Carbon Sequestration leadership forum

www.cslforum.org

Strategic Plan Implementation Report

September 2012

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Report from CSLF Secretariat

2011 CSLF Ministerial Meeting

The CSLF held its 4th CSLF Ministerial Meeting in Beijing, China on September 19-23, 2011. Over 400 people registered for this event, with the highlight being the Ministerial Conference on September 22. The first two days consisted of individual group and task force meetings, including the Projects Interaction and Review Team (PIRT), the Carbon Capture and Storage (CCS) in Academic Community Task Force, the Financing CCS Task Force, the Risk Assessment Task Force (RATF), the Task Force for Assessing Progress on Technical Issues Affecting CCS, the Capacity Building Task Force, and the Capacity Building Governing Council. The afternoon of the second day also included separate meetings of the Policy Group and Technical Group. Five new projects were approved for CSLF recognition:

- CO_2 Capture Project – Phase 3
- CGS Europe Project
- Rotterdam Opslag en Afvang Demonstratieproject (ROAD)
- SaskPower Integrated CCS Demonstration at Boundary Dam Unit 3
- Zero Emissions Porto Tolle (ZEPT)

This brings the total number of CSLF recognized projects to 34, including 24 active projects.

The morning of Wednesday, September 21, featured the Opening Ceremony of the 2011 CSLF Ministerial Meeting. Host country remarks were given by China's Vice Minister of Science and Technology Cao Jianlin. Policy Group Chair Charles McConnell, United States, delivered the Opening Statement. Afterwards, Vice Minister Cao, Policy Group Chair McConnell, and CSLF Secretariat Director Barbara McKee presented the CSLF Global Achievement Awards. Each of the three accomplished projects reached significant milestones with sustained operation demonstrating the capture, injection, and storage of several million tons of carbon dioxide (CO_2). Recipients of the award were the In Salah CO_2 Storage Project, Algeria; the Sleipner CO_2 Project, North Sea; and the Weyburn-Midale CO_2 Project, Canada.

After the Opening Ceremony, the Policy Group and Technical Group reconvened for separate meetings during the morning. The afternoon activities included the Stakeholders Forum with exhibition. Peng Sizhen, Deputy Director General, the Administrative Centre for China's Agenda 21, Ministry of Science and Technology, China; and Jeff Chapman, Chief Executive Officer, Carbon Capture and Storage Association, United Kingdom, served as the forum co-chairs. Sun Chengyong, Counsellor, Department of Social Development, Ministry of Science & Technology, China; provided a keynote address and welcoming remarks. Philippe Joubert, Deputy Chief Executive Officer, Alstom, France; provided the second keynote address. Topics for the two sessions during the Stakeholders Forum were "State-of-the-Art CCS Technologies" and "What Will Make CCS Attractive to Investors?"

Thursday, September 22, featured the Ministerial Conference. Wan Gang, Minister of Science and Technology, China; and Xie Zhenhua, Vice Chairman of the National Development and Reform Commission, China; provided the welcoming and remarks on carbon capture, utilization and storage (CCUS) in China. Martin Ferguson, Minister for Resources, Energy and Tourism, Australia; Steven Chu, Secretary of Energy, United States;

Ola Borten Moe, Minister of Petroleum and Energy, Norway; and Chris Huhne, Secretary of State of Energy & Climate Change, United Kingdom; served as moderators or keynote speakers for various aspects of the meeting. As a result of the meeting, the ministers and heads of delegation released the Communiqué that endorsed CCUS technologies as a key component of international plans to combat climate change. The Communiqué also stressed the urgency with which the number of large CCUS demonstrations must be increased to ensure deployment of CCUS commercially by the end of the decade. Later that afternoon, Steven Chu, Secretary of Energy, United States; Wan Gang, Minister of Science and Technology, China; and Xie Zhenhua, Vice Chairman of the National Development and Reform Commission, China; provided public statements at the Press Conference. To read the Communiqué, please visit the following address:
http://www.cslforum.org/pressroom/publications/beijing_communique_final.pdf

On the final day of the meeting, the Policy Group and Technical Group met during the morning for the Joint Meeting of the CSLF Policy and Technical Group. During the afternoon, participants attended a technical site visit to the Huaneng Group Beijing Gaobeidian, a 3,000 tons-per-annum CO_2 capture pilot project.

Additional information about the meeting is online at the CSLF website:
http://www.cslforum.org/meetings/beijing2011/index.html

2012 CSLF Technical Group Meeting and CO_2 Capture Workshop

The CSLF Technical Group met in Bergen, Norway on June 11-14, 2012. The meeting featured several presentations from Norwegian experts on the status of CCUS in their country, formation of four new task forces for work on various aspects of the new Technical Group Action Plan, and formation of a new working group to shepherd the development of the 2013 CSLF Technology Roadmap. Three new projects were recommended to the Policy Group for CSLF recognition:

- Illinois Basin – Decatur Project
- Illinois Industrial Carbon Capture and Storage Project
- Air Products CO_2 Capture from Hydrogen Facility Project

Additional information about the meeting is online at the CSLF website:
http://cslforum.org/meetings/bergen2012/index.html

A one-day technology workshop on CO_2 Capture was held on the final day of the Technical Group meeting, and featured presentations and interactive discussions with representatives from nine different CSLF-recognized projects. Approximately 40 people were in attendance. Session 1 of the workshop, “Scaling Up Carbon Capture for Commercial Deployment”, identified and described possible issues and other considerations for CO_2 capture in commercial-scale projects, such as identifying and understanding the scale-up risks of CO_2 capture processes. Session 2, “Strategies and Technologies for Carbon Capture Cost Reduction”, explored possible strategies and other considerations that can reduce the cost for CO_2 capture at commercial scale. Presentations from the CSLF Technical Workshop on Project Integration are available at the following link:
http://www.cslforum.org/meetings/workshops/technical_bergen2012.html

CSLF Risk and Liability Workshop

A Workshop on Risk and Liability of Geologic Storage of CO_2 was held in Paris, France on July 10-11, 2012. The purpose of this workshop was to improve the understanding of geological risks associated with CO_2 storage and their relationship to financial liabilities. This information is needed by governments to make decisions on liability management frameworks and by industry to make investment and operating decisions. The workshop also discussed how risk and liability information can be communicated effectively.

Session 1 of the workshop featured talks by senior representatives of the three sponsoring organizations, who defined the broader issues and related those to the overall context of CCUS deployment. Session 2 addressed how geologic risks are measured by geologists and geological engineers. Several presentations addressed how geological risks are estimated in different regions, the current state of knowledge about the risks of geologic storage, and how these risks vary by region. Session 3 addressed business risks and potential liabilities, how these are evaluated for business decisions and what this means to the different industries. Session 4 considered liability for geologic storage, how risks are valued and how the industry insurance and banking sectors address liabilities. Session 5 addressed government policy, the issues encountered by governments in addressing liability and their approaches to risk and liability. Session 6 addressed what will make the public be and feel safe and comfortable with CCUS and also what will make investors comfortable.

CSLF Hosts Technical Workshop on Project Integration with Global CCS Institute

As a part of both the CSLF's and Global CCS Institute's focus on assisting CCS projects through knowledge sharing, a one-day workshop was organized to share experiences on CCS project integration and to identify priority integration topics that need further attention to facilitate CCS project development and deployment. The workshop was held in London, United Kingdom on November 3, 2011.

Approximately 50 people were in attendance, which allowed for open discussions on a range of technical topics related to CCS project integration, including heat integration, plant operability, environmental control, CO_2 specifications, and scale-up challenges. Interactive discussions between workshop participants also delved into the opportunities and challenges associated with integrating the CCS chain from a commercial and management perspective. Insights were presented on the timing of storage site characterization and issues associated with balancing transportation systems for CCS.

The open panel discussions were fed by presentations from leading projects with experience on key integration themes. Presentations from the CSLF Technical Workshop on Project Integration are available at the following link:
http://www.cslforum.org/meetings/workshops/technical_london2011.html

Financing CCS Roundtable held in Paris

On January 20, 2012, the CSLF Financing CCS Task Force co-sponsored a roundtable discussion with the Global CCS Institute and the Societe Generale Corporate and Investment Banking in Paris, France. The discussion was titled "Commercial and Financial Structuring of Industrial Scale Projects with CCS, What Will it Take to Turn Ambition into Reality." The meeting discussed how the first of the planned large-scale CCS projects (i.e., the "lighthouse" projects that are intended to demonstrated CCS at commercial scale) are having great difficulty achieving financing due to a perceived risk. Integration risk is a major concern. These first-of-a-kind projects are not so much meant to demonstrate individual technologies at a large scale as to demonstrate their integration. In addition, the inclusion of enhanced oil recovery (EOR) where possible, helps alleviate some of the risk due to the added revenue stream from the sale of CO_2. The meeting concluded that at least ten "lighthouse" projects are needed to help reduce or remove risk and its resulting cost before commercialization of CCS is truly possible. As a result of this risk, no "lighthouse" project can be reasonably expected to go forward without substantial governmental support, either direct and/or from incentives, to close financing gaps.

CSLF Sponsors South African CCS Week

From October 24-28, 2011, the CSLF sponsored the second South African CCS Week. The week was organized by the South African Centre for Carbon Capture and Storage (SACCCS) and South Africa's Department of Energy. The meeting was paid in part with funds from the CSLF Capacity Building Governing Council. South African CCS Week included a two-day CCS conference focused on currently underway CCS activities in South Africa and the southern Africa region. South Africa's Department of Energy Director-General, Ms. Nelisiwe Magubane, provided the welcoming remarks.

Four technical workshops were also included during South African CCS Week. Workshop topics included CO_2 injection projects, CCS legal and regulatory frameworks, CCS risk assessment, and CCS public engagement. One of the many highlights of South African CCS Week included the South African Department of Energy announcing the formation of a CCS Interdepartmental Task Team to develop a legal and regulatory framework for CCS in South Africa.

CSLF Capacity Building Fund sponsors Capacity Building Workshops in Mexico City

In March 2012, two Capacity Building Workshops were held in Mexico City that were financially supported by the CSLF Capacity Building Fund. These workshops were organized by the CSLF, Mexico's Institute of Engineering (UNAM), and Mexico's National Autonomous University. This was an extended event, staged over two weeks, with the first week centered on geologic storage of CO_2 and the second week focused on CO_2 capture.

CSLF Capacity Building Fund sponsors Capacity Building Courses in Brazil

As part of the CSLF Capacity Building Program, Brazil hosted a basic course from July 30 – August 3, 2012 at the Pontifical Catholic University of Rio Grande do Sul in Porto Alegre. As the first of four planned courses in Brazil to focus on CCS, this course was titled "Understanding Carbon Capture and Storage," and was made possible through the CSLF Capacity Building funds. The event featured five days of presentations and discussions from global experts, including members from the Center of Excellence in Research and Innovation in Petroleum, Mineral Resources and Carbon Storage (CEPAC), Petrobras, and the CSLF Secretariat.

Public Outreach

On January 19, 2012, the CSLF issued its latest *inFocus* paper entitled "What is Capacity Building?" Capacity building is the collective activities and efforts to create the information, tools, skills, expertise and institutions required to implement CCUS demonstrations and move them rapidly into commercial operation, particularly in emerging economies. To view this paper and learn more about capacity building, please visit the following website: http://www.cslforum.org/publications/documents/cslf_infocus_whatiscapacity_building.pdf

Report from the CSLF Stakeholders Autumn 2012

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

Since the launch of the Atlas on Geological Storage of Carbon Dioxide in South Africa during September 2010, which indicated viable storage potential, work has proceeded on the pre-feasibility for the Test Injection scheduled for 2017. Projects currently underway include:

- Scoping Study for Test Injection
- Regulatory Requirements for Test Injection
- Zululand Basin Storage Potential
- Algoa Basin Storage Potential
- Geological Modelling of Storage Sites capacity building
- Financial Opportunities for CCS Test Injection in South Africa
- Public Outreach Determination
- Definition of "Capture Readiness" Determination
- Techno-Economic Study of CCS in South Africa
- Collateral Benefits – Job Creation/preservation, industry development
- The Department of Energy: Developing a Carbon Capture and Storage Regulatory Framework
- Participation in the COCATE Project to address inter alia transport of carbon dioxide

During May, 2012, the South African Government Cabinet endorsed the South African CCS Road Map.
Other CCS capacity building activities in South Africa include:

- Four post-graduate bursaries
- Post-primary Schools Science Expo
- CCS Course run by the University of Witwatersrand with NTNU Norway
- COP17 stand that was visited by the South African President and Minister of Energy.

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Gorgon Project
Chevron Australia Pty Ltd.
Perth, Australia

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. 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).

Achievements as of July 2012 include:

- The Gorgon Project remains on schedule for first gas in 2014. June 2012 marked 30 months of construction on Barrow Island and work continues to focus on constructing accommodation, site preparation and logistics activities.
- Dredging on the project has progressed well and is nearing completion.
- A Horizontal Direction Drilling program, which will bring the feed gas pipelines onto Barrow beneath an undisturbed shoreline, commenced in April 2011.
- More than $17 billion has already been committed to Australia industry with more than 9,000 jobs created. Over the construction period about $20 billion will flow to Australian industry.
- From the commencement of the Gorgon Project in September 2009, quarantine screening has been completed on more than 180,000 passengers and over 660,000 tonnes of freight. In addition, more than 26,000 personnel have received quarantine training specific to their role. One hundred and thirty audits have been completed to ensure contractors are meeting quarantine obligations and more than 200 quarantine compliant vessels successfully mobilised. The on-island workforce is steadily increasing with approximately 4,000 people. At peak construction around 5,000 will be housed on Barrow Island.

For more details on the latest Project news visit http://www.chevronaustralia.com

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SEUCO
School of Earth Sciences
Kitui
Kenya

Potential for CO2 geologic sequestration in Kenya

Kenya's Vision 2030 is a national long-term development blue-print to create a globally competitive and prosperous nation with a high quality of life by 2030. The aim is to transform Kenya into a newly industrialized middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment. Kenya acknowledges that this vision will necessarily involve an increase in carbon dioxide (CO2) emissions, particularly when taking into account newly discovered coal resources at Mui Basin and potential oil deposit in Ngamia1 located within the Anza Basin in Turrkana. Taking future emissions and current industrial and power generation point sources into account, Kenya wishes to explore the potential for Carbon Capture and Geologic Storage (CCS) locally.

The 17th Conference of the Parties (COP 17) to the United Nations Framework Convention on Climate Change (UNFCCC) and CMP (The ultimate decision making body of the Kyoto Protocol) adopted the modalities and procedures for carbon dioxide capture and storage in geological formations (CCS) as clean development mechanism (CDM) project activities, as contained in decision CMP 7 in 2011.The CDM Executive Board recently established the first CCS Working Group and as such, future CCS projects in Kenya registered under the

The Kenyan Ministries of Energy and Environment, the Kenya National Council for Science and Technology (NCST), the University of Nairobi and South Eastern University, the Nottingham Centre for Carbon Capture and Storage (NCCCS) and the Global CCS Institute wish to undertake a project that will consider the potential for the application of carbon capture storage (CCS) in Kenya.

A key part of this project is the development for a CCS Atlas of Kenya (the Atlas). The Atlas shall provide an effective and communicative tool for Kenyan decision makers as well as for the general public, media and energy agencies. The Atlas shall also serve to initiate a transnational dialogue regarding transport and storage of CO2 especially within the East African Community and the Sub-Saharan region in general.

The Australian, British and Chinese Oil Exploration companies that have obtained data, on the Kenyan Government's behalf, within specific hydrocarbons exploration blocks in the Kenya's sedimentary terrain including the continental shelves and offshore the West Indian Ocean (Kenya's Coast line).

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Alberta Energy
The Government of Alberta (GoA)
Canada

- In April 2011, Alberta passed the *Carbon Sequestration Tenure Regulation*, which addresses three main components of tenure for CCS:

- Operators are now allowed to evaluate a potential storage site to investigate the geology and determine the adequacy and effectiveness of the site.

  1. Operators are now allowed to obtain leases to enable commercial-scale sequestration at suitable storage sites.
  2. The Province now requires a monitoring, measurement and verification plan and a closure plan that is to be approved in order for an operator to obtain tenure.

- Starting in March 2011, Alberta Energy, in conjunction with national and international stakeholders, initiated a 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. The Regulatory Framework Assessment is a collaborative project involving local and international experts from government, industry, non-governmental and academia. Issue specific Working Groups have developed recommendations to refine and guide legislation, regulations and the regulatory process for CCS. The Assessment is nearing completion, and a final report is planned to be delivered to the Government of Alberta in late-2012.

- To increase public awareness of CCS and its benefits to Albertans, the Government of Alberta undertook a public education and outreach campaign in October and November of 2011. The campaign provided accurate information to the public via newspaper inserts, television commercials based on three themes: CCS, enhanced oil recovery and climate change, and a new website (www.SolutionsStartHere.com).

- The Government of Alberta has committed to a major investment in CCS. Under the province's CCS funding program, three commercial scale CCS projects have been selected and final funding agreements have been signed for over $1.5 billion (Cdn) over the next 15 years. These three fully integrated CCS projects will reduce carbon dioxide (CO_2) emissions from the oil sands, electricity and value-added sectors by four million tonnes per year starting in 2015:

- Alberta Carbon Trunk Line (ACTL): The project is a new 240-kilometer CO_2 pipeline that will transport CO_2 captured from fertilizer and bitumen upgrader facilities to enhanced oil recovery (EOR) projects located in central Alberta. The

capacity of the pipeline will be approximately 14 million tonnes per year. The funding agreement was signed in February 2011.

- Quest: The project will capture approximately 1.2 million tonnes of CO_2 per year from a bitumen upgrader and store it underground in a deep saline aquifer. It is a fully integrated CCS project involving capture, pipeline transportation and storage. The funding agreement was signed in June 2011. The Quest project received final regulatory approvals in the summer of 2012. On September 5th, 2012, Royal Dutch Shell and its partners formally announced that they will proceed with the Quest project, with operations scheduled to begin in 2015.

- Swan Hills: The project is an integrated CCS project that will capture, transport and store 1.3 million tonnes of CO_2 per year. The project will build an in-situ coal gasification (ISCG) facility that will tap an un-mineable coal seam 1,400 metres below the surface. The coal will be gasified underground to produce CO_2 and hydrogen and the CO_2 will be separated, captured, and transported for use in EOR in the area and the hydrogen will be used to generate 300 megawatts of base-load electricity generation. The funding agreement was signed in July 2011.

- Project Pioneer: Was one of the four original CCS projects announced under Alberta's CCS funding program. In April 2012, TransAlta Corporation announced the cancellation of Project Pioneer, citing an insufficient market for carbon sales and the current price of emission reductions as the main barriers that prevented the project from proceeding. The cancellation of Project Pioneer in no way changes the Government of Alberta's commitment to CCS. The Government's investment in the three active projects, in excess of $1.5 billion (Cdn), continues to be an unparalleled investment in CCS for a jurisdiction of Alberta's size.

- Knowledge sharing is a significant part of Alberta's CCS funding agreements. The Government of Alberta is committed to the public dissemination of the learnings and knowledge about CCS developed through the three projects to advance the development of other CCS projects in Alberta, and around the world. The first summary and detailed reports have been submitted by the proponents to the Government of Alberta, and a review of these documents for completeness is currently being undertaken.

- The International Organization for Standardization (ISO) is developing a standard for carbon capture and storage. This worked kicked-off in June, 2012. The Assistant Deputy Minister of the Electricity, Alternative Energy and Carbon Capture and Storage Division of Alberta Energy, Sandra Locke, has been appointed as the Chair of the ISO technical committee for the development of the CCS standard.

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Rio Tinto
Brisbane
Australia

Rio Tinto has announced AU$6M in sponsorship over three years for the CO2CRC and the new Peter Cook Centre for CCS research. The funds, which are in addition to Rio Tinto's normal CO2CRC membership contribution, will be used to support operational, maintenance and other overhead costs at the Otway facility and Peter Cook Centre.

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Task Force on Communications
CSLF Task Force Strategic Implementation Report
September 2012

1. Task Force Members

- Australia – Margaret Sewell
- European Commission – Marisa Atienza Morales
- Mexico – José Miguel González Santaló
- Norway – Tone Skogen
- United Kingdom – Jonathan Hood
- United States – John Grasser (Chair)

2. Purpose of Task Force

Implement a communications strategy to raise the profile of the CSLF and CCUS.

3. Milestones

- Developed an overall CSLF communications plan/outreach strategy;
- Rebuilt the CSLF web so as to have a first-rate site and a communications tool available to help promote the organization;
- Redeveloped the CSLF information kit;
- Established a CSLF daily clipping service to all members;
- Redesigned CSLF exhibit with new graphics to mirror web page;
- Developed CSLF web page linking policy;
- Developed CSLF conference sponsorship policy;
- Reviewed and updated all CSLF materials for media and public handout, including the full set of *InFocus* message papers;
- Completed update of CSLF core speech for member use;
- Completed new stakeholder audience speech for member use;
- Completed update of CSLF power point presentation for member use;
- Completed update of DVDs containing CSLF outreach materials;
- Completed new *InFocus* paper: *What is Carbon Utilization*;
- Completed new *InFocus* paper: *What is Capacity Building;*
- Completed new *InFocus* paper: *CCUS: Legal and Regulatory Challenges*;
- Continued liaison with the GCCSI and IEA Clean Coal Centre.

4. Status

The Task Force continues to review all previously prepared outreach materials so as to insure all information and data is current. The CSLF core speech and power point have recently been revised and updated. A new general speech for stakeholder audiences also has been developed. The Task Force continues to review current and possible new tools and avenues for improving the dissemination of CSLF messages, as well as reaching out to new partners for collaboration.

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Projects Interaction and Review Team (PIRT)
CSLF Task Force Strategic Implementation Report
September 2012

1. Task Force Members

The PIRT consists of:

- A core group comprising Members of the Technical Group, or as nominated by a CSLF Member country. Current membership consists of representatives from:

Australia	Clinton Foster (Chair), Richard Aldous
Canada	Stefan Bachu
Denmark	Flemming Ole Rasmussen
European Commission	Jeroen Schuppers
France	Didier Bonijoly
Germany	Jürgen-Friedrich Hake
Japan	Ryo Kubo
Mexico	José Miguel González Santaló
Netherlands	Paul Ramsak
Norway	Trygve Riis
Saudi Arabia	Khalid Abuleif, Abdulmuhsen Alsunaid
South Africa	Tony Surridge
UK	Philip Sharman
USA	Darren Mollot
Global CCS Institute	Klaas van Alphen

  During the period of this report the PIRT Chair resides with Australia.

- An *ad hoc* group of Stakeholders comprising representatives from CSLF-recognized projects.

2. Purpose of Task Force

The PIRT has the following functions:

- Assess projects proposed for recognition by the CSLF in accordance with 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

Near term (next 6 months)

- Input into the new Task Forces recognized at the Beijing CSLF Ministerial meeting and further developed at the Bergen Technical Group meeting.
- Reach agreement on emendations to simplify the *CSLF Gaps Analysis Checklist*, which accompanies the CSLF Project Submission Form.

Long term (next >18 months)

- Contribute to the next major revision of the CSLF Technology Road Map, scheduled for 2013. The PIRT Chair joins other Task Force Chairs as part of the Steering Group for the new Technology Road Map.
- Continue to assess projects that are submitted for recognition by the CSLF
- Work with the Technical Group, to continue to recognize opportunities for Technical Workshops, planning for at least one per year. These are effectively opportunistic, with respect to scheduling, location and topics of interest, based on collaboration or coordination with other CCS agencies and meetings.

4. Status

- At the Bergen meeting, three projects were recommended to Technical Group for submission to Policy Group for recognition as CSLF Projects
    - Illinois Basin Decatur Project
    - Illinois Industrial Carbon Capture and Storage Project
    - Air Products CO_2 Capture from Hydrogen Facility Project.
- The Draft report of the Task Force to *Assess the Technical Issues Affecting CCS* was submitted at the Bergen meeting: the outcomes will inform the new TRM and newly formed task forces.
- Governance .
  Continue to monitor CSLF- recognized projects: using four official classifications; *Completed*, *Active*, *Inactive*, and *Withdrawn by Sponsor* (the last category can only be applied upon formal notification by the project proponents, and not as a CSLF initiative).

CCS Bełchatów Project
CSLF Project Status Report
September 2012

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.
The Bełchatów CCS installation will be integrated into 858MW power unit being operated within the area mentioned above.
Initially three potential storage sites have been identified whereof one has been selected at the beginning of February 2012 for the II phase of storage component i.e. site characterization. The site selected for further geological examination is Wojszyce structure near Kutno town, about 115 km from Bełchatów.
A procedure aiming at selection of contractor for preparatory works for the CO_2 transport pipeline construction started in February 2012. One of the tasks in scope of these works is pipeline routing determination.

2. Project Lead

- **Project Manager:**
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  CCS Project Director
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  Fax: +48 44 735 4060
- **Project Contact Person:**
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  CCS Specialist
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  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 CO_2 capture process
  - equivalent power of 260MWe
  - capture efficiency at least 85%
  - capture rate of 1.8 Mtpa (design value)
- CO_2 transport
  - pipeline transport of captured CO_2 in super critical conditions over a distance of about 141km in the Łódź Province
- CO_2 storage
  - CO_2 storage in deep saline aquifers

4. Recent Milestones

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

the beginning of February 2012 for site characterization.
- Procedure aiming at selection of contractor for preparatory works for the CO_2 transport pipeline construction is launched.

5. Status

- A Comprehensive Environmental Impact Assessment Study for the entire CCS installation has been prepared. This study demonstrated enough information to obtain "environmental decision" for CCP which was issued by a relevant authority on 11 December 2009.
- In terms of the capture component, a comprehensive FEED study has been carried out in the years 2009-2011. The timing of the FEED works was developed to allow preparation of documentation required to support the permitting process aiming at obtaining the CCP building permit. The latter was issued and got validated in February 2010.
- In 2009 three geological structures were identified for potential storage of the CO_2 leaving the CCP, all of them in the Łódzkie voivodeship, from c.a. 45 to 115km away from the CCP.
- A feasibility study for the transport component was completed in 2009 wherein a preliminary routing for three pipelines to the three considered storage sites was determined.
- At the beginning of 2012, following comprehensive geological works, analyses and examinations carried out in 2009-2011 and based on the experts' recommendation Wojszyce structure was selected as most appropriate from geological point of view for continuation of geological works. The works will be done to get a detailed characterization of the site and thereby to confirm its suitability for safe CO_2 geological storage in industrial scale.
- Permitting activities for the transport component have been started; relevant EIA will be prepared in the scope of the preparatory works for the transport pipeline construction commenced shortly after the selection of Wojszyce site for the site characterization.
- On 5th May 2010 PGE GiEK S.A. signed Grant Agreement with European Commission and was awarded 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 national sources, New Entrants Reserve (NER) from the EU Emissions Trading System and Norwegian Financial Mechanism. On 9th February 2011 PGE GiEK S.A. submitted the NER300 application to the Ministry of Economy. 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.pgegiek.pl/index.php/category/events_ccs/ (information in Polish only).
- Project's website: http://www.pgegiek.pl/index.php/ccs/instalacja-demonstracyjna-ccs/ (website in Polish) and http://www.pgegiek.pl/index.php/ccs/ccs-demonstration-plant/ (website in English)

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CCS Rotterdam Project
CSLF Project Status Report
September 2012

1. Project Location
Rotterdam, The Netherlands
2. Project Lead
• Maarten de Hoog (maarten.dehoog@dcmr.nl) • Hans Knippels (hans.knippels@dcmr.nl)
3. Project Objectives
• Development of CCS in the greater Rotterdam area (Port of Rotterdam) • 2016 annual storage of 3 Mton CO_2 (postponement of FID ROAD makes meeting this target less likely) • 2025 annual storage of 17,5 Mton CO_2
4. Recent Milestones
• Strategic Position Paper Port of Rotterdam: "Port of Rotterdam CO_2 hub, crucial stepping stone towards sustainable growth." • Publication CO_2 capture and Storage in Rotterdam, a network approach, May 2011. • Due diligence of several (three) possible CO_2 storage locations on Dutch Continental Shelf has been performed. Further detailed analysis is performed to have clarity on suitability storage locations. • Rotterdam CCS Cluster Project, Case Study on 'lessons learnt'. Research carried out in commission of the Rotterdam Climate Initiative (= RCI) with funding from the Global CCS Institute.
5. Status
• 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 has been postponed to October 2012. • NER300 project, Green hydrogen production by Air Liquide. Final selection of projects due end 2012. • Consortium (CINTRA) Development of the shipping business case, participants, Anthony Veder, Gasunie, VOPAK and Air Liquide for development of CO_2 terminal.

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CGS Europe
CSLF Project Status Report
August 2012

1. Project Location

All of Europe

2. Project Lead

- Coordinator: Dr Isabelle Czernichowski-Lauriol (BRGM): i.czernichowski@brgm.fr
- Chair: Dr Nick Riley (BGS): nriley@bgs.ac.uk
- Management Board:
  - Dr Isabelle Czernichowski-Lauriol (BRGM): i.czernichowski@brgm.fr
  - Dr Anne Korre (Imperial College): a.korre@imperial.ac.uk
  - Dr Roberto Martinez (S-IGME): ro.martinez@igme.es
  - Dr Vit Hladik (CzGS): vit.hladik@geology.cz
- Secretariat: Zeljka Kurelec (University of Zagreb – RGNF): info@cgseurope.net

3. Project Objectives

- Create a credible, independent and long-lasting pan-European scientific body of expertise to support widespread understanding of the technology and foster knowledge development and sharing.
- Provide an independent platform and reference source where national, European and international experts, institutes and regulators are able to access the most up-to-date results of CO_2 storage-related studies, share experiences and good practices, discuss the implementation of regulations, identify research needs to face upcoming challenges, and build new projects.
- Build a centralised information source of the status of CO_2 storage R&D across the whole of Europe
- Reduce the gap in knowledge / awareness and in the implementation of geological storage of CO_2 between 'forerunner' countries and other countries where actions are not yet happening
- Contribute to the large scale demonstrations and industrial deployment of CCS by providing the necessary link between industrial developers and other vital players
- Support the implementation of the EU directive on the geological storage of CO_2 and other regulatory regimes through scientific advice, experience-sharing and dissemination of information

4. Recent Milestones

- April 13th – 14th Vilnius, Lithuania: 1st CGS Europe Regional CCS awareness-raising workshop 'CO_2 capture and storage – response to climate change', reaching out to stakeholders in the Baltic Sea region and central and eastern Europe
- 11th May 2011, San Servolo Island, Venice, Italy: 1st CGS Knowledge-sharing workshop: 'Legal and regulatory issues – implementation of the EU directive on the geological storage of CO_2'
- September 22nd – 23rd 2011, Brussels, Belgium: Internal communication workshop for press officers and researchers to share experiences in and knowledge of communication on CO_2 storage research

- October 17th – 19th 2011, Maria Laach, Germany: 2nd CGS Europe Knowledge-sharing workshop: 'Natural analogues'
- November 24th 2011, Brussels, Belgium: SciTechEUROPE: Masterclass and booth on CO_2 Geological storage aimed at promoting exchange with industry stakeholders, funding agencies, academics and policy makers
- April 19th 2012, Venice, Italy: 3rd CGS Europe Knowledge Sharing workshop: 'National research programmes'
- March 12th – 18th 2012, Leszcze, Poland. CGS Europe Spring School on CO_2 Geological Storage.
- June 13th – 14th 2012, Ankara, Turkey: 2nd CGS Europe CCS Awareness-raising workshop 'CO2 Capture and Storage – regional awareness raising workshop'
- Article published: 'CO_2 Geological Storage'. Public Service Review 22, p 200 – 201.
- CO_2GeoNet Brochure translated and published in Bulgarian, Croatian, Czech, Estonian, Finnish, Latvian, Lithuanian, Russian, Serbian, Slovakian, Slovenian, Swedish and Turkish.
- Knowledge Repository on CGS website now includes summaries of EU and National projects, a searchable scientific publication list and links to CO_2 storage glossaries

5. Status

- Project established November 2010; 3 year duration funded as a coordination action by the EU Framework 7 programme
- 34 institutes involved from 24 EU Member States and 4 Associated Countries thereby representing most of Europe
- The focus is on coordination and integration mechanisms between the CO_2GeoNet Association - the European Network of Excellence on the Geological Storage of CO_2 - and 23 other participants
- CGS Europe website at: http://www.cgseurope.net where more detailed project description and details of news and events can be found

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CO_2 Capture Project – Phase Three

CSLF Project Status Report
August 2012

1. Project Location

Houston, USA (location of Brian Williams, Chairman of the CCP)

2. Project Lead

Mark Crombie, CCP Program Manager
Mobile: +44 77 6988 6024 Tel: +44 1932 756 725
E-Mail: mark.crombie@uk.bp.com

3. Project Objectives

The CO_2 Capture Project (CCP) is a partnership of several major energy companies working together to advance the technologies and to improve operational approaches in order to reduce costs and accelerate the deployment of CO_2 Capture and Storage (CCS).

The CCP is currently in its third phase of activity – CCP3 (2009-2013). During the course of CCP3 the program will culminate in at least two field demonstrations of capture technologies and a series of monitoring field trials which will provide a clearer understanding of how to better monitor CO_2 in the subsurface.

4. Recent Milestones

Storage, Monitoring & Verification Team

- First phase of CO_2 Impurities Study completed, showing impact of stream impurities on underground CO_2 plume behaviour
- Modular Borehole Monitoring (MBM) assembly deployed at Citronelle Field prior to injection
- Injection started at Decatur, USA, with CCP3 SMV funded InSAR satellite technology deployed to detect surface deformation. Initial results are expected by the end of 2012
- CO_2 Contingencies program (detection and intervention of unexpected migration) underway with cross-industry and academic input

Capture Team

- Oxy-combustion capture trial on a pilot-scale fluid catalytic cracking unit (one of the highest CO_2 emitting units of a refinery) completed, results available by the end of 2012
- Oxy-fired once-through steam generator project Phase 2 (demonstration) preparation work continues. The demonstration run is scheduled in the spring of 2013
- Oxy-firing tests in a simulated process heater completed. Evaluated feasibility of using commercial burners with modifications, for oxy-firing. Results available by end of 2012
- Screening studies completed for novel natural gas combined cycle (NGCC) capture technologies, paving the way for potential future development and scale-up
- New baselines established for refinery and heavy oil extraction using pre-combustion and oxy-firing technologies

Policy & Incentives Team

- Investigation of various stakeholder issues at project and global level conducted, with the P&I Team presenting the findings at the COP17 conference in Durban, South Africa
- Review of regulatory issues for CCS projects study launched, results available by the end of 2012

Communications

- Continued to provide resources to be used by NGOs, industry, media and policy makers – second CCP Annual Report published
- Launched digital version of In Depth brochure, June 2012

5. Status

The CCP is currently in its third phase of activity – CCP3, due to run between 2009 and 2013. See www.co2captureproject.com for more information – including reports, factsheets and technical documents.

CO2CRC Otway Project
CSLF Project Status Report
April 2012

1. Project Location

Southwestern Victoria, Australia

2. Project Lead

Matthias Raab – Program Manager, Storage
- Phone: +61 3 8344 4309
- Mobile: +61 417 066 318
- Email: mraab@co2crc.com.au
- CO2CRC, 3rd Flr, School of Earth Science, University of Melbourne, VIC 3010

Rajindar Singh – Otway site Operations Manager
- Mobile: +61 418 428 020
- rssingh@co2crc.com.au
- CO2CRC, 3rd Flr, School of Earth Science, University of Melbourne, VIC 3010

3. Project Objectives

The Otway project has been designed to demonstrate geological storage and monitoring of CO_2 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.
Stage 1: Continue Monitoring and Verification.
Stage 2: Determine residual gas saturation (S_{gr}) of CO_2 from a single well test (Stage 2b) and determine smallest plume size of CO2 that can be imaged by 4D time lapse seismic by injecting of up to a maximum of 30,000 tons (Stage 2c) into the Paaratte saline water formation.

4. Recent Milestones

- Stage 2b Injection/Withdrawal (Residual gas saturation) test completed in September 2011.
- Community Reference Group (CRG) meeting held in May 2012.

5. Status

- Release of Stage 2b report for CO2CRC members planned for Oct 2012.
- U-tube sampling of reservoir data, atmospheric monitoring, ground water sampling and soil testing continues as part of Stage 1 activities.
- Stage 2c modeling peer review scheduled for Sep 2012. Review of static, dynamic, fault and seismic models for go/no-go decision.
- Community to be continuously updated on forward plans through CRG meetings.

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CO_2 Field Lab Project

CSLF Project Status Report
September 2012

1. Project Location

The Project is coordinated by SINTEF Petroleum Research in Trondheim (Norway). The Field Laboratory is located at the Svelvik Ridge, 50 km south-west of Oslo (Norway).

Aerial photo showing the Svelvik Ridge. The CO_2 Field Laboratory is indicated by the yellow rectangle (150 m × 300 m)

2. Project Lead

- Project Manager: Maria Barrio; SINTEF (maria.barrio@sintef.no)
- Project Coordinator: Audun Bakk; SINTEF (audun.bakk@sintef.no)
- Site & HSE Coordinator: Marion Børresen, NGI (marion.borresen@ngi.no)
- Project Advisor: Erik Lindeberg, SINTEF (erik.lindeberg@sintef.no)

3. Project Objectives

- Determine the sensitivity of monitoring systems to detect shallow CO_2 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 CO_2 storage by showing the performance of monitoring systems

4. Recent Milestones

- September 2011: Shallow CO_2 injection where 1600 kg CO_2 was injected at 18 meters depth in a permeable sandy formation (no cap rock)
- January 2012: Completed second draft of monitoring protocol
- February 2012: Technical workshop summarizing shallow injection experiment, Gardermoen, 8.2.2012
- August 2012: Operator chosen for drilling and completion of a 115 m deep injection well

5. Status

Project entered primo 2011 into its main (injection) phase (Phase 2). The shallow CO_2 injection (simulating leakage) during September 2011 was successful in order testing out several CO_2 monitoring techniques covering both the sub-surface and at the surface in the phreatic aquifer.

A 115 m deep well will be drilled and completed during September. The injectivity is planned to be assessed in this well right after drilling/completion.

Injection data and characterization data will now be further analyzed and backed up with simulations in order to update the geo-model. This should form a proper basis for further progress against the planned deeper injection in 2013/2014.

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CO_2 Technology Centre Mongstad Project

CSLF Project Status Report
April 2012

1. Project Location
Mongstad, Norway
2. Project Lead
Tore Amundsen; Managing Director. toaam@tcmda.com
3. Project Objectives
• Develop technologies for CO_2-capture capable of wide national and international deployment • Reduce cost and technical, environmental and financial risks related to large scale CO_2-capture • Test, verify and demonstrate CO_2-capture technology owned and marketed by Vendors • Encourage the development of a market for such technology
4. Recent Milestones
• Amine plant mechanically complete, start-up in March 2012 • Chilled Ammonia Plant: mechanical installations on-going, start-up in Summer 2012 • Overall progress February 2012 approximately 90%
5. Status
• Investment of approximately USD 1 billion • Construction progress: 90 % • Operating organization established and preparing for operations

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Demonstration of an Oxyfuel Combustion System
CSLF Project Status Report
April 2012

1. Project Location
Renfrew, Scotland, U.K.
2. Project Lead
Sang Hyeun Kim
3. Project Objectives
• to demonstrate the successful performance of a full-scale (40MWt) OxyCoalTM 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. Milestones Achieved
• A full scale 40MWt OxyCoalTM 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 CO_2 levels were achieved (in excess of 75% v/v dry, and up to 85% v/v dry). • Project won Rushlight Energy Environmental Award
5. Status
• **Project successfully concluded** • Final version of public report was issued February 2011 (available at DECC Publications Library website: http://www.decc.gov.uk/publications/) • Option for additional 2 year not exercised. Project partners pursuing individual development activities.

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Fort Nelson Carbon Capture and Storage Project
Carbon Sequestration Leadership Forum Project Status Report
August 2012

1. Project Location

Fort Nelson, British Columbia, Canada

2. Project Lead

- Al Laundry (alaundry@spectraenergy.com)
- Ed Steadman (esteadman@undeerc.org)
- Jim Sorensen (jsorensen@undeerc.org)
- Charles Gorecki (cgorecki@undeerc.org)

3. Project Objectives

The primary objective of the Fort Nelson Carbon Capture And Storage Feasibility Project is to verify and validate the concept of utilizing one of North America's large number of saline formations for large-scale CO_2 injection, proposed to be up to 2.2 Mt a year, of anthropogenic CO_2 for permanent storage. Specific goals include the following:

- Cost-effective risk management, simulation, and monitoring, verification, and accounting (MVA) strategies for large-scale CO_2 storage in deep saline formations.
- Testing and refinement of reservoir modeling intended to predict and estimate CO_2 injectivity (the potential for placing CO_2 into the reservoir). To confirm the practical CO_2 storage capacity for this site, areal extent and mobility of the supercritical CO_2 plume in the reservoir. To demonstrate 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 CO_2 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 CO_2 stream into a hotter in situ saline fluid.
- Test and model the reactions and fate of entrained H_2S in the injected supercritical CO_2 stream and impacts on reservoir and containment rocks.

4. Recent Milestones

- Risk assessments have been updated using an expert panel approach. The update is based on newly acquired data sets that facilitate a better interpretation of the extent and geometry of the injection target.
- Laboratory evaluation of reservoir properties has been conducted on core samples obtained from the C61E test well. Relevant properties including mechanical strength, porosity, permeability, and capillary entry pressures have been obtained.
- Well work over and reservoir pressure testing at the existing exploratory well (C61E) were completed in the first quarter of 2012.
- Geologic modeling and simulation have continued in this reporting period. A dynamic model based on the updated geologic model was constructed for the purpose of matching historical gas and water production, water disposal data, and scattered bottomhole pressures in areas near gas pools. Through the history-matching process, the geologic model was validated and improved.

5. Status

- 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 the project's second exploratory well and for an extensive 3-D seismic program are planned for completion in 2012–2013.

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Geologic CO_2 Storage Assurance at In Salah, Algeria
CSLF Project Status Report
August 2012

1. Project Location
In Salah, Algeria, Africa
2. Project Lead
Allan Mathieson: allan.mathieson@uk.bp.com BP Alternative Energy, Chertsey Road, Sunbury, Middlesex TW16 7LN, UK
3. Project Objectives
• Provide assurance that secure geological storage of CO_2 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 CO_2 is a viable GHG mitigation option. • Set precedents for the regulation and verification of the geological storage of CO_2, allowing eligibility for GHG credits
4. Recent Milestones
• Transfer of regular monitoring activities to the JV Operations team completed • Completed monitoring and detailed modeling of shallow potable aquifer • Completed assessments of microseismic data suggesting events during injection came from the injection horizon depth • Installing pressure transducers in shallow (potable) aquifer wells to monitor for irregularities in pressure • Results of Quantitative Risk Assessment incorporated into field operations and monitoring plans • A project website is available at: www.insalahco2.org
5. Status
• Stored 3.89mmt CO_2 in a deep saline aquifer (1900m deep, 20-22m thick, 13% porosity, 10mD permeability). Currently reviewing injection strategies and operational procedures to reflect recent monitoring information.

Gorgon CO_2 Injection Project
CSLF Project Status Report
September 2012

1. Project Location

Barrow Island, Western Australia, Australia

2. Project Lead

Inquiries in relation to the project should be addressed to:
Chevron Australia Pty Ltd
John Torkington - Senior Advisor, Climate Change Policy
trkn@chevron.com

3. Project Objectives

The project aims to demonstrate the safe commercial scale application of greenhouse gas storage technologies at a scale not previously attempted.

- It is proposed to inject over 100 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)
	Order placed for carbon dioxide compressors (October 2009).
	Official groundbreaking on Barrow Island (December 2009)
2011	Petroleum Pipeline Licence granted (December 2011)
	CO_2 injection pipeline construction contract awarded (December 2011)

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.

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.

In early 2011 the Gorgon Joint Venture Participants announced plans to add a further 5 million tonnes per annum processing train. The proposal is now subject to environmental review.

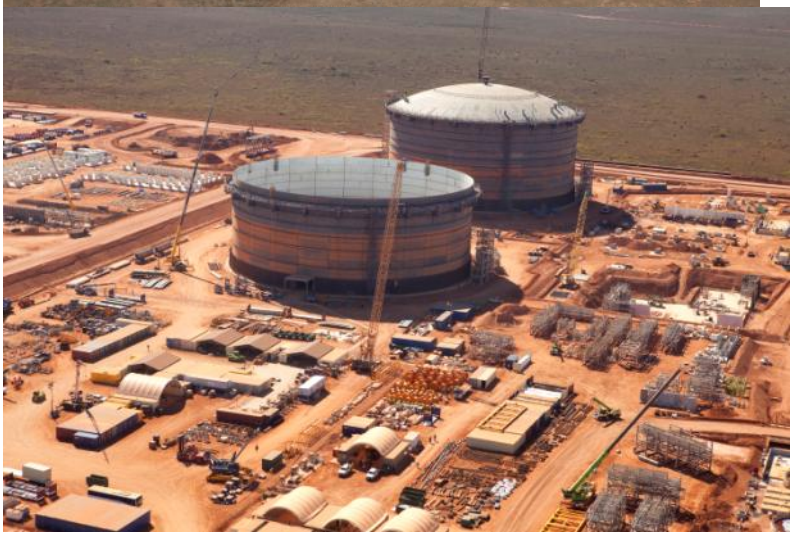
Achievements as of July 2012 include:

- The Gorgon Project remains on schedule for first gas in 2014. June 2012 marked 30 months of construction on Barrow Island and work continues to focus on constructing accommodation, site preparation and logistics activities.
- Dredging on the project has progressed well and is nearing completion.
- A Horizontal Direction Drilling program, which will bring the feed gas pipelines onto Barrow beneath an undisturbed shoreline, commenced in April 2011.
- More than $17 billion has already been committed to Australia industry with more than 9,000 jobs created. Over the construction period about $20 billion will flow to Australian industry.
- From the commencement of the Gorgon Project in September 2009, quarantine screening has been completed on more than 180,000 passengers and over 660,000 tonnes of freight. In addition, more than 26,000 personnel have received quarantine training specific to their role. One hundred and thirty audits have been completed to ensure contractors are meeting quarantine obligations and more than 200 quarantine compliant vessels successfully mobilised. The on-island workforce is steadily increasing with approximately 4,000 people. At peak construction around 5,000 will be housed on Barrow Island.
- The Gorgon Project's Quarantine Management System has won numerous awards including:
    - 2011 APPEA Environment Award
    - 2011 WA Engineering Excellence Award - Environment Category
    - 2011 WA Engineering Excellence Award- High Commended in Management of Engineering
- The first of the Project's major modules being built in Korea in has arrived on Barrow Island. In total there will be 48 modules weighing around 200,000 tonnes. In addition on the pre-assembled racks (PARs) and units (PAUs)being constructed in China and Indonesia have started arriving on the island.

- In October 2010, 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.
- For more details on the latest Project news visit http://www.chevronaustralia.com

6. Project Photographs (for the Gorgon Project in general)

The onshore construction site.



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

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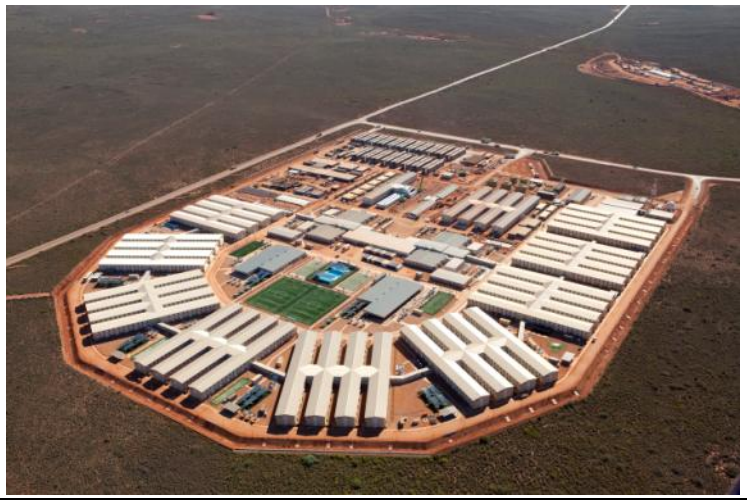
The accommodation village is nearing completion.



IEAGHG Weyburn-Midale CO_2 Monitoring and Storage Project
CSLF Project Status Report
April 2012

1. Project Location

Weyburn and Midale Units, Weyburn area, southeast Saskatchewan, Canada

2. Project Lead

- Floyd Wist (Saskatchewan Energy and Resources), Chair, Leading Sponsors Executive Committee (LSEC)
- Neil Wildgust (Petroleum Technology Research Centre), Chief Project Officer, Technical / Research Component
- Frank Mourits (Natural Resources Canada), Project Integrator / Coordinator Policy Component

3. Project Objectives

- Develop a comprehensive Best Practices Manual for CO_2 geological storage, which will guide all aspects of future CO_2-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

- 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 modelling 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 CO_2 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 and other research. Work funded by NRCan must be completed by March 2011 and that by DOE by December 2012.
- 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.

- March 31, 2011 – Most research completed.
- February 2012 – Project Integration and Sponsors' Meeting (PRISM-8), Denver, Colorado.

5. Status

- The static geological model has been completed will store much of the data generated within the project.
- A model using the percolation-invasion methodology for determining the long-term fate of CO_2 has been constructed and in the final stages of development.
- The in-field wellbore integrity testing program was completed in March 2011. This entailed performing drilling slots into the cement sheath and performing pressure-transient tests (PTT) to determine communication within the cement. Samples of cement were also collected. The PTT results and cement samples are currently being analyzed.
- 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. No additional surveys are planned within the PTRC program.
- Passive micro-seismic monitoring is ongoing. Surveys to date have indicated very minimal response to CO_2 injection.
- Extensive work is being performed to improve the rock physics model used to assist in calibrating the time-lapse 3D seismic for CO_2 saturations.
- Stochastic modelling has been completed to integrate both geophysical and geochemical databases to understand CO_2 behavior within the reservoir.
- 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, the now well-established www.ccs101.ca website is continually being improved and updated. A display stand with CCS information materials was developed for use at conferences and conventions (e.g. science teachers) as well as Open Houses for large CCS demonstration projects in Canada. Focus group testing activities are being developed for the remainder of 2011.
- Most research was completed by March 31, 2011. Results have been submitted and are in technical review. Several tasks, including some new work, will extend beyond this date and be completed by the end of 2011.
- A soil gas monitoring survey scheduled for spring 2011 was postponed due to extreme flooding in SE Saskatchewan until October 2011. Long-term flux measurements were conducted to determine biogenic activity within the soils.
- Project leads participated in the investigation by Cenovus into allegations of CO_2 leaks on the Kerr farm near the Weyburn field. A report, issued in November 2011, found no evidence of any leakage.
- The project's key deliverable, the Best Practices Manual, is scheduled to be completed by September 30, 2012.
- A special panel session of presentations on the Best Practices Manual will be held at the 11th Annual Carbon Capture, Utilization and Sequestration Conference in Pittsburgh (April 30 – May 3, 2012).

- A similar session is being planned for the GHGT-11 conference in Kyoto in November 2012.
- A special supplement to the International Journal of Greenhouse Gas Control, comprising a collection of papers on the results of the research undertaken in the project, is being prepared for publication in late 2012.

Lacq CO_2 Capture and Storage Project
CSLF Project Status Report
August 2012

1. Project Location

France – South West

2. Project Lead

- Jacques Monne : R&D Manager, jacques.monne@total.com
- Pierre Valette : Production Manager, pierre.valette@total.com

3. Project Objectives

- The overall aim of this project is to test the industrial-scale feasibility of an integrated CCS chain within industrials facilities.
- To demonstrate the feasibility of converting an existing 30 MWth industrial boiler to oxycombustion in order to confirm the following targets of
  - reduction of capture cost compared to classical post capture technologies
  - reduction of overall direct and indirect CO_2 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

- The design of an optimized up-scaled oxy boiler from 30 MWth to 200 MWth is on -going. A CFD model has been built based on the results of the test campaign performed in November 2011 concerning the heat fluxes and exit gas temperature measurements.
- 45000 tonnes of CO_2 have been injected (End of August) from the beginning of this experimentation.
- The R&D down hole micro seismic arrays system is working well. The data interpretation is still on-going.
- The disponibility factor during April has been 1 for the oxyboiler.(Best month)
- The pilot has been stopped (from 3rd June up to 19th July) for performing preventive maintenance and for doing an in-depth analysis of the recorded micro seismic events without CO_2 injection.

5. Status

- Reservoir pressure evolution is as predicted.
- No significant seismic event recorded.
- Results of environmental monitoring: no variation recorded compare to the base line.

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Quest CCS Project
CSLF Project Status Report
April 2012

1. Project Location

The Quest CCS Project is being proposed at Shell's Scotford Upgrader located near Edmonton, Alberta, Canada.

2. Project Lead

- Len Heckel, Quest Business Opportunity Manager, Shell Canada
  Len.Heckel@shell.com
- Project Contact
  Paul Hagel, Senior Government Relations Advisor
  paul.hagel@shell.com

3. Project Objectives

- The Quest CCS project is being advanced on behalf of the AOSP, a joint venture among Shell Canada (60 per cent) Chevron Canada Limited (20 per cent) and Marathon Oil Canada Corporation (20 per cent).
- Quest is a fully integrated capture, transportation, storage and monitoring project, which will capture and store up to 1.2 million tonnes/yr of CO_2 from the Shell Scotford Oil Sands Upgrader in central Alberta, Canada. The CO_2 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 CO_2 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 CO_2 storage in a deep saline aquifer (Basal Cambrian Sands) in central Alberta
- Demonstration of a significant reduction in CO_2 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

- October 11th 2011: Shell Canada receives a certification from Det Norske Veritas (DNV) regarding the suitability of the project's Storage Development Plan for the project. The certification, which is the first of its kind, is the result of a panel review by independent experts who assessed the SDP. This panel concluded that the planned storage zone has sufficient injectivity and capacity for the project life, that the storage zone has sufficient containment attributes, that the risks have been comprehensively assessed with appropriate risk management plans, and that the MMV plan is fit-for-purpose to demonstrate containment and conformance to predicted storage properties

- March 6-9th 2012: The Province of Alberta's Energy Resources Conservation Board (ERCB) conducts a public regulatory hearing on the Quest Project. The hearing provided the opportunity for any objectors with standing to table concerns regarding the project. Additionally, the opportunity was given to the ERCB panel and their experts to question the Quest team on any aspect of the project prior to providing a recommendation as to whether provincial regulatory approval should be given to proceed. The Board hearing report is expected in the May to June 2012 timeframe.

5. Status

- Following an anticipated favourable provincial and federal regulatory review, the project joint venture owners will make a final investment decision in 2012, subject to internal confirmation of economic and technical feasibility and regulatory conditions. This important milestone represents the final decision to proceed with the project.
- With CO_2 injection planned for 2015, the Quest Project will join only a handful of CCS projects around the world that are injecting CO_2 at a commercial scale. Shell is working with governments and other experts globally on both political and technical levels to facilitate the development and wide-scale deployment of CCS and is involved in progressing a number of projects around the world, across a wide range of sectors.
- Shell will be working with the Province of Alberta and the Government of Canada to develop a broad knowledge sharing program in accordance with the signed funding agreements with these governments. This will further assist the development of wide-scale CCS deployment
- For more information, check out www.shell.ca/quest or contact paul.hagel@shell.com

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Regional Carbon Sequestration Partnerships Project
CSLF Project Status Report
April 2012

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)

- John Litynski, Technology Manager, Carbon Storage Program, NETL (john.litynski@netl.doe.gov)
- Traci Rodosta, Director, Sequestration Division, NETL (traci.rodosta@netl.doe.gov)
- Traci Rodosta, Regional Partnerships Coordinator (Acting), NETL (traci.rodosta@netl.doe.gov)

3. Project Objectives

- 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:
  - Characterization Phase (2003 – 2005): The partnerships completed the initial characterization of their regions' potential to store CO_2 in different geologic formations.
  - Validation Phase (2005 – 2012): The partnerships are validating the most promising regional storage opportunities through a series of small-scale field tests. This phase builds upon Characterization Phase accomplishments and begins field testing of geologic and terrestrial storage 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 CO_2 per project to confirm that CO_2 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, accounting, and assessment (MVAA).

4. Recent Milestones

- Validation Phase field activities were initiated in 2005 and are scheduled to be completed in 2012. A total of 1.35 million metric tons has been injected in 18 out of 19 small scale field tests. The final test in the Columbia Basin (Basalt pilot test) is scheduled to be completed in late 2012. Below are the results from the completed tests.

  Completed Saline Formation CO_2 injection field tests:
  Midwest Geological Sequestration Consortium (MGSC)
  - Illinois Basin – injection site was merged with Phase III site, characterization well was drilled in Phase II.

  Midwest Regional Carbon Sequestration Partnership (MRCSP)
  - Michigan Basin – two injection tests totaling 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 of less than 50 metric tons 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 CO_2 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 CO_2 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 6,295 metric tons of CO_2 was injected at the rate of 22 to 27 metric tons per day; incremental oil production increased over the pre-CO_2 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 6,595 metric tons of CO_2 was injected at a rate of 22 metric tons per day into the Jackson Sandstone; oil recovery rate did increase despite early CO_2 breakthrough at one well and current oil production is 2,110 stock tank barrels.

Plains CO_2 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 (440 short tons) were injected, producing through September 17th , 2009, approximately 242 barrels of oil and 1,991,000 cubic feet of natural gas.
- Zama Oil Field – Since December 2006, acid gas (70% CO_2 and 30% H_2S) has been continuously injected at a depth of 4,900 feet into the Zama F Pool, one of over 800 pinnacle reefs in the Middle Devonian Keg River Formation in the Zama subbasin, Alberta, Canada. Through January 2011, over 60,000 metric tons of CO_2 has been injected, resulting in incremental oil production over 50,000 barrels.

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 CO_2 has been injected.

Southwest Regional Partnership on Carbon Sequestration (SWP)

- Aneth Oil Field – as of December 2009, approximately 292,000 metric tons have been injected at the detailed study area into the Deep Creek and Ismay Formations within the Paradox Basin for EOR operations by January 1, 2010.
- SACROC – injection of approximately 78,000 metric tons were injected into the Horseshoe Atoll and Pennsylvania Reef/Bank Play in the Permian Basin at the detailed study area.

Completed Enhanced Coalbed Methane (ECBM) CO_2 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 CO_2 Reduction Partnership (PCOR)

- Williston Basin – CO_2 injection was completed in March 2009 into a lignite coal seam in the Fort Union Formation in Burke County, North Dakota. Injection of 80 metric tons (90 short tons) of CO_2 took place over a period of 16 days.

Southwest Regional Partnership on Carbon Sequestration (SWP)

- San Juan Basin – approximately 16,700 metric tons were injected into the coals in the Upper Cretaceous Fruitland Formation, and low amounts of additional methane may 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 CO_2 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 have continued through 2012. Project categorization includes agriculture soils, soil reclamation, afforestation, accounting/aggregation and wetlands reclamation. NETL has developed a Best-Practices manual for Terrestrial Storage of Carbon Dioxide that covers land types and management methods that can maximize carbon storage in vegetation and soil. It also covers the analytical techniques necessary to monitor, verify, and account for terrestrially stored carbon, which is required for this carbon to be traded. Results and lessons learned from the Regional Carbon Sequestration Partnerships terrestrial field trials are discussed as example terrestrial carbon storage practices. This manual is available at: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/BPM_Terrestrial.pdf

- Development Phase activities began in 2008 and will continue for approximately 10+ years. There are eight large-volume injection tests initiating between 2009 –2014. These injection tests are being conducted in saline and oil/natural gas bearing formations.

Partnership Development Project Status:

Big Sky Regional Carbon Sequestration Partnership (Big Sky)

- Kevin Dome Project. The Partnership is planning to inject one million metric tons over a four year period. The natural source of CO_2 will be extracted from the Kevin Dome and injected into the primary target, Duperow Formation, or a secondary target, Souris River Formation in Northern Montana. The Partnership has injection scheduled for mid 2013.

Midwest Geological Sequestration Consortium (MGSC)

- Decatur Project. The Partnership has initiated the large-scale saline formation injection in the Illinois Basin that will inject 365,000 metric tons of CO_2 per year into the Mt. Simon Sandstone for three years totaling one million metric tons. The source of the CO_2 will be the Archer Daniels Midland Company (ADM), ethanol production facility in Decatur, Illinois. The project has injected approximately 100,000 metric tons into the Mt. Simon Sandstone.

Midwest Regional Carbon Sequestration Partnership (MRCSP)

- Michigan Basin Project. The Partnership will conduct a large scale injection test in Otsego County, Michigan Basin, injecting one million metric tons of CO_2 over a four year period. The source of the CO_2 will be Core Energy via natural gas processing facility and the test is scheduled to begin in the 2012/2013 timeframe.

Plains CO_2 Reduction Partnership (PCOR)

- Bell Creek Project. The first of the Partnership's two development projects is located in the Powder River Basin in Montana. In partnership with Denbury Resources Inc, the Bell Creek Project will couple EOR and CO_2 storage by monitoring the injection of over one million metric tons of CO_2 into the Muddy Sandstone Formation. The source of CO_2 is the Lost Cabin/Madden Gas Plant operated by ConocoPhillips. Denbury Onshore LLC is currently constructing a 232-mile (373-kilometer) CO_2 pipeline (known as the Greencore pipeline) which will deliver CO_2 from the COP Lost Cabin gas-processing plant to the Bell Creek Oil Field. The pipeline is scheduled to be completed by December 2012. Injection is anticipated in early 2013.
- Fort Nelson Project. The second development phase project, the Fort Nelson project, will have the capability to capture more than two million metric tons of sour CO_2 (95% CO_2 and 5% H_2S) from one of the largest gas-processing plants in North America and inject into the Devonian Elk Point Group/Sulphur Point Formation, Alberta Basin. The source of the CO_2 will be Spectra Energy's Fort Nelson Natural Gas Processing Plant, and injection is anticipated in 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 nearly three million metric tons of CO_2 into the Lower Tuscaloosa Formation. The source of CO_2 is the Jackson Dome, and it is being delivered via Denbury Resources' CO_2 pipeline.
- Citronelle Dome Anthropogenic Project. This second development project the Partnership is conducting is an integrated capture and injection project that will inject approximately 250,000 metric tons of CO_2 over two years into the Paluxy Formation. The source of the CO_2 is a 25 megawatt (MW) flue gas stream from Southern Company's Plant Barry Power Station located near Mobile, Alabama. CO_2 injection is anticipated to begin in May 2012.

Southwest Regional Partnership on Carbon Sequestration (SWP)

- Gordon Creek Project. The Partnership plans to perform a large scale injection into the primary target formation, Jurassic-aged Navajo Sandstone with potential injection into the secondary target, the Estrada Formations. The Partnership anticipates over one million metric tons of CO_2 to be injected into the Wasatch Plateau over a four year period utilizing a natural source of CO_2. Injection is scheduled to commence in the 2013/2014 timeframe.

West Coast Regional Carbon Sequestration Partnership (WESTCARB)

- Development Phase. The Partnership plans to facilitate successful commercial-scale carbon capture and storage (CCS) development through expanded and enhanced regional characterization and R&D to identify and address CCS implementation issues. This includes: (1) working with state agencies and universities to further characterize geologic storage potential and capacity; (2) working with industry partners to define promising sites and facilitate the process for developing commercial-scale CCS projects; and (3) working with policymakers and regulatory agencies to identify impediments and solutions to future CCS project development.

Additional Sequestration Program RCSP Updates:

- The 2011 Project Portfolio is available and includes information on the Carbon Storage Program, Regional Partnerships, Carbon Storage 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/2011/index.html

- The third edition of the Carbon Sequestration Atlas of the United States and Canada is now available online: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlasIII/index.html The 2010 Carbon Sequestration Atlas includes an overview of DOE's Storage Program, International Collaborations, National Risk Assessment, RCSP Activities, Refined CO_2 Storage and Prospective Storage Resources within the RCSPs, Worldwide CCS projects and regulatory issues and NATCARB's improved databases and GIS system. The fourth edition of the Carbon Storage Atlas of the United States and Canada will be available in November 2012.
- Six of the seven anticipated Best Practices Manuals and one case history document 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 CO_2 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 CO_2 in Deep Geologic Formations
  - Geologic Storage Formation Classification: Understanding Its Importance and Impacts on CCS Opportunities in the United States
  - Risk Analysis and Simulation for Geologic Storage of CO_2
  - Best Practices for Terrestrial Sequestration of Carbon Dioxide
  - Regional Carbon Sequestration Partnerships' Simulation and Risk Assessment Case History
- NETL is continuing ongoing collaboration with Interstate Oil and Gas Compact Commission (IOGCC), through SECARB, to evaluate potential for subsurface geological storage of CO_2, 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.
- 18 of the 19 geologic and 11 terrestrial field tests have been completed in the Validation Phase with one geologic field test remaining to be completed in 2012.
- The Development Phase has been underway since 2008, with eight anticipated large-scale projects currently being undertaken.
- The 2011 Regional Carbon Sequestration Partnerships Review Annual Review Proceedings, which include more detailed descriptions of status, are at: http://www.netl.doe.gov/publications/proceedings/11/carbon_storage/index.html
- U.S. DOE/NETL Carbon Storage R&D Project Review Meeting, Developing the Technologies and Building the Infrastructure for CO2 Storage" will take place August 20th-23rd , 2012 in Pittsburgh, PA, U.S.. It will include updates to the RCSPs Development Phase Projects.

6. Links to RCSP Programmatic Information

- Carbon Storage 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 Storage Program: Technology Program Plan 2011: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/2011_Sequestration_Program_Plan.pdf
- 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/
- 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/infrastructure/charefforts.html

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SaskPower Integrated CCS Demonstration Project at Boundary Dam Unit 3
CSLF Project Status Report
April 2012

1. Project Location:
Project Location: SaskPower's Boundary Dam power site, Estevan Saskatchewan Canada
2. Project Lead
Lead project contacts: SaskPower, Michael Monea • mmonea@saskpower.com
3. Project Objectives
• Rebuild a 45 year old 139 Mw power plant • Install a new 1,242 bn Cdn. 90% CO2, 100% SO2, capture unit • Make a commercial coal C02 capture unit have comparable lifecycle cost as a new Natural Gas Combined Cycle plant.
4. Recent Milestones
• Started construction May 1, 2011 • Feb. 23, 2012,40% finished construction of the capture unit
5. Status
• In construction, commissioning date 1st Quarter, 2014. • Negotiating sales contracts for CO2 in the EOR industry • Will construct a deep saline reservoir storage site with the Petroleum Technology Research Centre near the Boundary Dam site • On time, on budget • Website: http://www.saskpower.com/sustainable_growth/projects/carbon_capture_storage.shtml.

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Southeast Regional Carbon Sequestration Partnership (SECARB)
Early Test at Cranfield Project
CSLF Project Status Report
August 2012

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
• 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 services are provided by Sandia Technologies LLC
4. Recent Milestones
• Four 2008-2012 years of monitoring has been completed • Data collected from time-lapse measurements after 1 year injection is in analysis. A clear response to CO_2 is observed in the down-dip part of the field where CO_2 has replaced brine. Signal from emplaced CO_2 is more variable in the regions that contained oil and gas. • 3.8 million metric tons CO_2 from Jackson Dome (natural source) have been stored
5. Status
• 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. CO_2 was imaged. Complex responses related to fluid complexity, and reservoir heterogeneity as well as data collection limitations are in assessment • Lawrence Livermore National Laboratory has documented the response of an Electrical Resistance Tomography array to a CO_2 flood • An in-zone geochemical monitoring program with Oak Ridge National Laboratory and USGS Menlo Park as major contributors has been completed. Geochemical response to CO_2 –rock-brine reaction is limited. • A near surface monitoring program has been conducted with University of Mississippi and Mississippi State University as major collaborators. Data collection continues. One small area, high amplitude surface anomaly, the “P Site” is undergoing intensive testing. • Project website; www.gulfcoastcarbon.org. See ‘bookshelf’ for reports.

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Zama Acid Gas Enhanced Oil Recovery, CO_2 Sequestration, and Monitoring Project
CSLF Project Status Report
August 2012

1. Project Location

Zama City, Alberta, Canada

2. Project Lead

- Ed Steadman (esteadman@undeerc.org)
- Jim Sorensen (jsorensen@undeerc.org)
- Charles Gorecki (cgorecki@undeerc.org)
- Julie Gunderson (julie.gunderson@apachecorp.com)

3. Project Objectives

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

4. Recent Milestones

- Laboratory work has continued with the following experiments:
  - Wellbore casing steels are being exposed for durations of 15 and 28 days to mixtures of CO_2 and H_2S. Experiments are carried out at reservoir conditions analogous to Zama (2100 psi, 160°F). Analytical work is focused on deriving the nature and rates of degradation observed.
  - Rock samples are also being exposed under the same conditions to determine if mineralogical changes are observed. If observed, rates and quantification of change will be determined.
- Modeling and simulation have continued on the injection and production reservoir. This model will be used to better understand the sweep efficiency of the reservoir and to calculate the overall storage potential of this and similar pinnacles in the field.
- Additional data has been acquired and is being analyzed for input into new static geologic models.

5. Status

As of May 2012, cumulative acid gas injected into the F Pool was 133,550 tons (CO_2 fraction – 93,485 tons), with net CO_2 stored of 40,357 tons.

- Approximately 74,202 incremental barrels of oil has been produced using this technique.
- At this time, Apache has shut down the gas plant, and plans for future oil field operations are ongoing.
- Improved static geologic models of additional pinnacles are being developed and detailed dynamic simulations of injection and production will be conducted. The goal of these efforts is to develop improved estimates of OOIP, recoverable reserves, and CO_2 storage capacity for each of those pinnacles that have yet to be extensively researched.

Zero Emission Porto Tolle Project (ZEPT)
CSLF Project Status Report
September 2012

1. Project Location

Power plant owned by Enel Produzione and located in Porto Tolle, Province of Rovigo, Region of Veneto,160 km south from Venice, Italy.

The CO_2 capture plant will be installed in Porto Tolle power plant, owned by Enel Produzione and located in the area of the Po river south bank (Po di Pila), approx 160 km south of Venice.

The separated CO_2 will be transported by a carbon steel pipeline, from an onshore pipeline terminal at Porto Tolle to an offshore injection platform through a subsea pipeline of about 100 km length.

The onshore terminal will be within the battery limits of the Porto Tolle power station. Regarding storage location, the pre-FEED studies have been based on a saline aquifer reservoir, located at around 25 km from the Adriatic coast.

2. Project Contact

- Mario Graziadio Enel Engineering and Research Spa
  mario.graziadio@enel.com
- Cristiana La Marca Enel Engineering and Research Spa
  cristiana.lamarca@enel.com

3. Project Objectives

The goal of the Porto Tolle Zero Emission Project is to demonstrate the industrial application of the CO_2 capture and geological storage in the power sector at full scale. The demo plant will be operated for an extended period (10 years) in order to fully demonstrate the technology on an industrial scale, access clearly the real costs of CCS and provide a commercial solution for new installations after 2020. The project is intended to prove the retrofit option for high-efficiency coal fired units which will be built (or replaced) in the coming 10-15 years.
This activity will be performed through:

- the design, procurement and construction of the demonstration CCS plant as well as all the detailed site characterisation aimed at verifying the feasibility of the injection and storage of CO_2 in a safe and detectable manner
- identification of the specific technical solutions for the whole CCS chain
- identification of the permitting procedures
- R&D activities related to CO_2 capture, that will allow to assess the environmental impact, the performances
- development of CCS public acceptance

4. Recent Milestones

- Realization, start-up and testing of a CO_2 capture pilot plant (10.000 Nm^3/h)
- Storage site selection and detailed characterization, feasibility study of injection well and platform
- Development of FEED studies for CCU (Carbon Capture Unit) technology

5. Status
• The overall progress of the conversion to coal firing of Porto Tolle power plant has been affected by the Decision of the Council of State, that partially voided the Environmental Authorization. • The impact of the issue on both the Porto Tolle conversion to coal firing and on CCS permitting procedure is currently under assessment. • The impact on the CCS project concerning the dispute over the permit for the base power plant, is still being analysed by the project team. The updated timetable is currently under assessment.