive Committee (LSEC) • Frank Mourits (Natural Resources Canada), Project Integrator / Coordinator Policy Component • Steve Whittaker (Petroleum Technology Research Centre), Senior Project Manager, Technical / Research Component • Malcolm Wilson (Petroleum Technology Research Centre), Executive Director
3. Project Objectives
<ul style="list-style-type: none"> • Develop a comprehensive Best Practices Manual for CO₂ geological storage, which will guide all aspects of future CO₂-EOR storage projects. • Building on the successes of the First Phase, focus the technical research component on site characterization, wellbore integrity, monitoring and verification, and performance (risk) assessment. • Focus the policy component on public communications and outreach, regulatory issues and the business environment. • Ensure integration across technical research and policy components.
4. Recent Milestones
<ul style="list-style-type: none"> • March 2009 – Public Communications and Outreach work program and budget approved by LSEC. Work on CCS website and outreach activities commenced. • June 2009 – Project Integration and Sponsors Meeting (PRISM-4), Regina, Saskatchewan. • June 2009 – an expert workshop was held in Calgary as part of the ongoing Risk Assessment work. • October 2009 – a workshop was held in Ottawa with researchers involved in modeling tasks. • January 2010 – Project Integration and Sponsors’ Meeting (PRISM-5), Ottawa, Ontario. • March 2010 – Completion of a study that clarifies the regulatory framework governing injection and storage of CO₂ in Saskatchewan (second major deliverable under the Regulatory Theme). • January / May 2010 – Additional funding of \$2.2 million by NRCan and \$3 million by DOE/NETL announced for expanded well integrity program. • The new www.ccs101.ca website was launched at the 9th Carbon Capture and Sequestration Conference in Pittsburgh (May 10-13, 2010). • June 2010 - Project Integration and Sponsors’ Meeting (PRISM-6), Saskatoon, Saskatchewan. • December 2010 - Project Integration and Sponsors’ Meeting (PRISM-7), Calgary, Alberta.

5. Status

- 30 active research projects in four Themes are underway as of January 2010.
- The static geological model is being updated with incremental research results and will store much of the data generated within the project.
- A model for determining the long-term fate of CO₂ has been constructed and input parameters have largely been determined. Initial runs have been completed.
- In field wellbore integrity testing is being implemented using a well scheduled for abandonment in the Weyburn Field. Cased hole logs have been run and the in-field operations are expected to commence in mid- to late-February. Tool development has been underway for several months and has undergone significant laboratory and bench top testing.
- A shallow groundwater survey was completed fall 2009. This survey complements similar surveys performed since the inception of the project in 2000.
- Three reservoir fluid sampling monitoring surveys were completed in October 2008, May 2009 and October 2009. Additional surveys were conducted in May and October of 2010 for a total of 16 monitoring surveys for reservoir fluids.
- Passive micro-seismic monitoring is ongoing. Surveys to date have indicated very minimal response to CO₂ injection.
- Extensive work is being performed to improve the rock physics model used to assist in calibrating the time-lapse 3D seismic for CO₂ saturations.
- Stochastic modeling has made progress in integrating both geophysical and geochemical databases to understand CO₂ behavior within the reservoir.
- A soil gas monitoring survey is scheduled for spring 2011.
- The Risk Assessment process is in the final stages of integrating stakeholder community members, technical expert opinions and biosphere discussions.
- Major work items under the Regulatory Theme have been completed. The Theme Lead will maintain a watching brief to keep the completed studies up-to-date. Presentations on these studies to government agencies, conferences and other events are being made on request.
- Under the Public Communications and Outreach Theme, a display stand with CCS information materials was developed for use at conferences and conventions (e.g. science teachers' conferences), and Open Houses by new large CCS demonstration projects in Canada. Further outreach activities are being developed for 2010-2011.
- Most research will be completed by March 31, 2011. Several tasks, including new work, will extend beyond this date.
- The project's key deliverable, a Best Practice Manual, is scheduled to be completed by September 30, 2011.

Lacq Integrated CCS Project
CSLF Project Status Report
February 2011

1. Project Location
France – South West
2. Project Lead
<ul style="list-style-type: none">• Jacques Monne : R&D Manager, jacques.monne@total.com• Jean-Pierre Quet : Production Manager, jean-pierre.quet@total.com
3. Project Objectives
<ul style="list-style-type: none">• The overall aim of this project is to test the industrial-scale feasibility of an integrated CCS chain within industrial facilities.• To demonstrate the feasibility of converting an existing 30 MW industrial boiler to oxycombustion in order to confirm the following targets of<ul style="list-style-type: none">○ reduction of capture cost compared to classical post capture technologies○ reduction of overall direct and indirect CO₂ emissions if indirect emissions are not captured• To develop and apply geological storage qualification methodologies, monitoring and verification techniques on a real operational case to prepare future larger scale long term storage projects
4. Recent Milestones
<ul style="list-style-type: none">• Environmental baseline acquired since 2008 (soil gas, ecosystems, passive micro-seismicity)• January 2010 : beginning of injection
5. Status
<ul style="list-style-type: none">• Reservoir pressure evolution is as predicted• Continuous micro seismic monitoring and seasonal surveys for environmental monitoring in progress

QUEST CCS Project
 CSLF Project Status Report
 February 2011

1. Project Location
Shell Scotford Upgrader, Fort Saskatchewan, Alberta, Canada
2. Project Lead
<ul style="list-style-type: none"> • Ian Silk, Quest Venture Manager, Shell Canada i.silk@shell.com • Project Contact Paul Hagel, Senior Government Relations Advisor paul.hagel@shell.com
3. Project Objectives
<ul style="list-style-type: none"> • The Quest CCS project is a fully integrated capture, transportation, storage and monitoring project, which will capture and store up to 1.2 million tonnes/yr of CO₂ from the Shell Scotford Oil Sands Upgrader in central Alberta, Canada. The CO₂ will be transported via pipeline approximately 80 km northeast of Scotford and stored underground (2000 m to 2300m) in a deep geological formation (Basal Cambrian Sands). • Demonstration by 2015 of technology, innovation and cost for the design, construction and operation of CO₂ capture from steam methane reforming associated with an existing oil sands upgrader • Demonstration by 2015 of technology, innovation and cost associated with the compression, and pipeline transportation up to 80km from the capture facilities to the storage site • Demonstration by 2015 of technology, innovation and cost associated with appraisal, design, construction, operation and monitoring (MMV) of CO₂ storage in a deep saline aquifer (Basal Cambrian Sands) in central Alberta • Demonstration of a significant reduction in CO₂ footprint from an existing oil sands operation through an industrial, commercial-scale CCS application. • Continuous operation beyond 2015 of the commercial scale CCS project associated with the Scotford oil sands upgrader for a minimum of 10 years.
4. Recent Milestones
<ul style="list-style-type: none"> • On November 30th 2010 Shell Quest Venture team submitted the required government regulatory applications including regulatory applications for each component of the project: Capture, transport and storage of CO₂. The Energy Resources Conservation Board (ERCB) is the primary regulatory agency for the project. A cooperative Environmental Assessment was conducted to meet both provincial and federal requirements – with Alberta Environment acting as the lead party. • Nov.1-4, 2010, the project team held four open houses near the proposed project in central Alberta including Fort Saskatchewan , Radway, Bruderheim and Thorhild. This was the third round of open houses conducted in the past two years. • The 84km CO₂ pipeline route leading from the Scotford Upgrader to the injection wells north is nearly identified; the project team expects to confirm the entire pipeline route by early 2011

- September/October 2010, successful water injection tests conducted
- In early 2010, the project team completed a comprehensive seismic data collection

5. Status

- Shell's stakeholder outreach program will continue into 2011 as the project team continues to provide information and seek input on the all aspects of project leading up to and beyond a regulatory decision.
- The capture and pipeline design activities have entered the define phase, this being the final stage ahead of a final investment decision
- Shell's test well and storage appraisal program will continue over 2011 to inform all technical elements of the project including the final storage site location, number of wells, well spacing and design, as well as reservoir suitability and capacity for permanent CO2 storage.
- For more information, check out www.shell.ca/quest or contact paul.hagel@shell.com

Regional Carbon Sequestration Partnerships (RCSP) Project
 CSLF Project Status Report
 February 2011

1. Project Location
Various locations in United States and Canada
2. Project Lead
National Regional Carbon Sequestration Partnership (RCSP) Initiative Managed by the U.S. Department of Energy National Energy Technology Laboratory (NETL) <ul style="list-style-type: none"> • John Litynski, Sequestration Technology Manager, NETL (john.litynski@netl.doe.gov) • John Litynski, Sequestration Division Director (Acting), NETL (john.litynski@netl.doe.gov) • Traci Rodosta, Regional Partnerships Coordinator, NETL (traci.rodosta@netl.doe.gov)
3. Project Objectives
<ul style="list-style-type: none"> • Coordinate this government/industry effort of seven RCSPs tasked with determining the most suitable technologies, regulations, and infrastructure needs for carbon capture, transport, and storage across areas of the United States and Canada. • Develop the infrastructure necessary for the future deployment and commercialization of carbon capture and storage (CCS) as a critical strategy mitigation of greenhouse gas emissions and climate change. • Implement the RCSP program in three phases: <ul style="list-style-type: none"> ○ Characterization Phase (2003 – 2005): The partnerships completed the initial characterization of their regions’ potential to store CO₂ in different geologic formations. ○ Validation Phase (2005 – 2011): The partnerships are 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 Development Phase activities. ○ Development Phase (2008 – 2018): The partnerships will implement large-scale field testing involving at least one million tons of CO₂ per project to confirm that CO₂ injection and storage can be achieved safely, permanently, and economically. These tests will include one to three years of site characterization; one to three years of injection; and two or more years of post-injection monitoring, verification, and accounting (MVA).
4. Recent Milestones
<ul style="list-style-type: none"> • Validation Phase was initiated in 2005 and is scheduled for completion in 2011. A total of 19 out of 20 small scale field tests have been completed with one test having ongoing monitoring activities. The final test is the Columbia Basin basalt test that should be completed in 2011. Below are the results from the completed tests. <p style="margin-left: 40px;">Completed Saline Formation CO₂ injection field tests:</p> <p style="margin-left: 40px;"><u>Midwest Geological Sequestration Consortium (MGSC)</u></p> <ul style="list-style-type: none"> ○ Illinois Basin – injection site was merged with Phase III site, characterization well was drilled in Phase II. <p style="margin-left: 40px;"><u>Midwest Regional Carbon Sequestration Partnership (MRCSP)</u></p>

- Michigan Basin – two injection tests totalling 60,000 metric tons in the Bass Islands Dolomites completed in July 2009.
- Cincinnati Arch – injection of approximately 900 metric tons in the Mt. Simon was completed in September 2009.
- Appalachian Basin – injection was completed in September 2008 targeting the Oriskany and Clinton Sandstones.

Southeast Regional Carbon Sequestration Partnership (SECARB)

- Mississippi Gulf Coast – injection of approximately 2,740 metric tons into the Lower Tuscaloosa Formation at Plant Daniel in late 2008.

West Coast Regional Carbon Sequestration Partnership (WESTCARB)

- Colorado Plateau – evaluation completed in Naco and Martin Sandstones in December 2009.

Completed Enhanced Oil or Gas Recovery and CO₂ storage:

Midwest Geological Sequestration Consortium (MGSC)

- Illinois Basin – Huff’ n Puff test in the Weller Sandstone was completed in March 2007 in Fayette County, Illinois; approximately 39 metric tons of CO₂ were injected and 93 barrels of oil produced.
- Illinois Basin – Mumford Hills EOR field test in the Clore Formation was completed in early 2010 in Posey County, Indiana; approximately 6,300 metric tons of CO₂ was injected at the rate of 22 to 27 metric tons per day; incremental oil production increased over the pre-CO₂ injection oil rate and current EOR production is 1,590 stock tank barrels.
- Illinois Basin – Sugar Creek EOR field test was completed in 2010 in Hopkins County, Kentucky; approximately 6,600 metric tons of CO₂ was injected at a rate of 22 metric tons per day into the Jackson Sandstone; oil recovery rate did increase despite early CO₂ breakthrough at one well and current oil production is 2,110 stock tank barrels.

Plains CO₂ Reduction Partnership (PCOR)

- Williston Basin – Huff’ n Puff in the Mississippian Canyon Formation was completed in June 2009 in Williams County, North Dakota; approximately 400 metric tons were injected producing through September 17th, 2009, approximately 242 barrels of oil and 1,991 thousand cubic feet of natural gas.
- Zama Oil Field – acid gas (70% CO₂ and 30% H₂S) injection was completed December 2006 in the Middle Devonian Keg River Formation at the Alberta, Canada, site in which 25,400 metric tons of CO₂ has been injected, producing more than 25,000 barrels of oil.

Southeast Regional Carbon Sequestration Partnership (SECARB)

- Cranfield Oil Field – initial injection of 627,744 metric tons into the Tuscaloosa Formation was completed in July 2008 for enhanced oil recovery, project transitioned into Development Phase and to date more than one million tons of CO₂ has been injected.

Southwest Regional Partnership on Carbon Sequestration (SWP)

- Aneth Oil Field – as of December 2009, approximately 630,000 metric tons have been injected into the Deep Creek and Ismay Formations within the Paradox Basin for EOR operations.
- SACROC – injection of approximately 86,000 metric tons were injected into the Horseshoe Atoll and Pennsylvania Reef/Bank Play in the Permian Basin.

Completed Enhanced Coalbed Methane (ECBM) CO₂ tests:

Midwest Geological Sequestration Consortium (MGSC)

- Illinois Basin – the 91 metric tons injection was completed in July 2008 into the Pennsylvanian Carbondale Formation at 2-3 tons per day, methane gas was produced as a

result.

Plains CO2 Reduction Partnership (PCOR)

- Williston Basin – injection of 80 metric tons of CO2 into lignite in the Fort Union Formation in Burke County, North Dakota.

Southwest Regional Partnership on Carbon Sequestration (SWP)

- San Juan Basin – to date approximately 16,700 metric tons has been injected into the coals in the Upper Cretaceous Fruitland Formation, and low amounts of methane have been subsequently produced.

Southeast Regional Carbon Sequestration Partnership (SECARB)

- Central Appalachian Basin – injection of 907 metric tons into coals in the Pocahontas and Lee Formations was completed in early 2009.
- Black Warrior Basin – injection of approximately 252 metric tons of CO2 was injected into the Black Creek, Mary Lee and Pratt Coals at the Blue Creek Coal Degasification Field, Tuscaloosa County, Alabama.

Terrestrial Sequestration Projects: Eleven successful terrestrial sequestration projects have been completed during the Validation Phase, and additional projects will continue through 2011. Project categorization includes agriculture soils, soil reclamation, afforestation, accounting/aggregation and wetlands reclamation.

- Development Phase activities began in 2008 and will continue for approximately 10 years. There are seven to nine large-volume injection tests initiating between 2009 –2014. These injection tests are being conducted primarily in saline formations with one test being conducted in an oil bearing formation.

Partnership Development Project Status:

Big Sky Regional Carbon Sequestration Partnership (Big Sky)

- The Partnership is currently conducting final site determination activities.

Midwest Geological Sequestration Consortium (MGSC)

- Decatur Project. The Partnership will conduct a large scale saline formation test in the Illinois Basin that will inject 365,000 metric tons of CO2 per year into the Mt. Simon Sandstone for three years totalling one million metric tons. The source of the CO2 will be the Archer Daniels Midland Company (ADM), ethanol production facility in Decatur, Illinois. It is scheduled to begin injection in mid 2011 timeframe.

Midwest Regional Carbon Sequestration Partnership (MRCSP)

- Michigan Basin Project. The Partnership will conduct a large scale saline formation test in Otsego County, Michigan Basin, injecting one million metric tons of CO2 over a four year period. The primary target formation is the St. Peter Sandstone with a secondary target, Bass Islands Dolomite, which accepted 60,000 metric tons during the Validation Phase. The source of the CO2 will be Core Energy via natural gas processing facility and the test is scheduled to begin in the 2011/2012 timeframe.

Plains CO2 Reduction Partnership (PCOR)

- Bell Creek Project. The first of the Partnership's two development projects is located in the Powder River Basin project in Montana. In partnership with Denbury Resources Inc, the Bell Creek Project will couple EOR and CO2 storage by injecting over one million metric tons of CO2 per year into the Muddy Sandstone Formation. The source of CO2 is the Lost Cabin/Madden Gas Plant operated by ConocoPhillips and injection is anticipated in late

2012 or early 2013.

- Fort Nelson Project. The second development project, the Fort Nelson project, will have the capability to capture more than two million metric tons of sour CO₂ (95% CO₂ and 5% H₂S) per year from one of the largest gas-processing plants in North America and inject it into the Devonian Elk Point Group/Sulphur Point Formation, Horn River Basin. The source of the CO₂ will be Spectra Energy's Fort Nelson Natural Gas Processing Plant and injection is anticipated in early 2014.

Southeast Regional Carbon Sequestration Partnership (SECARB)

- Cranfield Early Test Project. The first of the Partnership's two development projects began injection in April 2009 and has injected one and a half million tons of CO₂ over 18 months into the Lower Tuscaloosa Formation. The source of CO₂ was Jackson Dome, and it was delivered via Denbury Resources' CO₂ pipeline.
- Citronelle Dome Anthropogenic Project. This second development project the Partnership is conducting is an integrated capture and injection project that will inject 300,000 metric tons of CO₂ over three years into the Paluxy Formation. The source of the CO₂ is a 25 MW flue gas stream from Southern Company's Plant Barry Power Station located near Mobile, Alabama. Injection is anticipated to begin in mid 2011.

Southwest Regional Partnership on Carbon Sequestration (SWP)

- The Partnership is currently conducting final site determination activities.

West Coast Regional Carbon Sequestration Partnership (WESTCARB)

- The Partnership is currently conducting final site determination activities.

Additional Sequestration Program RCSP Updates:

- The 2010 Sequestration Project Portfolio is available and includes information on the Sequestration Program, Regional Partnerships, Carbon Sequestration Program R&D Focus Areas (Project Fact Sheets) and American Recovery and Reinvestment Act Sequestration projects. Please see the link below for more information:
http://www.netl.doe.gov/technologies/carbon_seq/refshelf/project%20portfolio/2010/index.html
- The third edition of the Carbon Sequestration Atlas of the United States and Canada is now available online. The 2010 Carbon Sequestration Atlas includes an overview of DOE's Sequestration Program, International Collaborations, National Risk Assessment, RCSP Activities, Refined CO₂ Storage and Prospective Storage Resources within the RCSPs, Worldwide CCS projects and regulatory issues and NATCARB's improved databases and GIS system.
- Five of the seven anticipated Best Practices Manuals based on the lessons learned from the RCSP Initiative have been completed and are available online:
http://www.netl.doe.gov/technologies/carbon_seq/refshelf/refshelf.html
 - Monitoring, Verification, and Accounting of CO₂ Stored in Deep Geologic Formations
 - Best Practices for Public Outreach and Education for Carbon Storage Projects
 - Site Screening, Site Selection, and Initial Characterization for Storage of CO₂ in Deep Geologic Formations
 - Geologic Storage Formation Classification: Understanding Its Importance and Impacts on CCS Opportunities in the United States
 - Best Practices for Terrestrial Sequestration of Carbon Dioxide
- NETL is continuing ongoing collaboration with Interstate Oil and Gas Compact Commission (IOGCC), through SECARB, to evaluate potential for subsurface geological storage of CO₂, in Federal waters, Gulf of Mexico (GOM), utilizing existing infrastructure, such as wells and pipelines and addressing regulatory, legal and technical issues.

5. Status

- The RCSPs span 43 states and 4 Canadian provinces and include agency participation from six member countries of the CSLF.
- 19 of the 20 geologic and 11 of 12 terrestrial field tests have been completed in the Validation Phase with one remaining to be completed in 2011.
- The Development Phase is underway starting 2008, with the first four awards announced in late 2007 and three more large-scale awards announced in 2008.
- The 2010 Regional Carbon Sequestration Partnerships Review Annual Review Proceedings, which include more detailed descriptions of status, are at:
<http://www.netl.doe.gov/publications/proceedings/10/rcsp/index.html>

6. Links to RCSP Programmatic Information

- Carbon Sequestration webpage on the NETL website:
- 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
- DOE/NETL Carbon Dioxide Capture and Storage RD&D Roadmap 2010:
- http://www.netl.doe.gov/technologies/carbon_seq/refshelf/CCSRoadmap.pdf
- Carbon Sequestration Atlas of the United States and Canada:
- http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlasIII/index.html
- An Introduction to Carbon Capture and Sequestration (video):
- 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
- Carbon Sequestration Project Portfolio:
- http://www.netl.doe.gov/technologies/carbon_seq/refshelf/project%20portfolio/2010/index.html
- Regional Carbon Sequestration Partnerships Phase I Accomplishments, see:
http://www.netl.doe.gov/technologies/carbon_seq/partnerships/phase1/workproducts_table.html

**Southeast Regional Carbon Sequestration Partnership (SECARB) Early Test at
Cranfield Project**
 CSLF Project Status Report
 February 2011

1. Project Location
Test area is northeastern side of Cranfield Unit, 16 km east of Natchez Mississippi, USA
2. Project Lead
Susan D. Hovorka, Gulf Coast Carbon Center, Bureau of Economic Geology, Jackson School of Geosciences, the University of Texas at Austin susan.hovorka@beg.utexas.edu
3. Project Objectives
<ul style="list-style-type: none"> • History matching to compare model predictions of fluid flow to observed measurements of fluid flow in a complex rock unit. • Test the effectiveness of standard and innovating monitoring tools in the reservoir, above the reservoir, in the groundwater system, and in the shallow soil zone • This project is hosted by Denbury Onshore LLC; and field serviced are provided by Sandia Technologies LLC
4. Recent Milestones
<ul style="list-style-type: none"> • One year of monitoring has been completed • 2.5 million metric tons CO₂ from Jackson Dome (natural source) have been injected
5. Status
<ul style="list-style-type: none"> • Post-injection 3-D seismic survey, VSP survey and cross well seismic survey, and cased hole logging has been completed with Lawrence Berkeley National Laboratory and Schlumberger as lead collaborators • Lawrence Livermore National Laboratory has documented the response of an Electrical Resistance Tomography array to a CO₂ flood • An in-zone geochemical monitoring program with Oak Ridge National Laboratory and USGS Menlo Park as major contributors has been completed • A near surface monitoring program has been conducted with University of Mississippi and Mississippi State University as major collaborators • Project website; gulfoastcarbon.org. See 'bookshelf' for reports.

Zama Acid Gas Enhanced Oil Recovery, CO₂ Sequestration, and Monitoring Project
CSLF Project Status Report
February 2011

1. Project Location
Zama City, Alberta, Canada
2. Project Lead
<ul style="list-style-type: none">• Ed Steadman, Energy & Environmental Research Center, Grand Forks, North Dakota, USA<ul style="list-style-type: none">– E-mail: esteadman@undeerc.org• Steven Smith, Energy & Environmental Research Center, Grand Forks, North Dakota, USA<ul style="list-style-type: none">– E-mail: ssmith@undeerc.org• Bill Jackson, Apache Canada Ltd, Calgary, Alberta, Canada<ul style="list-style-type: none">- E-mail: bill.jackson@apachecorp.com
3. Project Objectives
To validate the sequestration of CO ₂ -rich acid gas in a depleted oil reservoir
4. Recent Milestones
<ul style="list-style-type: none">• Preliminary static geological model has been developed utilizing as much as 50 years worth of reservoir specific data provided by Apache Canada, Ltd. This model will be used to validate stored volumes of CO₂ and better understand overall sweep efficiency.• All laboratory work has been planned in anticipation of activities kicking off this upcoming quarter.
5. Status
<ul style="list-style-type: none">• Injection is ongoing. Over 80,000 tons of acid gas has been injected to date.• Approximately 40,000 incremental barrels of oil have been produced to date.